

Creative Computing[®]

the #1 magazine of computer applications and software

A User's View
of Prestel

May 1983
vol. 9, no. 5
\$2.95

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- **Video Technology VZ200**
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- **Atari Landing Simulator**

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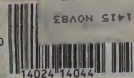
- **IBM**
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FOR UNDER \$300

SPECTRAVIDEO SV-318 COMPUTER COMPARISON CHART

	SPECTRAVIDEO SV-318	APPLE II PLUS	ATARI 800	COMMODORE 64	NEC 9801	RADIO SHACK COLOR COMPUTER
BASE PRICE	\$299	\$1,549	\$399	\$195	\$399	\$299
COMPUTING POWER FEATURES						
ROM MEMORY	32K	12K	12K	25K	16K	8K
BUILT-IN EXTENDED MICROSOFT BASIC	YES	YES	YES	YES	YES	YES
BUILT-IN BASIC	YES**	YES	YES	YES	YES	YES
EXPANDABLE TO	96K**	96K	96K	96K	96K	96K
RETROGRADE FEATURES						
NUMBER OF FEES	21	51	51	56	21	70
USER DEFINED FUNCTIONS	YES	NO	NO	NO	NO	NO
SPECIAL WORD PROCESSING	YES	NO	NO	NO	NO	NO
GRAPHICAL DISPLAYS FROM KEYBOARD	YES	NO	NO	YES	NO	NO
OPTIONAL CURSOR	YES	UPPER ONLY	YES	YES	YES	YES
GAMING VIDEO FEATURES						
SEPARATE CARTRIDGE SLOTS	YES	NO	YES	NO	NO	NO
BUILT-IN JOYSTICK	YES	NO	NO	NO	NO	NO
COLOR	YES	NO	NO	NO	NO	NO
RESOLUTION (PIXELS)	768 x 192	288 x 192	384 x 192	384 x 192	384 x 192	128 x 64
SOUND CHANNELS	2	1	4	2	2	1
ACTIVATES NEW CHANNEL	YES	NO	NO	YES	YES	NO
80 x 8 ENVELOPE	YES	NO	NO	YES	YES	NO
PERIPHERAL SPECIFICATIONS						
CASSETTE	2 CHANNEL	1 CHANNEL	2 CHANNEL	1 CHANNEL	1 CHANNEL	CHANNEL
BUILT-IN	YES	NO	NO	NO	NO	NO
BUILT-IN MIC	YES	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY	YES	YES	YES	YES	YES	YES
80 x 8 PROFILE	YES	NO	NO	NO	NO	NO
CP/M COMPATIBILITY (80 column programs)	YES	NO***	NO	NO	NO	NO
CP/M 8.0	YES	NO****	NO	NO	NO	NO

THE

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on language
can be used
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the data
to help
grams



SV-902 FLOPPY DISK DRIVE

This extremely compact, low profile unit uses standard 5 1/4" flexible diskettes. Its single side double density configuration allows a capacity of 256K bytes of data (unformatted). Linked to the Super Expander, the SV-902 is your key to the virtually unlimited scope of CP/M 8.0/S as well as a complete variety of program languages such as LOGO, PASCAL, FORTRAN, COBOL and PL-1.

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SV-318

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CIRCLE 261 ON READER SERVICE CARD

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** 128K user memory plus plus 16K graphics support

*** Apple II can accept modified 40 or 80 column CP/M
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FOR APPLE II COMPUTERS, Microbuffer II features on-board firmware for text formatting and advanced graphics dump routines. Both serial and parallel versions

have a power-efficient low-consumption design. Special functions include Basic listing formatter, self-test, buffer zap, and transparent and maintain modes. The 16K model is priced at \$259 and the 32K, at \$299.



FOR EPSON PRINTERS, Microbuffer/E comes in two serial versions — 8K or 16K (upgradable to 32K) — and two parallel versions — 16K or 32K (upgradable to 64K). The serial buffer supports both hardware handshaking and XON-XOFF software handshaking at baud rates up to 19,200. Both interfaces are compatible with standard Epson commands, including GRAFTRAX-80 and GRAFTRAX-80+. Prices range from \$159 to \$279.



ALL OTHER COMPUTER/PRINTER COMBINATIONS are served by the stand-alone Microbuffer In-line.

The serial stand-alone will support different input and output baud rates and different hand-shake protocol. Both serial and parallel versions are available in a 32K model at \$299 or 64K for \$349. Either can be user-upgraded to a total of 256K with 64K add-ons — just \$179 each.

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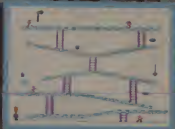
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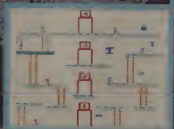
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May, 1983
Volume 9, Number 5



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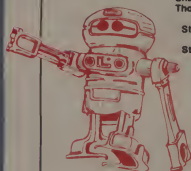
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advertising sales

Advertising Director
Jeff Weiner
Creative Computing
Ziff-Davis Publishing Company
One Park Avenue
New York, NY 10016
(212) 725-7957

Advertising Coordinator
Ruth Darling
Creative Computing
Ziff-Davis Publishing Company
One Park Ave.
New York, NY 10016
(212) 725-3446

Northern California, Northwest
Jeff Miller
Ziff-Davis Publishing Company
3030 Bridgeview Blvd.
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Southern California, Southwest
Tom Whiteway
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New England
CEL Associates, Inc.
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Jeff Edman
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Canada
The Patis Group
1623 Young St.
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Consumer Computers & Electronics Magazine Division
President: Larry Sporn
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and on the new VOICE BOX II

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CIRCLE 107 ON READER SERVICE CARD

Output...input/output...input

Backsliding

Dear Editor:

Thank you for David Ahl's survey of slide show systems for the Apple ("Make Your Apple Into A Slide Projector," November 1982). With so many presentation packages on the market, the overview will certainly guide business graphics users to the most useful programs.

However, I would like to point out some features which were not described appropriately:

The review states that *Screen Director* can hold only 17 images per disk. In fact, the program has the ability to reduce ("pack") each screen so that it takes up less room on the disk (as much as 50% less). Since text screens fill even less disk space than graphs, a *Screen Director* disk actually can hold 30 to 40 images. With an Apple III and Profile, the number increases to over 200 (*Screen Director* operates fully on both the Apple II and the Apple III).

Unlike *Screen Director*, *Executive Briefing System* cannot display images created by *Apple Business Graphics*.

In addition, users of *Screen Director* may select automatic display times of one or more seconds; the comparison chart lists "5 or more."

Finally, the article states that when using *Screen Director* to print out slides, one must print an entire presentation. In fact, *Screen Director* allows the user to specify one or several slides in a presentation and print out only those.

Thank you for bringing this to the attention of your readers.

David Solomon
President

Business & Professional Software, Inc.
143 Binney Street
Cambridge, MA 02142

Pain In The NEC

Dear Editor:

I read with interest the review of the C.Itoh 8510A and NEC 8023A printers by Joseph Simpson which appeared in your 1983 *Buyer's Guide to Personal Computers*.

I purchased a NEC 8023A in December of 1981 shortly after their introduction and have found it to be nearly ideal in every respect as did Mr. Simpson. However, I was surprised when I read Mr. Simpson's remarks that the C.Itoh printer produces better graphics than the NEC. Mr. Simpson explains that this is a result of the NEC being unable to support uni-directional print

thereby printing vertical lines with a slight offset of approximately one dot with each pass of the bi-directional print head.

I would like to point out that Mr. Simpson apparently didn't realize that the NEC's "incremental mode" disables the logic-seeking mode and results in uni-directional printing of graphics. This mode can be selected simply by sending the printer an escape sequence code. In the "incremental mode," the graphics are identical to those of the C.Itoh and are truly impressive.

Aside from Mr. Simpson's apparent confusion on this matter, his article appeared to describe accurately the fine features available on these printers. In my opinion, they are two of the best values on the market today.

I might also add that I have found my subscription to *Creative Computing* to be one of the better values in the personal computing field. Keep up the good work.

Tony Bonanno
9 Knoll Ridge Drive
Asheville, NC 28804

Three Ways Of Looking At A Bug

Dear Editor:

I read with interest the article "Three Ways of Looking at a Function" by James Fuller that appeared in the January, 1983 issue of *Creative Computing*. I was able to get most of the equations to yield graphs similar to those illustrated in the article, and to obtain a hard copy on an Epson MX-80 FT connected to an Apple II+ with a Grappler and printer interface.

One finds both the program to save a picture on disk and the one to display it have bugs in them. Line 140 of the save picture should be 140 PRINT CHR\$(4); "BSAVE"; AS; ", AS2000, L\$1FFFF". Add line 125 to "display picture"; 125 INPUT "name of picture"; AS.

The program will have to be modified slightly to yield a reasonable graph for the Archimedes' spiral. If line 690 is changed to read For G = 0 to 3600 step 1 one will obtain a spiral of 3600/360 or ten turns if the X and Y axes are scaled properly.

The equation in the upper left column on page 206 should read $f(x) = \cos(2x) + \cos(x + BB/16)$. Also, on page 20, Figure 5 is incomplete. The bottom part of the plot will "fill in" if the program is allowed to run until it is completed.

George Shellenberger
Associate Professor
Natural Science
The College of the Ozarks
Clarksville, AR 72830

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Input...input/output...input

Eamon Update

Dear Editor:

My article, "Eamon: An Adventure Game for the Apple II With (Almost) Everything," (Jan. '83) contained a typographical error.

On page 98, when discussing the Apple Avocation Alliance, it said that there is "a fee of \$27 on your first order or exchange." In reality, this annual membership fee is only \$3.

A number of things have changed on the Eamon front since I wrote the article.

Ron Maleika of 3A and John Nelson have been collaborating, and have standardized the catalog numbers of the Eamon adventures. John Nelson has written more adventures and improved the Dungeon Designer Disk. The new version includes a "Save game" feature and allows the use of abbreviated commands.

3A now carries 33 Eamon Adventures, three Eamon Tournament Adventures, the Dungeon Designers' Disk, and two utility disks.

Robert Plamondon
555 SW Jefferson Avenue
Corvallis, OR 97333

Gregorian Can't

Dear Editor:

There are two errors in Daniel Smith's article, "Using Step Functions in Microsoft Basic" (November 1982), but they don't detract from the cleverness or usefulness of his Julian date algorithm. The errors are as follows:

The year 1900 was not a leap year and 2000 will be. According to "The Gregorian Calendar" by Gordon Moyer in the May 1982 issue of *Scientific American*, pages 150-151, "The plan that forms the basis of the Gregorian civil calendar was devised by...Aloisius Lilius... The intercalation Lilius proposed in the *Compendium* was simple: The suppression of three leap days in centennial years not perfectly divisible by 400. The Gregorian intercalation therefore follows the Julian system with the single exception that centennial years such as 1700, 1800 and 1900, which would have been leap years in the Julian calendar, became

SORRY BOYS, BUT THAT'S NOT QUITE WHAT I
WAS LOOKING FOR IN THE WAY OF DIGITIZING.



common years (with the leap day dropped)."

So in the calendar program the references to 1900 should be changed to 1901; then it can generate calendars up from 1901 through 2099.

Applesoft evaluates true Boolean expressions as 1, not -1. Apple owners will have to change the Julian date algorithm to:

```
J = INT((M-1) * 30.42) + (M-2) - (M>2 AND M<8) + (M>2  
AND (INT(Y/4)=Y/4)) + D
```

Dan Meilander
4384 Wolff Drive
Brunswick, OH 44212

IBM Squirrel

Dear Editor:

Regarding the article "Why We Really Buy Creative Computing" in the January issue of *Creative Computing*, I am enclosing a listing of the SQUIRAL routine for the IBM Personal Computer. It is very similar to the TRS-80 Color version because the languages are in Microsoft Basic. However, my listing contains the missing line to increment the DISTANCE variable!

Q LISTING OF PC VERSION--SQUIRAL

```
40 CLS :KEY OFF : SCREEN 1 : WIDTH 40 :COLOR 0:7  
20 PRINT " BASIC SQUIRAL FOR THE IBM PC " : PRINT  
30 INPUT "ENTER DISTANCE --> ",D  
40 INPUT "ENTER ANGLE --> ",ANG  
50 INPUT "ENTER INCREMENT --> ",I  
60 PI = 3.14159 : W = PI/180 : SCALE,FACTOR=2  
70 CLS : WIDTH 40 : COLOR 0:ANGLE MOD 2  
75 CLS : WIDTH 80 'HIGH RES VERSION  
80 'X = 160 : Y = 100 : A = ANG  
85 X = 320 : Y = 100 : A = ANG 'HIGH RES VERSION  
90 XN = X + DACOS(WNA)*SCALE,FACTOR  
100 YN = Y + DSIN(WNA)  
110 'LINE (X,Y)-(XN,YN),D MOD 3  
115 LINE (X,Y)-(XN,YN) 'HIGH RES VERSION  
120 D = D + I  
130 IF D>200 THEN 170  
140 A = A + ANG  
150 SWAP X,XN : SWAP Y,YN  
160 GOTO 90  
170 AS = INKEY$ : IF AS<>" THEN RUN  
180 GOTO 170
```

The high resolution version is B & W but looks quite nice on a television monitor. The colors, if desired, of the line and the background are selected using the MOD function. The SCALE, FACTOR variable helps to make the squirrels more distinct.

I hope others take up the challenge. Keep up your excellent efforts in publishing the best microcomputing magazine in the field.

Thomas R. Hockswender
3173 Meadowridge Ct.
Gibsonia, PA 15044

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CIRCLE 193 ON READER SERVICE CARD

input...input/output...input

Too Many Backspaces?

Dear Editor:

The article "Input Without Carriage Return/Line Feed" by Tom Disque on page 334 in the December 1982 issue of *Creative Computing* was very helpful to me as I had just encountered the same problem in a program I was writing. I immediately tested the code for its possible use in my program. During this testing I found one important error/omission which needed correcting and two cosmetic improvements which I felt should be passed along to anyone else who plans to employ Mr. Disque's code. These modifications are shown in the revised code of Listing 1.

The error is related to the handling of backspace characters (code 8) in line 10020 of the original code. A problem will arise if the first character entered is a backspace or if more backspaces than other characters are entered (i.e., the input is erased). In this case A\$ is a null string. When the MIDS function attempts to remove the last character from A\$ the length function LEN(A\$)-1 returns a -1 value which generates an "Illegal Function Call" error. To correct this problem, a test on A\$ must be performed in addition to the test for X=8. This was added by removing all of line 10027 to make the required check and skip the MIDS function when A\$ is null.

Listing 1.

```
10000 A$="": PRINT "? "; CHR$(95);  
10010 B$=INKEY$: IF B$="" THEN 10010 ELSE X=ASC(B$)  
10020 IF X=9 AND X<11 PRINT CHR$(8);: RETURN  
10023 IF X=24 PRINT STRING$(LEN(A$)+3,CHR$(8));: GOTO 10000  
10027 IF X=8 THEN A$=A$+B$ ELSE IF A$="" THEN 10010 ELSE  
10030 PRINT CHR$(8); B$; CHR$(95);: GOTO 10010
```

The first cosmetic improvement causes the routine to resemble the standard INPUT statement in operation. To do this, a question mark, blank and underline (code 95 for a cursor) are printed by line 10000 at the point where input is to begin. When the entered character is printed in line 10030 it is preceded by a backspace/erase (code 8) to erase the previous cursor and it is followed by a new cursor character. Finally, when the carriage return is found by line 10020, a backspace must be printed to remove the last cursor after the end of the input.

The second cosmetic improvement implements the shift-back



arrow entry for an erase line command. This is handled by a new line 10023 which identifies the entry (code 24) and then issues a string of backspaces long enough to erase all of the characters printed by the routine. When this is done the routine will start over again.

Despite the high values of the line numbers shown in this code, it should be located as early as is possible in the program so as to minimize the time between executions of the INKEY\$ function. Even if this is done, the input controlled by this code will be slower than that of an INPUT statement and even a moderate typing speed could cause it to drop some characters.

As a final note I believe a quick clarification is in order regarding Mr. Disque's comment about testing for control codes of 10 through 13 as a carriage return. The Reference Manual lists both 10 and 13 as "line feed/carriage return" with 11 and 12 as "top of form (with line printers)". A simple test program (see Listing 2) will show the code values of the possible inputs from the keyboard. A code of 10 is produced by the down arrow key

```
Listing 2. 10 A$=""  
20 PRINT "?";  
30 A$=INKEY$  
40 IF A$="" THEN 30  
50 PRINT " "; A$; " "; ASC(A$)  
60 PRINT  
70 GOTO 10
```

and actually represents only a line feed. A code of 13 is produced by the Return key and represents only a carriage return. Confusion over the exact functions of these control codes is very easy due to the lack of consistent correspondence between the TRS-80 control codes and the ASCII control codes and due to the minimal explanations in the manual. The test of X between 9 and 14 is valid, however, since I have found no way to produce the 11 or 12 codes from an unmodified keyboard.

David H. Ternes
695 Kennedy Dr.
Bloomfield, IN 47424

Zapping SuperScriptit

Dear Editor:

In his review of *SuperScriptit* in your February 1983 issue, Dan Robinson comments that *SuperScriptit* will not function with operating systems other than TRSDOS. Apparat, Inc. wishes to announce that we have zaps available to let *SuperScriptit* operate under Newdos/80 Version 2.0 for the Model I and Model III TRS-80. We have sent these zaps to Dan Robinson since he submitted his review to *Creative Computing*.

In addition, Apparat now offers a printer driver to allow the use of *SuperScriptit* with the Epson printers that have the Graftrax-Plus ROM installed. This includes both the Epson MX-80 and MX-100. It is available on disk for \$17.95 for both the Model I and Model III TRS-80.

Brian L. Uitti
Assistant Manager,
Software Research & Development
Apparat Incorporated
4401 South Tamarac Parkway
Denver, CO 80237

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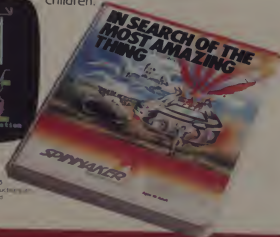
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ow... dateline: tomorrow... da

David H. Ahl

TI Controlling Software Distribution for 99/4A

Program cartridges for the 99/4A contain a GROM chip, or graphics read only memory. All TI cartridges have a GROM even though it is not always needed. Now, TI plans to alter the 99/4A so that cartridges without GROMs won't work.

TI will not license the GROM technology to others, hence those who wish to publish TI cartridge software must now give TI the rights to make and market the cartridges. In turn, TI will pay authors a royalty.

The reason for this is that TI is practically giving 99/4As away (street price \$149) so they must make their money from peripherals and software purchased later. So far, Milton-Bradley, Scott Foresman, and Walt Disney have agreed to develop TI cartridges. However, most smaller manufacturers are scaling back any efforts to develop TI software. Imagic, Activision, and Spinnaker all have said they will now concentrate on computers other than TI. Too bad.

ROMs, PROMs, GROMs, EPROMs, and now EEPROMs

You've heard of read only memory (ROM); it holds things that are never altered such as the operating system and Basic language. If you want to create your own ROM, you need a programmable ROM (PROM) into which a program or data can be entered just once. That's not so good for software development, so along came the erasable PROM or EPROM. But to erase an EPROM, it has to be exposed to ultraviolet light for about 15 minutes.

Now, several makers have announced an EEPROM, or electrically erasable PROM. The EEPROM can be erased with a small burst of electricity and reprogrammed up to 10,000 times. The EEPROM probably won't be in your next computer but you may meet one on a future trip to the supermarket. Since it can be reprogrammed by telephone or even radio, it is ideal for holding prices and product codes in electronic scanning cash registers or identification data in air-to-air missiles which must distinguish between enemy and friendly aircraft. Older chips had to be replaced as new aircraft that were not in memory went into service; an EEPROM can be reprogrammed on the fly to deal with new planes.

In the Education Arena

A recent article in the London Times noted that Britain is the first country to have provided almost every secondary school in the country with a microcomputer. During the past 18 months, over 5800 schools took advantage of the "Micros in Schools" program. According to Kenneth Baker, Industry Minister of State, "Every secondary school now has some computer facility and we are the first country in the world to achieve this."

Closer to home, New Jersey Institute of Technology, a leader in computer conferencing, is offering 16 seminars that can be taken via a personal computer or timesharing terminal. Courses cover a wide range of topics and include Alternative Leadership Styles, Apple Basic and DOS, How to Start a Small Business, Mathematics for Financial Investment, Pascal Programming, Technical Writing, and ten others. Since the instructors are hooked in via the same conferencing system as the students, both students and instructors can be located anywhere in the U.S.

Each terminal on the system becomes part of a nationwide computer conferencing system which allows unlimited communication with the instructor and other participants at any time that is convenient to the user. Director of the conferencing system is Dr. Murray Turoff, a pioneer in computer conferencing.

Each seminar runs for three months, and each will deliver at least as much material as would be given in four full days of face-to-face lectures. Series of seminars will start each spring, summer, and fall. For more information, call the NJIT Dept. of Continuing Education at (201) 645-5235.

April Foolishness Haunts Us Too

Readers of our April issue may have been startled at some of the ads and product reviews. These appeared in the spirit of April 1st and we hope they provided you with a few chuckles.

On the other hand, we were startled to see the "screen illustration" on the top of page 180 instead of the lovely colored one we expected to see showing "Sammy, the Sea Serpent," a delightful program in the PDI Preschool Library. Sorry, readers. Sorry, PDI. We'll catch that April gremlin yet.

And Some News Notes

SpectraVideo, who have barely started to deliver their nifty SV-318 computer, have already announced an upgraded version, the SV-328. Major changes include 64K of RAM and an alphanumeric keyboard compared with 32K and an alpha-only keyboard on the 318.

NEC began shipping their new PC-6800 computer at a retail price of \$349. The unit has 16K, 71-key keyboard, three channels of sound, color graphics, and a full array of peripherals. NEC Ltd. (Japan) is also supplying 38 entertainment software packages. We hope they're translated.

Tandy will soon announce a Japanese-made, 5-lb. portable computer with full-size keyboard, a screen that can display one-third of a page of text, and built-in word processing software. Many other goodies will be included or available on cartridge for this enhanced version of the NEC PC-8201. Expected price, around \$700.

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Panasonic JR-200



David H. Ahl

The Panasonic JR-200 personal computer from Matsushita has been several years in the making. We have seen versions of it at the last two Consumer Electronic Shows. Now, it is finally being released; it was worth the wait.

Handsome Styling

Outwardly, the JR-200 has modern, pleasing styling. The case measures 13.5" x 8.0" and slants from a height of 1" in the front to 2" in the rear. Made of plastic and finished in silver and matte black in the keyboard area, the case is rugged and durable. We carried it in a fabric tote bag from Las Vegas to Morristown to Phoenix to Orlando and back to Morristown with no ill effects.

The power switch is recessed on the left side of the case; a red power on indicator is on the top right. The power cord is permanently attached at the right rear. In contrast to several other small computers, the transformer and power supply are completely self-contained. Also

on the rear of the case are six connectors of various sorts.

Connectors and Switches

Two connectors are provided for the video display. An eight-pin D.I.N. connector attaches to a cable (included) which goes to an NTSC composite video or RGB monitor. An RCA jack provides an RF signal on channel 3 or 4. Interestingly, this signal is provided at a 75-ohm impedance and the supplied 6-foot cable has a quick disconnect F Connector at the TV end. Most current TV sets have a 75-ohm F-type input; on such sets the JR-200 produces a crisp, clear image, almost of monitor quality. For some strange reason this image deteriorates noticeably if this output is routed through a 75 to 300-ohm transformer and fed into standard antenna terminals. This seemed odd so we tried it on five different make TV sets with the same result—outstanding with a 75-ohm F input, mediocre with a transformer.

Another RCA jack provides 8-ohm audio output to an external speaker. Next to it is a volume control which controls both the volume of the external and 1-1/2" internal speakers. Audio power is more than adequate; people in the rear of a 100-seat conference room had no trouble hearing the internal speaker during a demonstration. While JR-200 is theoretically capable of producing tones in the range of 0 to 65535 Hz, only dogs will be interested in sounds in the upper three or four octaves. Realistically, the usable sound range is about five octaves, an impressive achievement in a computer of this size.

A second 8-pin D.I.N. connector is for a cable (included) to a tape recorder. The cable has three jacks for input (earphone), output (microphone), and motor control. A DIP switch on the bottom of the case selects either 600 or 2400 bps. We were pleased to find that the JR-200 performed reliably at 2400 bps on modest quality (\$19-\$29) recorders over a reason-

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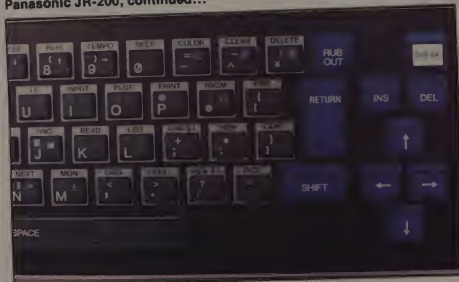
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Separate cursor control keys make on-screen editing a joy.

ground and background use: blue, red, magenta, green, cyan, yellow, white, and black.

Sound

The JR-200 is capable of producing sounds ranging from simple to complex. The simplest way of getting a sound is with BEEP 1 which turns on the beeper (880 Hz or A above the middle octave). It stays on until a BEEP 0 is encountered which turns it off.

One step above BEEP is SOUND (P,L) in which P is the pitch in Hertz (0 to 65535) and L is the length of the tone in milliseconds (0 to 255). This is very easy to use in a program.

More complicated are the PLAY and TEMPO commands which permit playing tunes with up to three parts over a 5-octave range at any imaginable tempo. Notes are stored in memory and may be played either in foreground (pauses program) or background (program continues) mode.

JR-200 Basic

As you may have surmised by now, JR-Basic is not Microsoft Basic, but it is not far away either. Most of the commands, statements, and functions are identical or very similar. Rather than going through JR-Basic in detail, we will simply highlight some of the more interesting and novel features.

As expected, JR-Basic has immediate mode and will execute most Basic commands directly from the keyboard singly or in groups (separated with a colon) as long as the maximum line length of 80 characters is not exceeded.

When the JR-200 is fired up, a copyright notice appears along with the number of free bytes. In all configurations, 2052 bytes are reserved for the Basic work

area and the remaining RAM is available to the user. We used a 32K machine and thus had 30,716 bytes free. User memory can be expanded to 40K. Basic occupies 16K of ROM while video RAM, I/O and the built-in character set occupy another 6K plus.

A requirement of JR-Basic is that Basic keywords be separated by at least one space or a colon or semi-colon from other characters. While this requirement is imposed by the internal interpreter, it also enhances the readability of finished programs.

Numeric values can range from 2.9 to 1.06³⁸ and are stored and displayed with nine digits of accuracy. Don't ask me how. Both numeric and string variable arrays can have one or two dimensions. Unfortunately variable names are restricted to two letters or a letter and a number.

All the standard operators are available: arithmetic, relational, logical and string concatenation. As expected, LET is optional.

Although the RENUM (renumber) command is listed in the manual, it steadfastly refused to work on the JR-200 we tested.

RUN performs its usual function but can also be imbedded within a program to run another program or to run the existing program from any specified line number, e.g., RUN 480. When used with a filename (RUN "Border"), it will load the program from cassette tape and then run it.

The functions HPOS and VPOS return the current horizontal and vertical position of the cursor respectively. PEEK lets you examine any memory location; its counterpart, POKE lets you put a value into a location. An unusual function is VARPTR which returns the memory loca-

tion where a particular variable is stored.

On-Screen Editing

A delightful feature of the JR-200 is full on-screen editing. To correct a mistake or make a change you simply list the line or group of lines to be changed, and use the four directional keys at the right of the keyboard to move the cursor to the character to be changed. At this point you can type the change or use the insert, delete or rub out keys to make changes. You then move the cursor to the end of the line and type RETURN. Whoosh; the change is made.

The only time we ran into trouble was when a change extended a line so that it overlapped the next line down. If you are not careful in a case like this, you can wipe out both lines. The solution? Don't press RETURN. Unless program lines are short, the best bet is just to list one at a time for editing or use the LINE INSERT key to open up a new line after the one being edited.

Another handy editing feature is the FIND command. It will search for a string of characters and list the line(s) with that combination of characters. For example, FIND "FO" would list all the FOR statements in a program plus lines containing any words with FO (in caps) in them. LFIND performs the same function but lists the lines on the printer.

Tape Handling and Files

Programs are loaded with either LOAD or LOAD "Filename." A program must be saved with a filename specified.

Files or other material may also be saved and loaded directly from and to memory with the commands MSAVE and MLOAD.

A very handy feature is the ability to load one program at the end of another. This is done using the MERGE command. Of course, if the programs use the same line numbers, only the most recently loaded one will survive.

Another handy command is VERIFY which checks to see if a program in memory and on cassette tape match.

Files of data (not programs) may be stored sequentially on cassette tape using the PRINT # command, and read back with the INPUT # command. While sequential tape files are not nearly as handy as random access disk files, the 2400 bps I/O speed is quite tolerable and such files are probably suitable for lists of names and addresses, items in a collection, and the like.

Printed Output

We did not have a printer with our JR-200, hence, we can only note that the manual lists five printer commands. Two are the expected LPRINT and LLIST. A third, HCOPI, generates a copy of the

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able range of volume settings on standard tape. This is in sharp contrast to many other computers which require precise volume and tone settings on a high quality recorder using premium tape.

Two other connectors on the rear of the JR-200 connect to a printer and external bus. Via this bus, the JR-200 has a serial RS-232C port which may be set up for half or full duplex, 7- or 8-bit words, and odd, even, or no parity. JR-Basic does not use the standard format for RS-232C communications. Although data may be transmitted by using the OPEN-INPUT#/PRINT#-CLOSE statements, the user must develop a routine that will send or receive data on the end of the line. JR-Basic does not have EOF (end of file) when using RS-232C communications.

User-Friendly Keyboard

The keyboard has 63 "Chiclet" style rubberized keys in standard typewriter layout. The keys are 1/2" square and the spacing is identical to a standard keyboard. A full-width (5") spacebar is provided along with two double-width shift keys and a double-height return key. All the keys are in the expected places.

The standard alphanumeric and symbol keys are all matte finished in dark gray, function keys (shift, return, cursor movement, etc.) are blue, and the control and break keys are white.

Each of the gray keys can produce five

inputs: an upper- and lowercase letter (or number and symbol), two graphics characters, and a Basic keyword. Two keys, ALPHA and GRAPH, are used to switch back and forth between character and graphics modes. Holding down the CONTROL key while pressing a gray key produces a Basic keyword.

In total, the JR-200 has 253 built-in characters: 96 English letters, numbers and symbols; 5 Greek letters; 63 graphics characters; 79 Katakana (Japanese) symbols; and 10 music and other symbols. All

told, this is an exceptionally rich character set, right down to the inclusion of a happy face and stick figure man. All the symbols are formed within an 8 x 8 matrix of pixels.

According to the specifications, it is possible to define your own characters. However, the preliminary documentation we had did not describe how to do this so we couldn't try it out.

Although the keys do not provide any tactile feedback, each keystroke is accompanied by a beep. All keys with the exception of CONTROL, SHIFT, RETURN and BREAK repeat rapidly upon being held down for about two seconds.

Screen Display

The screen display is 32 characters by 24 lines. Each of the 768 locations can be individually addressed with the LOCATE (x,y) command. As mentioned earlier, each symbol and character is formed by lighting pixels within an 8 x 8 matrix, hence by using the correct combination of graphics characters, it is possible to achieve very high resolution images, up to 256 x 192 if you are clever.

Medium resolution (64 x 48) is much more easily achieved by use of the PLOT (x,y) command which permits direct addressing of one-quarter of each character.

PLOT would normally be used in conjunction with COLOR which allows selection of character color, background color and display mode. Four display modes are available: normal, user-defined characters, inverse color of previous characters, and alter background color for positions following the cursor. When we got the hang of it, we found the COLOR command very powerful for producing interesting, and occasionally bizarre, effects. See Figure 1.

Eight colors are available for fore-

1 REMARKABLE PROGRAM BY Dave Ahl	
10 CLS	Clear screen
20 RANDOMIZE	
30 I=INT(23*RND(0))	Select starting point between 0 and 23 for rectangle
40 COLOR (INT(8*RND(0)))	Select random color
50 X2=63-I	Right edge of rectangle
60 Y2=47-I	Bottom edge of rectangle
70 FOR X=I TO X2	
80 PLOT X,I	Draws top edge
90 PLOT X,Y2	Draws bottom edge
100 IF X2-X<=16 THEN 130	Tests if length of vertical sides is too long
110 PLOT I,X	Draws left side
120 PLOT X2,X	Draws right side
130 NEXT X	
140 GOTO 30	
150 END	

Figure 1. Program shows the use of COLOR and PLOT to produce a series of different colored concentric borders starting at random points in the upper left quarter of the screen. Note the clever way of putting the PLOT statements for all four sides in a single FOR loop.

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1 Performance is based on bench mark test in the JAN 1982 issue of BYTE magazine, pg 54 with LNW80 II as the comparison

2 IBM PC is a trademark of IBM CORP

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Panasonic JR-200, continued...

video display on the line printer. This presumably includes graphics, but we can't say for sure.

The last two commands are TAB which tabs over from the left margin and SPC which spaces over from the last cursor position.

Joysticks

The JR-200 has two DB-9 sockets on the left of the case which accept standard Atari-type joysticks. Values from them can be read into programs by means of the STICK function.

Monitor Commands

The JR-200 allows machine language aficionados to get into the monitor and the assembly language.

The monitor has only three commands: D, M, and G. D displays 128 bytes of memory from the location specified. M sequentially lists the memory locations from the address specified and allows you to alter them. G begins execution of an assembly language program from a specified address. Memory locations are all in hexadecimal.

Since we had only the scantiest information about these commands and none at all about JR-200 assembly language, we did not check out this feature.

Software and Support

From talking to Robert Zangrillo at Winter CES, we know that Panasonic is sincere in trying to provide support for the JR-200. All the early machines have been put in the hands of software developers such as Datamost, a smart move for



The JR-200 is a compact 13-1/2" x 8".

getting third party software on the market. Also Datamost has produced a version of their book, *Kids and the Apple*, for the JR-200. Likewise, we are in the process of producing a volume in our ideabook series for the JR-200, *The Panasonic JR-200 Ideabook*.

On the other hand, the preliminary JR-Basic manual is tough going, has very few programming examples, and could in no

way be considered user-friendly. We are told that the Datamost book will be supplied with the JR-200 as the Basic programming primer—probably a reasonable approach.

In Summary

The Panasonic JR-200 is one of the nicest new computers to make the scene in some time. It is attractively styled, is easy to use, and boasts an excellent, if not standard, Basic language. The graphics are very approachable and although resolution is not exceptionally high, the character set is excellent and allows the creation of detailed images. The keyboard is among the best of its type and the separate cursor movement keys make on-screen editing a joy.

The JR-200 is cassette tape oriented and uses it well for program and data storage. We are disappointed that Panasonic does not seem to be moving in the direction of a low-cost compact floppy disk unit.

Peripherals, documentation, software and support are, at this time, question marks although Panasonic appears to be moving in the right direction on all fronts. At the suggested list price of \$350, the JR-200 is an excellent choice. □

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Video Technology VZ200 Personal Computer

David H. Ahl

The Video Technology VZ200 is a compact microcomputer with a great deal of capability and many unexpected features at a very attractive price.

The VZ200 is based on the 6502 microprocessor, the same one found in the Apple, Commodore, and Atari computers. The 12K ROM memory includes the monitor and an excellent implementation of Microsoft Basic.

The RAM memory included with the

***All the Basic
commands, keywords,
and functions can be
produced with a single
keystroke.***

basic unit is a sparse 4K. Two plug-in expansion modules are available, one with 16K and the other with 64K. These modules plug into a slot on the back of the computer and extend out about 5.5".

The computer itself measures 11.4" x 6.3" x 2". Two-thirds of the top surface is occupied by a keyboard with 45 keys in four rows. The keys are "Chiclet" style rubber and have a very short throw. Touch typing is possible in only a rather limited way. Although key spacing is the same as on a regular typewriter, the rubberized keys have a different "feel." Much more disastrous for touch typing is the fact that there is no space bar; instead a space key is



The VZ200 with 16K RAM memory pack.

found at the right end of the bottom row next to the period. This also means that there is only one shift key (at the left end of the bottom row). Several other keys do not have the expected characters; for example the question mark is on the L key.

On the brighter side, each key on the keyboard provides several functions in addition to typing a single letter, number, or character. All the Basic commands, keywords, and functions can be produced with a single keystroke by holding down a control or shift key while the key is pressed. This is very

impressive. Most other computers which type Basic keywords with a single keystroke can produce only as many words as there are keys, i.e., one keyword per key. Each key on the VZ200, on the other hand, produces two Basic keywords as well as one or two graphics characters. So each key actually has five outputs: two Basic keywords, two graphics symbols, and an alphanumeric character.

When a key is pressed, it makes a short "beep" indicating one keystroke. If it is held down, it automatically repeats with a beep indicating each key entry.

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Four I/O connectors and two plug-in slots are on the back.

The top of the computer also has an on/off light. An on/off switch is recessed on the right side of the case.

Peripherals

The VZ200 has an interface to a standard cassette recorder which operates at a Baud rate of 600 bps. This is somewhat slower than other new computers which have rates up to 2400 bps; nevertheless it is twice as fast as machines of just a few years ago. A program that fills the entire 4K of memory with program code takes about 54 seconds to load; a 16K program takes four minutes to load. Bear in mind, however, that most 16K programs do not use 16K of code; much of the memory space is taken by dimensioned arrays and the like.

The manufacturer specifications note that a peripheral expansion bus is built-in, however, we are not quite sure what this means. It appears that expansion modules, which, presumably, can be connected to printers, modems, or other external devices, can be plugged into the back of the computer.

The VZ200 produces two forms of video output: a video signal for a monitor and RF output (on channel 33) for a TV set. It requires 9 volts DC at 800 ma; an AC adapter is included.

Output from the VZ200 can be in one of three modes: text, mixed graphics and

text, and high-resolution graphics. In text mode, the VZ200 produces 16 rows of 32 characters (upper case only). Characters can be displayed in regular or inverse video.

```
10 CLS:PRINT "KALEIDOSCOPE BY
DAVE AHL":PRINT
20 X=1: Y=1: XU=126: YU=62: Z=1
30 INPUT "ENTER 1,2, OR 3":I
40 I=.5*I: J=1
50 MODE (1)
60 X=X+I
70 Y=Y+J
80 COLOR (RND(B))
90 IF X>XU OR X<Z THEN I=-I:
SOUND 30,1
100 IF Y>YU OR Y<Z THEN J=-J:
SOUND 27,1
110 SET (X,Y)
120 GOTO 60
```

Set hi-res graphics mode
Compute new x and y
position

Tests to see if edge of
screen has been reached.
If so, reverse direction
of bounce.

Draw new spot

Figure 1. Program produces a kaleidoscopic pattern of eight colors on the screen. The input parameter changes the incremental amount added to each successive horizontal or X position. Each time the leading edge of the pattern hits a border of the screen, a beep tone is sounded.

Graphics

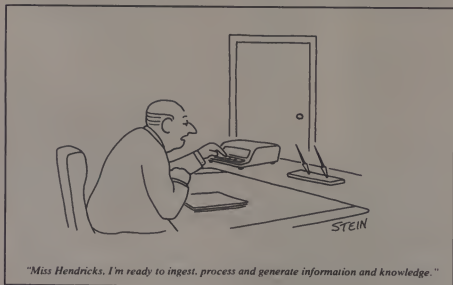
In mixed mode, text resolution is doubled to 32 x 64 pixels. This is accomplished by dividing each text character

pixel; and POINT (x,y) examines whether a pixel is on or off. Figure 1 is a listing of a simple program that lets a ball bounce around the screen.

By means of the SOUND (P,T) command, 32 notes or pitches (P) are available which can be played over a wide range of time intervals (T).

On-Screen Editing

Full on-screen editing makes it a pleasure to program on the VZ200. To edit a line of code, it is not necessary to invoke an EDIT command or remember a set of editing commands as one must do on the TRS-80 Color Computer and many others. Instead, on the VZ200, the line to be edited is listed, by itself, with the whole program or with a group of lines. By using the four directional keys on the bottom right of the keyboard, the cursor is moved to the character to be changed. You type the change, move the cursor to the end of the line (remember, a key repeats by holding it down), and type RETURN. Voila! The change is made. On-screen editing can also use the DE-



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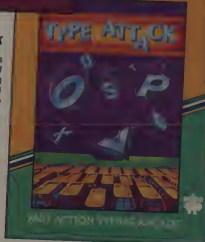
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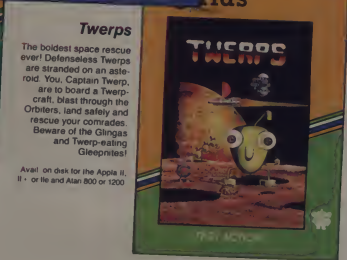
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VZ200, continued...

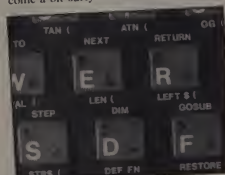
1.ET, INSERT, and RUBOUT keys.

We experienced two small problems with on-screen editing. First, the cursor directional keys are activated by pressing the control key on the left and one of the directional keys on the right. It was all too easy to hit the shift key instead of the control key, but this is probably something that one gets used to after using the computer for a few days. The other problem was that after a while the editing buffer seems to overflow and further editing is not accepted. Admittedly, we were trying to push the computer over the brink and it is unlikely that this will be a problem in normal use.

Problems

Speaking of pushing the computer to the brink, we found several things from which there was no way to recover short of turning the computer off. Even BREAK (the equivalent of RESET on some other machines) failed to return control of the computer to the user. The most common irrecoverable condition was 1.1ST. This would normally list a program on the line printer. However, if no line printer is attached, the computer hangs. This is particularly bad because the rubberized keys tend to bounce a bit and it is very easy to type 1.1ST instead

of just plain 1.1ST. If you have a long program in the computer and have to turn it off because it hangs up as we did four or five times, you are forgiven if you become a bit surly toward the machine.



Each key produces several outputs.

The surest cure is to use Control/4 to list a program. After a while, we learned to do this.

Other things that would hang the machine are all in the same family, in particular, trying to use a peripheral device that is not attached. In some cases, the VZ200 gave an error message, but in some others it went into never-never land.

We did not have an opportunity to try

any of the peripherals. The printer interface module, as mentioned earlier, plugs into the back of the computer. It measures 5.5" x 2" and provides a Centronics parallel signal. The Video Teichology printer appears to be a Seikoshia unit which we have previously found to be a satisfactory, cost effective printer.

Video Technology also promises a full line of software, however, we will reserve judgment on it until we actually see some of the packages in operation.

Summary

All in all, the Video Technology folks in Hong Kong have done an excellent job producing a versatile small computer. We are impressed with the excellent implementation of Microsoft Basic, full on-screen editing, repeat keys, and easy-to-use graphics features. The idiosyncrasies were a bit annoying, but owners will get used to them and will probably not notice them after a week or two of operation. Bottom line: the VZ200 is a great value for the suggested price of under \$100.

Video Technology (U.S.) Inc., 2633 Greenleaf, Elk Grove Village, IL 60007.

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Auto-dialing, auto-answer, and auto-hangup	Yes	No	Yes
Half/Full Duplex	Yes	Yes	Yes
Auto Chatter/Answer	Yes	Yes	Yes
Non-compatibility inside Apple	No	No	Yes
Auto Answer Dialing	No	Yes	Yes
Single Modem Card Reliability	No	No	Yes
Parity Monitor	No	No	Yes
Self Testing	Yes	Yes	Yes
Warranty period	2 yr	1 yr	2 yr
Free money SOURCE Offer	No	No	Yes
Suggested Retail Price	\$379	\$589	\$525

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System Saver™

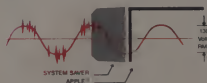
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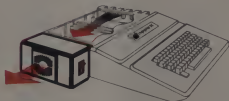


By connecting the Apple II power input through the SYSTEM SAVER, power is controlled in two ways 1) Dangerous voltage spikes are clipped off at a safe 130 Volts RMS/175 Volts dc level. 2) High frequency noise is smoothed out before reaching the Apple II. A PI type filter attenuates common mode noise signals by a minimum of 30 dB from 600 khz to 20 mhz, with a maximum attenuation of 50 dB.

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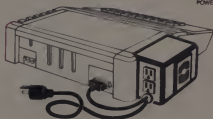
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The TI 99/4A

The Texas Instruments 99/4, long disregarded or treated with derision by manufacturers and owners of more "popular" computers, has finally come into its own as the 99/4A. With enormous distribution in retail outlets across the country, TI now vies with Commodore and Timex for the top spot on the Consumer Computer Hit Parade. And we expect that the birth of TI's newest offspring, the 99/2, will strengthen the position of the 99/4A. Hence, we take a second look at the TI 99/4.

Fred Gray

But under the funny keyboard was a mighty machine with dazzling color graphics and the 16-bit soul. TI looked at the sales figures and said to the engineers: Fix the fool thing and make it live up to the genius inside. And so they did. And so it does. And look out, others.

There were many things wrong with

the TI 99/4 when it hit the street. It was much too expensive, it had a calculator style keyboard, it could run only Basic or plug-in modules, and had no expansion capability. These were not oversights, and TI had reasons. The cost was high because it was a new generation of machine and a color monitor came as part of the package. The keyboard came from the TI calculator heritage and allowed the use of slip-on overlays to redefine the keys for special modules. The machine was designed as a home appliance and the home user was not seen as being interested in fancy assemblers or exotic languages. Finally, to keep it com-

In the beginning there was TI. And it was big and strong and mighty in the ways of digitals. It had The Watch, and it had The Calculator, and it made more chips than Frito-Lay. But other companies not as big and strong had home computers and were selling them like twinkies. TI looked in its parts drawer and saw a wondrous 16-bit microprocessor that it was most proud of. "We shall make a Home Computer," said TI, and did so.

The TI 99/4 came out in 1979, was small, had calculator buttons for keys, and cost a lot. "See!" said TI, "we have a home computer!" "Hooray!" said the others, "You have a bomb!" And they were right and they were wrong. For the home computer was not a hit and sold like cold cakes, even when the price dropped from Apple Sky to Cheap City.

Fred Gray, 41 Belvoir Drive, Fort Belvoir, VA 22060.



TI 99 4/A, continued...

compact and easy for the home user to use, there was no provision for slots or expansion board space; instead, peripherals and expansions were designed into silver boxes to be plugged into the side of the computer.

The price didn't stay high for long. It dropped from \$1100 (with mandatory monitor) to under \$500 (without it) by the end of 1980. The Basic on board was a good one, full of error-checking and editing capabilities, and considerable graphics capabilities. But the graphics capabilities were slow, too slow to allow anything exciting. True to their promise, TI did bring out expansion modules in silver boxes to plug into an ever-expanding daisy chain at the right side of the computer.

Chief among these was the Solid State Speech box, which gave the 99/4 300 words of highly understandable speech and made it, for a while, the only home computer that could talk.

Still, the 99/4 did not sell, a fact that may have been due to the philosophy of the TI hierarchy. Because the TMS9900 is an unusual microprocessor, and the 99/4 an unusual microcomputer with quite different architecture and I/O, TI decided to leave the fancy programming to their own staff, or to selected large organizations such as Scott, Foresman and Milton Bradley. So they did not publish anything about the workings of the machine and did not offer an assembler, and anyone wishing to do whizbang graphics or anything fast had to get a minicomputer development system, which cost about \$50,000.

The result was predictable: practically no one wrote anything for the 99/4. And because the internal workings of the 99/4 were inscrutable and undecipherable, practically no one made any peripherals for it. While creative souls at TI were working hard on modules and peripherals, there were thousands of creative souls among the Great Unwashed who were writing Adventures and Starfigs and making superboards and

widget controllers for Apples, Pets, and TRS-80s. But not for the 99/4.

To their credit, the folks at TI woke up and have rectified virtually all of the problems of the 99/4. The 99/4A is all the 99/4 should have been and more, and now the machine is easier to exploit than ever before.

Hardware Improvements

Let's look at what is different about the 99/4A.

Of course, there is the new keyboard, a sturdy professional one that looks like a computer keyboard. It has a bunch of new keys, offers braces, square brackets, and lower case. It allows any key to be repeated at will, and allows keys to be used in three ways: key, shift key, and function key. Add to this the retained capability to redefine all of the keys through software and the ability of programs to search the keyboard during a run, and you have a most impressive input capability. All that is really lacking is a number pad for quick input of numerical data, which wouldn't have fit on the case.

But there are other changes, deep in the chips and ROMs. One is the use of the TMS9918A Video Display Processor (VDP) in place of the older 9918. To go with it is a revised operating system in ROM that opens up some of the advanced capabilities of both it and the 9900 microprocessor itself, as well as allowing the use of the expanded keyboard.

The TMS9918 is worth a side trip by itself. The VDP is an extraordinary display processor, able to display ASCII characters or user-defined characters in 16 colors on a 24 by 32 grid. More than that, embedded in the chip is the ability to display and move graphics characters called sprites, which can move smoothly across the screen and which, once set in motion by the calling program, continue to move at the specified speed and direction *without CPU attention* until changed by the program.

The VDP creates and moves the sprites based on data stored in the VDP RAM area by the program. By changing data, the sprites can be made to change course, shape, speed, color, vanish, or appear. The sprites afforded an incredible game and moving graphics capability to the 99/4, but because the internal Basic did not support their use, the capabilities were limited to plug-in modules, and not available to the home programmer.

The sprite capabilities of the Computer were opened up through the introduction of Extended Basic, available for both the 99/4 and the 99/4A. This module, adding some 36K of ROM to the on-board Basic, corrects many of the

annoying limitations of the original Basic and opens up a wide range of additional capabilities to the machine.

With Extended Basic, the programmer can create sprites in two sizes, set their initial shape, location, velocity, direction, and color; change any of these at will; detect coincidences of sprites with each other or with specified points; change their size and make them vanish or become invisible—all with a simple call to one or more predefined subprograms.

Because the VDP does the work, the main processor is involved only with initiating the action, and the sprites will move as set while the 9900 processor is busy computing other things. Heavy computing by the CPU has no effect on the moving graphics as long as the motion doesn't change, and wild motion on the screen has no effect on the work of the CPU. Since up to 28 individual sprites can be defined and set in motion, the capability for dazzling color animation and games is almost unmatched in the home computer field.

The 99/4A adds another dimension to the sprite graphics not available on the 99/4, bit-mapped graphics. This high-resolution mode is attributable to the 9918A VDP, and provides the capability to do bit-mapped color graphics on a 256 by 192 grid. Now the TI has high-resolution graphics in addition to the sprite capability. Unfortunately, the bit-map mode does not allow the automatic movement feature of the sprites to exist along with the high resolution capability, as the VDP gets a bit overworked. Even with this limitation, the capabilities are astounding. We should see some amazing game and graphics programs soon.

Another capability of the TMS9900 microprocessor has been opened up for the 99/4A through a change to the ROM-based operating system. This is the ability to define up to 16 operations at the assembly level that can be used just as if they were added opcodes for the processor. The effect is to extend the instruction set by 16 and turns the new Assembler/Editor into a Macro Assembler. The ROM change did not take effect with the first bunch of 99/4A units, but is incorporated in the ones coming off the line now.

Editor/Assembler Package

The new Editor/Assembler module is now available for the 99/4A. From a review of the manual I can report that this module plus disk set is an extremely powerful software tool—in reality a minicomputer assembler in microcomputer form. TI has taken their assembler, editor, and linking loader packages developed for the 990 series



minicomputers and reshaped them for the 99/4A. This was made possible by the fact that the 900 and 990 instruction sets are virtually the same. Some of the remarkable capabilities that the Editor/Assembler brings to the microcomputer field are these:

- Writing of relocatable, linkable code. The programmer does not need to worry about absolute addresses and can write his programs as independent subprograms to be linked together later by the loader. By defining certain labels as external references, the loader can match them up and link the programs together, filling in the addresses at load time. This also allows the loader to put the programs into memory wherever they fit best and not be constrained by the present configuration. The computer begins to look more like a minicomputer here. The great advantage for the programmer is the ability to write a library of subroutines, keep them on disk, and bring them into his programs as they are needed without worrying about the addresses or linkages.

- Extraordinary editing capabilities. The Editor is very complete and offers a wide variety of conveniences for the programmer. Some of these are: inserting and deleting characters, inserting and deleting lines, copying whole blocks of code and inserting them elsewhere in the program, moving whole blocks of code around, searching for strings with the option to replace each occurrence with a new string, and a variety of filing commands. The system looks rather like a word processor for assembler code. It makes coding a great deal easier by removing much of the nuisance work.

- Links to Utility Routines. TI has a great variety of utility routines tucked away in both ROM and GROM that are used by the operating system and the interpreters. Access to these routines makes it much easier to do the complicated graphics, sound, and speech routines. The programmer need only load certain parameters in the registers and then call on the utility routine to do the work. This capability is particularly needed with the graphics routines, as this area is rather inscrutable anyway. The utilities give the programmer the ease of programming exhibited by the Extended Basic while allowing the speed of machine-assembled code.

In summary, the TI 99/4A finally lives up to the promises of its makers. With new software and hardware improvements, the TI Home Computer is finally a powerful force in the microcomputer field and should not be counted out. At a normally discounted price of under \$300, the 99/4A is an astounding value and may yet make its mark on the microcomputer world. □

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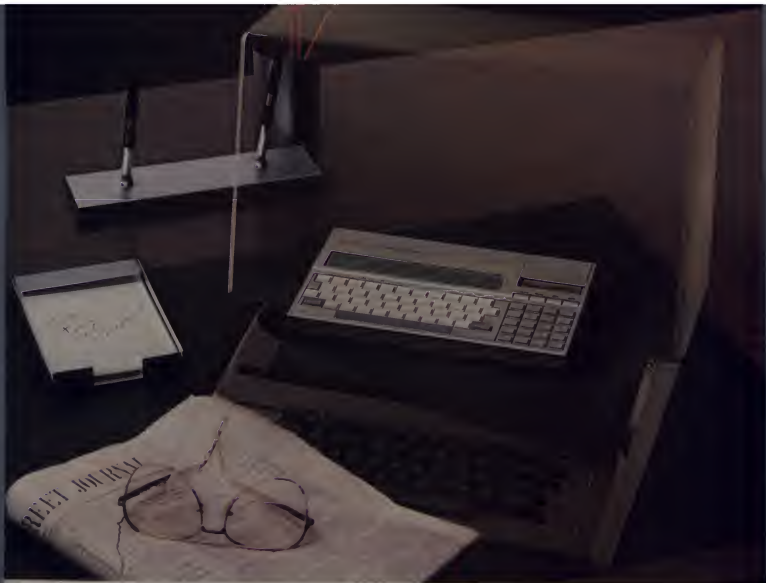
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TEXAS INSTRUMENTS

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Texnet

I bought my TI99/4 because I had always wanted to own a home computer but didn't have any programming experience. Today, I have the ability to hold my own when discussing computers, but no one to discuss with.

Apple, Atari, and TRS-80 owners don't have to look very far for someone to talk to. Most computer outlets sell one of these and can supply information on hardware, software, user's groups, or whatever.

It's different for TI users though, as about the only places that carry the 99/4 or its accessories are mail order houses and retail stores. If you have a question, forget the retail stores. You probably know more than they do.

I suppose I could join a TI user's group, but I live in Massachusetts where there are no user's groups. As a matter of fact there isn't one in all of New England that I know of. I could also join a few clubs in distant locations and communicate by mail, but it just isn't the same.

There is, however, an alternative; it is called *Texnet*, the information service that with Source Telecomputing created a system developed specifically for users of the 99/4 and 99/4A home computers.

When I first heard about *Texnet*, I

Robert Cashman

thought it was too good to be true. First, you receive all the products of The Source—some 1400 different services—everything from electronic mail to catalog shopping, from dining and travel to home and leisure.

Making friends on Texnet was great, but what I really wanted was some of that free software.

But you also get *Texnet*, a service which adds custom features such as:

- TI News
- TI Software Directory
- TI User's Groups
- TI Service Centers
- TI Help
- TI Phonetic Dictionary
- TI Voice Chat
- TI Graphics Library
- TI Music and Sound Library
- TI Idea
- TI Logo Exchange

All of these are terrific, but none can compare with the TI Software Exchange—free software supplied by the International 99/4 User's Group. (Note: software can be downloaded to a disk drive only.)

We all know how difficult it is to find software, but can you imagine getting it for free? Recently, *Texnet* made it possible to upload your own programs to the TI Software Exchange. If even half of the current TI owners would contribute, think of the library of programs we would have to share.

Without giving it a second thought, I decided to subscribe. But first I had to get several accessories. This wasn't a cheap experiment; I needed a modem, an RS-232 interface, and a terminal emulator. I decided to get the TE II for its text-to-speech capabilities, since I already owned a speech synthesizer. In all, those three items cost me about \$400. I also had an extra telephone installed for another \$50.

The cost for a one-time registration is \$100. Once on-line, you incur charges of \$20.75 per hour weekdays between 7:00 a.m. and 6:00 p.m., \$7.75 per hour evenings, weekends and holidays, and \$5.75 an hour from midnight to 7:00 a.m. daily for 300 baud service. Prices for 1200 baud users are \$25.75, \$10.75, and \$8.75 respectively.

Robert Cashman, 692 Lowell St., Lawrence, MA 01841.

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Double Entry	NO	YES
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Accommodates Any Type Transaction	NO	YES
Transaction Retrieval	SOMETIMES	ALWAYS
Backdate Transactions	YES	NO
Ability to interrupt While Printing	292661	292,661 42
132 COL PRINTER REQUIRED	NO	YES
NUMERIC FORMATTING	113 sec	44 sec
Optional VisiCalc Interface	162 sec	1 sec
PERFORMANCE		
Startup to Transaction Entry	106 sec	2 sec
Begin Printing Balance Sheet After Entering Transactions		
Begin Printing Transactions After Entering Transactions	C D	A
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"The ACCOUNTANT does, indeed, make financial management a simple and straightforward procedure."

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Texnet, continued...

I can't tell you how excited I was when I received my ID number and password. No longer did I feel alone. Everything I wanted was at my fingertips, just a phone call away. It's a good feeling to know that you are no longer communicating only with a computer, but with literally the whole world. Some Texnet subscribers live as far away as Australia.

Making friends on Texnet was great, but what I really wanted was some of that free software, and for that I needed a disk drive. Just as I began to shop around for a disk drive and controller, a classified section for the TI99/4 appeared in The Source POST category. I inserted a "free" wanted-to-buy ad for the things I needed, and got an immediate response and some excellent prices—better than I had seen anywhere. Needless to say, I am now downloading programs.

How difficult is it to access the more than 1400 services on The Source and Texnet? It is not difficult at all. When you receive your confirmed application, an extremely easy-to-read user's manual is included. It is a three-ring binder with dividers that allow easy retrieval of subject matter.

Can I find any fault with Texnet? Unfortunately, yes. Texnet is accessed primarily through two computer telephone networks called Tymnet and Telenet. They are located in over 350 metropolitan areas in the United States. The city that I live in is not one of them. This surprised me as there are approximately 200,000 people living within a ten-mile radius of my city.

The closest city to me with the telephone access line is some 20 miles away, and I have run up some very high telephone bills. I have contacted the local Telenet office (Tymnet did not have an access line) to see when they planned to install a line in my city. I was told that if there was a demand, a line would be installed. Until that happens, I have to be careful not to lose track of time while I'm enjoying Texnet.

I did experience a little difficulty while on-line a few times. I was downloading from the TI Software Exchange and lost the carrier signal. This can be aggravating when you are close to completing the data transfer and lose it all. It can take as long as 25 minutes to download a program, so you could end up paying for 25 minutes of on-line time and have nothing to show for it. This has happened to me a couple of times.

Another nice feature of Texnet is their terrific customer service. If you should have any problems or questions that the manual can't help you with, you can call a toll-free number and get immediate assistance.

The Source, 1616 Anderson Road, McLean, VA 22102. □

May 1983 • Creative Computing

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key permits users to self-test ROM, RAM, audio-visual circuitry and keyboard functionality or call up assistance within complex programs. For even more help, Atari gives you a toll-free number to call for product and technical information (800) 538-8543; in California 1-(800) 672-1404.

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Modem80

Modem80 is a package of communications software for the TRS-80 which is easy to use and sufficiently flexible for all normal computer communications. With this program one may successfully access bulletin boards, other TRS-80s, mainframe computers which permit telephone access, and other brands of microcomputers. Files may be transferred to and from other computers provided they can be set up either to receive ASCII files or to operate under the protocol of the CP/M program Modem.

Files may be sent in their entirety or a line at a time—as for example, to get material into a mainframe text editor such as SOS or TECO. The *Modem80* package—which consists of seven separate programs—is extraordinarily versatile.

Modem80

The main program of the package is *MODEM80/CMD*. Like the other offerings on the disk it may be copied without difficulty and runs perfectly under TRSDOS, NEWDOS 2.1, NEWDOS-80 (both versions), DOSPLUS, and LDOS. *Modem80/CMD* loads, initializes the RS-232 parameters, and then presents the user with a menu which lists a variety of activities. By using simple control codes (the CLEAR key is designated as a control switch), you can set the system up to receive or send a disk file, toggle the printer on or off, or transmit some of the characters left off the TRS-80 keyboard. Alternatively, you may switch to the main menu, which offers additional possibilities.

All file transfers are to or from disk: a large buffer is established to which or from which file material is sent. During the transmission, you may query the sys-

Robert Jacobs

tem and receive a report of file and buffer status. One advantage of this procedure is that files of unlimited length may be sent or received—or, more precisely, the largest files your disk storage system will handle may be received and sent.

Transmission may be interrupted at any time, and it is even possible to break certain kinds of files in the middle and put the remainder on a different disk. Another advantage of a disk-oriented system is that files may be prepared offline, by programs such as *Scriptit*, and saved to disk. Then, should there be some transmission difficulty, the material is still safely ensconced on your disk, ready for another try.

Disk file material may be intermixed with keyboard characters, thus permitting the transmission of data to computers that cannot accept full-speed transmission and which do not use control codes to start and stop the transmission.

Reception of files is nearly as flexible, especially if the sending computer can be set up to respond to control codes, since under *MODEM80/CMD* the TRS-80 can be set up to use any ASCII control code needed to regulate the sending machine. Control codes may also be used to permit the remote computer to control the file operations.

Two file transmission protocols are available. The first is a handshaking protocol compatible with the widely used CP/M program Modem. As files are transmitted, they are checksummed in blocks, and the checksums verified at either end. Should a block be transmitted incorrectly, *Modem80* automati-

cally retransmits it. Any type of file may be transmitted or received, whether TRS-80 compatible or not. This protocol requires that the remote computer be using a similar program. Should this condition not exist, transmission and reception of files may still take place—but here you are limited to ASCII files. You may send or receive text or Basic programs saved in ASCII under the A option, or a binary file may be converted to an ASCII file by using the utility *HEX/CMD*, supplied with the *Modem80* package. Thus the limitation to ASCII files turns out not to be a limitation; in fact, *HEX/CMD* offers a file checksum also, so that you may verify correct reception by comparing the sent version to the received version. And naturally, an ASCII file may be converted back to binary form by the final option offered under *HEX/CMD*.

The main menu of *MODEM80/CMD* permits a good deal of local housekeeping. The user selects between "echo" and "terminal" modes so that full-duplex

creative computing

SOFTWARE PROFILE

Name: Modem80

Type: Communications package

System: TRS-80 Model I, III

Format: Disk

Language: Machine

Summary: Seven versatile telecommunications programs

Price: \$39.95

Manufacturer:

The Alternate Source
704 N. Pennsylvania
Lansing, MI 48906

Modem80, continued...

transmission may take place between computers (one of the two should be on "echo"). All of the RS-232 functions may be altered from the keyboard by changing local communication parameters. In addition, you can set the system for full or half-duplex, to add linefeeds to carriage returns, to send nulls after carriage returns, to receive graphics, and to print line feeds or not. In short, complete flexibility is offered, and though my description of the program may make it appear complex, it is, in fact, easy to use.

Other Programs

The remaining programs are also interesting. HOST1/CMD allows remote control of the computer, and XMODEM/CMD is a file transfer utility which may be run under HOST1 so as to permit file transfers under the control of the remote computer. Only in this case must both computers be using *Modem80* or other derivative of CP/M.

TYPE/CMD, also included as part of the package, lists a file on the display or printer and may be used under HOST1 to send a file to a remote computer or

terminal. TYPE/CMD responds to the XON-XOFF protocol used by so many mainframe computers and thus fulfills a function that XMODEM does not.

The last two programs, SAVE/CMD and TEXTFIX/CMD, assist in the preparation of disk files for transmission. SAVE/CMD allows one to key directly to disk, thus permitting off-line text file preparation. If the user does not have a word processing program available, this utility fills the gap. TEXTFIX cleans up text files by removing control characters so that the received file may be loaded into a word processor. It also has the ability to add the terminal zeroes required by *Visicalc* and *Electric Pencil* files. These are not the kinds of things one uses often, but when you do need them, you need them badly.

Uses

I have been using this package for several purposes. The simplest has been to transfer materials back and forth from friends' TRS-80s and from Model I to III, for which it is ideal. I also access bulletin boards and Micronet occasionally and with complete success.

The most demanding application has

been contact with my university's computers—a DEC-10 and a VAX. The flexibility of the *Modem80* package has allowed me to transfer text, Basic, and Fortran files without difficulty.

The author of *Modem80*, Leslie Mikesell, has done a wonderful job on the documentation, and it is clear that a great deal of thought has gone into the design of the program as well. I was most impressed by Mikesell's provision of four translation tables, which permit alteration of all the control codes, establishment of special keys, redefinition of transmitted or display characters and the like. These are the output, video, disk, and printer translation tables. All are readily alterable by the user by entering DEBBUG, and although most applications will not require such changes, some will. The ability to make these changes is an important attribute of smart terminal programs.

This package of programs is an excellent value. It will serve the communications needs of practically every user. In several months of heavy use, I have yet to discover a bug in it and have had no difficulty with either specialized or common applications. □

ces... notices... noti

Computers in Education '83

Computers in Education '83, a conference and summer institute for educators is set for June 20 through July 15, 1983 at Rutgers—The State University of New Jersey. This year's theme is "Necessary Direction for Computer Education: Navigational Aids for the 80's." The focus of the conference (June 27-29) and the four-week Summer Institute centers on microcomputers and other new information technologies and their impact on education at elementary, secondary and college levels.

Included among the featured participants are David H. Ahl, founder and editor-in-chief of *Creative Computing*; and *Creative Computing* contributors and friends Gary G. Bitter, professor of computer education, Arizona State University; Alfred M. Bork, director, Educational Technology Center, University of California at Irvine; Lud Braun, software director, Office of Instructional Development, New York Institute of Technology; Jim Butterfield of Toronto, Ontario, Canada; Sylvia Sharp, director of instructional systems, Philadelphia Public Schools; Fred T. Hofstetter, director, Office of Computer Based Instruction, University of Delaware; Dan Isaacson, California State University at Fresno;

Arthur Luehrmann, founding partner, Computer Literacy, Berkeley; Seymour Papert, Massachusetts Institute of Technology; Robert P. Taylor, Teachers College, Columbia University; and Karl L. Zinn, Center for Research in Learning and Teaching, University of Michigan.

The final brochure, which contains program details, description of the forty short courses in the Summer Institute, and a registration form, will be mailed in late March.

Additional information can be obtained from: Mitchell E. Batoff, Institute for Professional Development, 245 Nassau St., Suite D, Princeton, NJ 08540. Telephone: (609) 924-8333.

Basic Standard

The American National Standards Institute has approved a public comment period for the Basic Standard; it will begin around mid-March and last until mid-July.

Persons interested in reviewing the proposed standard and commenting on it should write to: X3 Secretariat, CBEMA, 311 First St., N.W., Washington, DC 20001. Ask for document X3J2/82-17 entitled "Proposed Draft for American National Standard for Basic," and enclose a check or money order of \$20 for duplicating.

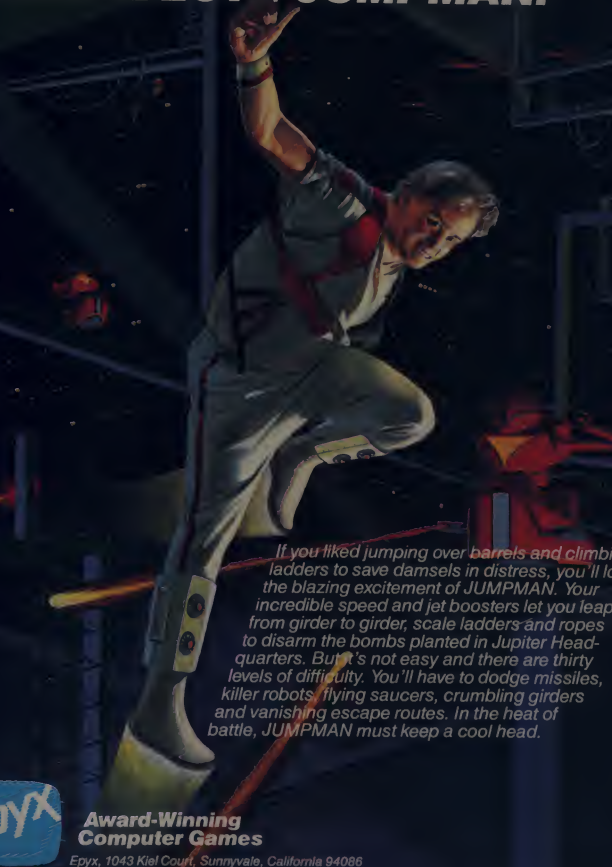
Radio Shack Educational Challenge

Radio Shack, a division of Tandy Corporation, has announced America's Educational Challenge, an opportunity for elementary and secondary school teachers in the United States to achieve a basic familiarity with computers and their use in the classroom.

Information on the program has been mailed to every school principal in the United States. The mailing includes an educator's handbook describing the ways microcomputers are being used in schools, a basic computer literacy package, including spirit masters and teacher information designed for use in a classroom to teach elementary computer concepts, a secondary level textbook on computer programming, information about what several school districts are doing with computers, and an order form which a school can use to obtain two filmstrip audio-visual presentations suitable for conducting teacher workshops and staff development sessions on computer concepts and the use of computers in education.

Also included are several certificates entitling teachers to two free classes in Basic programming and an educator's workshop at one of over 375 Radio Shack Computer Centers. All of these materials will be provided to a school on request and without charge, according to William Gattis, Director of Radio Shack's Education Division.

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If you liked jumping over barrels and climbing ladders to save damsels in distress, you'll love the blazing excitement of JUMPMAN. Your incredible speed and jet boosters let you leap from girder to girder, scale ladders and ropes to disarm the bombs planted in Jupiter Headquarters. But it's not easy and there are thirty levels of difficulty. You'll have to dodge missiles, killer robots, flying saucers, crumbling girders and vanishing escape routes. In the heat of battle, JUMPMAN must keep a cool head.



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Z-Term, The Professional

Do you have an Apple II, a Z80 SoftCard with CP/M, and one of the popular modem cards, or a serial interface with an outboard modem? Do you wish you had some decent software to use the combination to connect your computer to the outside world of databases and other computers in just about every way imaginable?

If so, your wish may not only become a reality, but with *Z-Term, The Professional* from Southwestern Data Systems, you may get quite a bit more than you thought was possible. *The Professional*, which we will call *Z-Pro* is certainly everything I wanted in a communications package.

A good bit of the CP/M software available these days is not something that you can buy over the counter in your nearest computer store. Some of it may be up and running on a friend's computer, near or far. There are CP/M bulletin boards all over the country with sophisticated public domain programs written by very competent programmers available for download.

With *Z-Pro*, you can read or download text just as it was originally formatted, including control characters from time-sharing systems such as The Source, Micronet, and others. With an external terminal or 80-column board, you can take advantage of the mainframe at your office and use the screen-oriented editor or database.

You can transfer a COM file between your machine and someone else's, or download one from a CP/M bulletin board. With this package, you can transfer text, source code, data files, or encrypted gibberish from one system to

J. Robert McCown

the other and make sure it arrives in one piece the first time. You can even have your system answer the phone and do all this for another CP/M system with similar capabilities!

Let's start with a general overview of *Z-Pro*. The package supports most peripheral communications devices at baud rates from 50 to 1200 and can also speak Baudot (the deaf TTY standard) when using the Novation Apple Cat modem.

creative computing

SOFTWARE PROFILE

Name: Z-Term, The Professional

Type: Advanced communications package for the CP/M Apple

System: An Apple II or Apple II+ with 48K RAM, Z-80 SoftCard, and modem card or serial interface with associated modem.

Format: 5 1/4" disk

Summary: Excellent data communications package.

Price: \$149 in computer stores, or can be ordered directly from SDS

Manufacturer:

Southwestern Data Systems
P.O. Box 582
Santee, CA 92071
(714) 562-3221

Z-Pro supports all kinds of screen display, ranging from the standard 40-column Apple screen to any 80-column display board or external terminal. Any disk system currently interfaced to your Apple II under CP/M is also supported with no modifications necessary.

If you are using the local Apple keyboard and 40-column screen, provision is made for the generation of lower case and other characters normally not available on that keyboard. In this configuration, however, you must have some sort of lower case board in the computer to be able to view the lower case characters.

With *Z-Pro* you can send or receive ASCII (7-bit) data of any type to most any dial-up system. Files of any size may be sent and files of up to 34K may be received at any one time. The package also supports the Christensen protocol, an established standard among CP/M dial-up systems. This makes it compatible with MODEM, XMODEM (most variations), LMODEM (DEC-10) and CMODEM (Unix). Using this protocol, any kind of file (8-bit) of any size may be transferred with complete checksum and CRC error checking.

Z-Pro supports the PAN protocol (a subset of PCnet) for the sending and receiving of forwarded mail by other *Z-Pro* or PAN systems. The system can be left on-line unattended to answer the phone, receive PAN mail or send and receive Christensen transfers.

You can set up keyboard Macros, including imbedded control characters, to function as mini-programs. At a key-press, you can do such things as sign on to a host system or perform custom hand-shaking routines with another system.

We will discuss some of the finer points

J. Robert McCown, 4670 W. 63rd Street, Los Angeles, CA 90043.

of the system later on in the article, but let's see what we get on our screen as a menu when we first fire this program up.

Using The Program

After executing the program ZPRO.COM, the first thing we get is the * prompt, which is the indicator throughout the program that asks us for a Z-Pro command. Pressing ^Q, which is the single control key we must remember to get back and forth between terminal and command modes, displays the menu shown in Figure 1.

Figure 1.

```

-MAIN COMMAND SUMMARY-

I = Display program status
C = Clear buffer
D = Dial or connect (if applies)
E = Echo -- duplex full-half
F = Free buffer space
G = Get file from host (protocol)
H = Hang-up (if applies)
I = Disk directory
J = View disk file
K = Change logged disk
M = Macro group select
P = Printer on-off
R = Copy on-off
S = Send file
U = Secondary menu
V = View current buffer
W = Write file & clear buff
X = exit to CP/M
  
```

To examine the secondary menu of functions, we type U from the main menu. The result appears in Figure 2.

Figure 2.

```

-SECONDARY COMMAND SUMMARY-

A = Show control characters
B = Baud rate change (if applies)
L = Terminal chat mode on-off
N = Set delay after c/c (send)
O = Auto-save on-off
Q = Main command menu
T = Transpose ^R/RUB
Y = Set protocol options
  H = No show
  S = Show
  F = File
  R = Received data
  S = Sent data
Z = Screen format on-off
z = Auto-disconnect on-off
@ = Apple CAT voice modes
@ = Apple CAT port switches
+ = Answer phone (if applies)
* = Keyclick on-off
/ = Do CRC
  
```

A good many of the instructions described here have their own sub-menus and subsequent choices of things that you may want to do, but it is not my intention to duplicate the manual. The manual contains about 125 pages and each of the

capabilities of the system is discussed in great detail.

A program called Z-MOD.COM comes with Z-Pro. You use this in a kind of DDT fashion to modify various tables and flags in Z-Pro to customize the program for your particular configuration. Among the things that can be changed are the defaults for most of the main commands, the flags to control various peripheral devices, and the communications protocols.

In addition, you can configure whatever terminal you use to look like the terminal that the host computer expects. For the most part, if you have a reasonably common set-up with one of the modems or terminals listed in Figure 3, Z-Pro will run as configured when you get it.

With close attention to the manual and some thoughtful planning, you can use the Z-MOD program to create a completely personalized version of the system. With the exception that certain changes must be made for some modems or terminals you can run this package just as it is. Z-Pro knows what kind of modem or terminal card you have plugged into your machine and treats it accordingly.

Another program that comes with the package is GO.COM, which can be executed once you have exited from Z-Pro to CP/M. Providing you have not run

another program or reset the system, you can then re-enter Z-Pro with all flags and data intact. This really comes in handy if you want to rename files, change disk files, etc. and continue your session without disconnecting the phone.

Figure 3. Some of the peripheral cards and modems supported by Z-Pro.

```

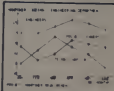
Hayes Micromodem II
Apple Communications Card
SSM AIO board
CCS Asynchronous Serial Board
7710A (or D)
ESI Apple Lynx system
Novation Apple Cat
MicroPeripherals Micro Connection
Hayes SmartModem (with compatible interface)
Mountain Computer CPS card
All display cards, provided they are compatible with CP/M
Mountain Computer Clock (original)
CCS 7424 Calendar Clock Module
Thunderware ThunderClock
  
```

Z-Term. The Professional is the best communications package for the CP/M Apple II that I have seen. It is user-friendly, and had me feeling like a pro in no time.

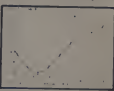
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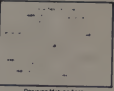
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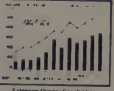
General Purpose Plotting



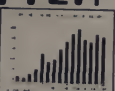
Statistical Data Analysis Forecasting



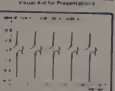
Decision Making Tree



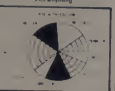
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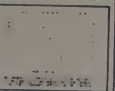
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Data may be input directly or from previously generated data files. Comprehensive documentation is provided including printer dump instructions and directions for accessing data bases created by other programs. Requires Apple II and one DOS 3.3 disk drive.

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RICHARD ALTWASSER AND STEVEN VICKERS

Steven Vickers

Steven gained his degree in Math at King's College, Cambridge, England, and his Ph.D in Algebra at Leeds University. His first assignment after school was to create the Sinclair ZX-81 or Timex 1000 8K ROM, and to write the ZX-81 manual. Subsequently he wrote most of the ROM for the Sinclair Spectrum or Timex 2000.

Richard Altwasser

Richard gained his honors degree in Engineering at Trinity College, Cambridge, England. He joined Sinclair in September 1980, and was instrumental in the research that led to the development of the Spectrum or Timex 2000.

Recently these two experts started their own company and developed the Jupiter Ace range of hardware which is based on the exciting new language for micro-computers "FORTH"

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Speed Comparison Chart showing times in seconds to perform one thousand operations.

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Print a character	0.62	3.1	7.5	24
Add two numbers	0.45	5.5	7.5	28
Multiply two numbers	0.9	6.5	7.5	32

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide

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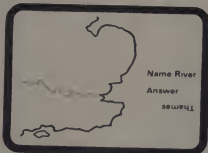
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Total Order			

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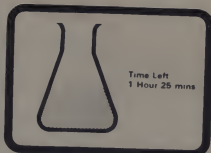
Jupiter ACE

*What can you
do with a
Jupiter Ace?*



In Schools

Teachers already know how quickly children take to computing, and the Jupiter Ace is an ideal introduction. FORTH is an easy and important language to learn and by making learning fun, the Ace can help to teach science, music and many other subjects.



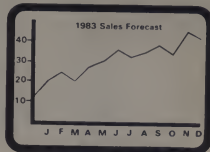
In Laboratories

For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built in quartz timer allows experiments to run all weekend.



At Home

The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.



In the Office

Stock control, Accounts and Financial forecasts are all possible on the Jupiter Ace. With a printer and extra memory attached you can do word processing as well.

The Jupiter Ace also features a full-size moving-key keyboard, high resolution graphics, sound, floating point arithmetic and 3K of RAM. Expandable to 51K.

For the beginner

Which Personal Computer is best for you?

Simple! You need an easy-to-use language and a system that gives you all you need to start off with, but with room to expand. FORTH is the best language for personal computers and the Jupiter Ace is the only one designed to use it. The specification of the Ace is already impressive and with extra memory and a printer interface it can grow with you.

For the Personal Computer owner

You are already aware of the limitations of BASIC. You know how slowly your programs run and how quickly your computer's memory gets filled.

FORTH is your answer. It is easier to learn and is typically ten times faster than BASIC and it only uses 20% more memory than machine code.

For the FORTH enthusiast

The Jupiter Ace closely follows the FORTH 79 standard with extensions for floating point, sound and cassette. It has a unique and remarkable editor that allows you to list and alter words that have been previously compiled into the dictionary. This avoids the need to store screens of source, allowing the dictionary itself to be saved on cassette. Comprehensive error checking removes the worry of accidentally crashing your programs.

Micro-Courier Electronic Mail Software for Apple Computers.

MICROCOM
We make little computers talk big.

Micro-Courier

"Jones, take a letter. I want this to go to all our salespeople immediately. Hrrumph."

"Right, R.J. No problem. Go ahead."

"Dear fellows and gals. I'm happy to announce that we have had a tremendous production breakthrough. It allows us to cut the price on our model 2342 from \$250 to \$150, effective immediately. This price cut should increase sales immensely."

"Sign it, 'R.J. Johnson.' Hrrumph."

"It'll go out tonight, R.J."

The secretary walked down the row of offices to a door labeled Corporate Electronic Communications. Inside was an Apple II Plus, two disk drives, a Hayes Micromodem, monitor, and a printer.

He sat down and selected Create/Edit Mail from the eight-part menu on the screen. After a couple of questions from the program, he entered R.J.'s message and saved it to disk.

After hitting ESC a couple of times, he selected Address and Review Messages from the menu. Once there, he chose the list of all 47 salespeople the company

had by typing Q, then entered a time of 0100 the following morning.

When that was complete, he added a few extra communications, a couple of text files, a *VisiCalc* formula, and some other odds and ends. These were addressed to the individual salespeople who had need of them.

After hitting ESC again to get to the main menu, he selected the Send/Receive Mail menu. Leaving the Apple

A total of 100 different messages can be placed in queue for automatic transmittal.

turned on, he flipped the lights in the room off and shut the door.

The next morning, at 1:00, the disk drives began to whir. In offices around the country, a sequence of *Micro-Courier* programmed Apple disk drives mirrored this activity.

By 8:00 a.m., when Jones arrived to look at the message log, all salespeople had been notified of the price change; the text and other files had been transmitted; new information had arrived at the home office from the branches; and the company had saved a great deal of time and money.

This fictitious scenario is an example of how a product such as *Micro-Courier* can operate. It will send text generated by the included text editor, or any DOS 3.3 file, including programs, data, or binary files. A total of 100 different messages can be placed in queue for automatic transmittal.

Automatic service will occur only at other stations using *Micro-Courier*. However, you can also use the program as a terminal program and send text files only over the telephone lines manually.

The program was written by Microcom, located near Boston, and

creative computing SOFTWARE PROFILE

Name: Micro-Courier

Type: Electronic mail disseminator

System: 48K Apple II with Applesoft in ROM, or II+, DOS 3.3 disk drive, D.C. Hayes Micromodem; second drive, clock card, and printer optional, but highly recommended.

Format: Disk

Language: Applesoft Basic and assembly

Summary: Valuable business utility
Price: \$250

Manufacturer:

Apple Computer, Inc.
10260 Bandley Dr.
Cupertino, CA 95014

Dale Archibald, 1817 Third Ave., N., Minneapolis, MN 55405.

The Enhancer II™ Proudly Presents A Whole New Cast of "Key" Characters!



Remember those old Macintosh "key" characters? You've seen them all before on your Apple II. And now the Enhancer II has given these old new identities!

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Besides that, the Enhancer II gives your Apple II type writer mode, with each key assuming the

function of a common-sense experience key. Not only will you recognize the characters, you'll positively rejoice at having upper and lowercase letters, repeat, shift and shift lock again! The Enhancer II also has a type-ahead buffer of 128 characters, so you can keep sending messages to your Apple II even while it's busy with something else.

And if you want to meet even more new characters, the optional Function Strip™ will introduce you to 16 brand-new keys across the top of your keyboard which are yours alone to define. (These characters will never get mixed up with characters from the keyboard!)

We can be guaranteed, that with yours you're going to like these new "key" characters from Enhancer II. In fact, we'll bet that once you've seen them perform, they'll become the stars of your screen.

Suggested retail prices:
Enhancer II, \$149
Function Strip, \$79
Combined Package, \$215

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The Enhancer II and Function Strip can be used with any Apple with a 68000 processor board.

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ZAP—Climbing the corporate ladder could be fun except for all that talling paperwork. This Hires arcade type game allows up to 4 players to advance through each floor and change levels to scale the corporate ranks. Be careful, it's easy to be ZAPPED! CARTRIDGE for the VIC 20 **\$29.95**

Bomber Word—A unique graphic word game on cartridge that provides the full thrill of arcade action. Complete with six modes of play options for added enjoyment. Play against the computer or another player. 6 to adult. For VIC 20 **\$29.95.**

Tic Attack—A fast action arcade game on Cartridge that challenges all of your dexterity. Written in machine language for special audio & visual effects. Over 100 levels of play. High score indication. For VIC 20 **\$29.95**

Get-A-Lot—As you wander through the maze of life collecting Bernies, you happen upon some magical turn. Pick one and the treasures appear, but the Meanies are out today looking to spoil your fun. Defeat them and continue on to a higher level. An ever changing maze plus arcade type animation and sound will provide a real winning CARTRIDGE for the VIC 20 **\$29.95**

Triple Play—Three word games that are both fun and educational. The games that are included are CROSSWORDS (requires at least 8K expansion). Five complete puzzles are included and each puzzle has up to 100 different words. CRYPTO-SOLVE will help you solve those cryptic messages found in newspapers, books, and magazines with a

systematic computer technique. Included are approximately 50 different puzzles. You can even enter your own cryptic messages. HIDDEN WORDS will display a matrix of seemingly random letters on the screen. Upon closer inspection, you will be able to find many words. Included are approximately 25 different puzzles. For VIC 20 **ONLY \$29.95 for all 3**

Sketch Pad & Char-Gen—This hi-resolution drawing program will allow you to draw pictures in detail. Use either the keyboard or optional joystick. A fill command will allow you to fill a block and other commands allow you to easily clear the screen. You can also save and load pictures. Char-Gen is a simple to use custom character generator that will allow you to design different characters for each printable key on the computer. This program is an excellent device to design game creatures, foreign alphabets, secret symbols, or other special characters. One set is included and you can make and store others quite easily. Both for VIC 20 **ONLY \$24.95**

HARDWARE

Expand-O-Ram—16K Expansion Board for the VIC 20 with reset, memory write protect, full memory allocation, plus TND expansion slots. Like having 2 products in 1. Can even be used as a cartridge development system. **\$119.00**

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Universal Parallel Interfacer—Now you can use most any parallel Centronics® type printer with your VIC 20®/CBM 64®. The inexpensive model will allow you to access your printer through the user port. This cable and driver is only \$19.95. Our other model from TYMAC is more extensive with graphic capabilities. Call or write for more information and prices.

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NOTE: We solicit hardware and software items for the VIC 20® and CBM 64®. Royalties, license fees, or outright purchases can be negotiated. CBM 64® & VIC 20® are Registered Trademarks of Commodore Business Machines Inc.

CIRCLE 221 ON READER SERVICE CARD

Micro-Courier, continued...

distributed by Apple to Apple dealers and customers.

When I first received this program to examine, I was impressed by the care that had been taken with it. The 168-page instruction manual is bound exactly as the Apple manuals are.

The manual/tutorial is clear and well documented; the program prompts at every step of the way. Overall, *Micro-Courier* appears to be a good program for firms that need this type of high performance.

Naturally, a program this expensive is protected against copying. One caveat: I don't like the offer of immediate replacement upon return of the master disk; when a company needs a program like this, they need it *now*. If they had wanted to put up with delays and slow delivery, they could have continued to patronize the USPS.

After 90 days, replacements cost \$35.

Using the Program

You begin by configuring the program to your system. Up to four disk drives can be accommodated, as well as the other peripherals. You also enter your

The built-in editor is simple but complete.

printer line width, and the sender ID which will be attached to each *Micro-Courier* station.

You have mailbox IDs from 01 to 99 which you can assign. Select Mailbox Directory Maintenance from the menu, and the display will give you another menu. Among other things, you can then add or change mailboxes, print a directory or a list of numbers to which you regularly send electronic mail, and other things.

Once you have assigned an ID number to a recipient, you can enter his name and telephone number. Up to 36 digits can be entered here to allow for access and user codes, and pauses (an asterisk will pause for two seconds).

That's it. That's all there is to entering a mailbox ID. To send electronic mail after that just select the recipient's number.

Other Features

If you want to build a specific list (from A to Z) to which you often send a common message, select a name of up to 20 characters. The program will display the valid mailbox IDs you can add or remove.

The built-in editor is simple but complete. You can enter up to 4000 upper-

case only characters with it. It will beep at the 3980 mark and at each character thereafter to warn you.

Note: I am told that this 4000 character limit applies to all files. You can transmit a longer file, but it won't be saved. If you want to send longer ones, you must break them into smaller segments and give them different file names.

Once you have saved the file under a name you have selected, you can come back and edit or change it, or print the file.

Next you have the Review/Address Outgoing Mail menu. This lets you address messages with mailbox IDs, see a log of messages ready to go or that have already been sent, and a log of messages that were sent during the last sending session. You could also remove messages, or print copies of them.

In the case of the message R.J. wanted to send to his sales force, he would have picked selection 2, Send Message to List, from the Address Messages menu.

You are asked if a file is printable. Obviously, some text files will be; other files must be interpreted by a program to have any value. It also asks if you want to use the current date and time. Thus, if you select this and go into the Send/Receive Mode, the message will be sent immediately.

If you have a clock, you will be prompted for a date and time to send. This might be helpful for "timed" announcements such as press releases, the manual points out.

You could also select Send Mail Only, Receive Only, or Send and Receive Mail. A block of four characters, two by two, mirrors what is being sent. This is visible reassurance that something is really going on inside the machine.

During a transmission, you can also stop the action with CTRL-H (Halt) or CTRL-I (Immediate Halt). Even with the precipitous effect of CTRL-I, the program will close any open files and place them into the message log.

With Review Incoming Mail from the menu, you can see and/or get a printed copy of all messages received, plus make a log of received messages, you can even review only messages addressed to a specific person at the receiving Apple.

The receiving *Micro-Courier* system adds a five-digit number from 10,000 to 99,999 to each incoming message. Thus, if two sending stations happen to use the same file name you won't be stalled, since the numbers will be different.

You can also rename a file incorrectly, using a duplicate of a name already assigned.

Micro-Courier will postpone transmissions if a message is being received while the Apple is supposed to be send-

ing. The print-out of the Received Mail log can be used for record keeping. Thus, records that aren't printable can be tracked.

If a line is busy when the program telephones, it will go on to the next mailbox immediately and try to connect with the missed one later.

You don't need to set protocols (instructions for various machines to connect) for other *Micro-Courier* machines.

There are some weaknesses, however. The first is that the machine must redial for each message. The second is that to catalog the file names, you must go through the Utility section of the program. I could find no way to print out the file names, either.

Finally, in some segments of the program, entry of information is very limited. That is, a date must be entered as MM/DD/YY.

All things considered, *Micro-Courier* is a good program. It is easy to use, and would undoubtedly be of great value in the appropriate business situation.

Microcom

Microcom views communications for small computers as a three-step process.

First is the simple addition of a modem, smart or dumb, and some basic software so the computer can act as a terminal. In this mode, it is able to initiate communications to a host computer, but it cannot act as a host. Some terminals use a simple protocol while others emulate more sophisticated special-purpose terminals (Telex, 3240, etc.).

Second is communications in which the small computer can act as a host to either a smart or dumb terminal or another computer. *Micro-Courier* is an example of this type of system. The computer can then be used for point-to-point electronic mail, local bulletin boards and data bases, and downloading of programs. An advanced version of *Micro-Courier* can support several different protocols so that, for example, a Basic program can be transmitted from a TRS-80 Model III to an Apple II (it won't necessarily run once it gets there, however).

The third step is a specific applications software package overlaid on the basic communications software. This could simulate a Telegraph or TWX and could operate completely unattended for both receiving and sending. *Micro Telegraph* is such a product.

VisiCalc Made Easier

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SOFTWARE PROFILE

Name: Cdex Training for Visicalc

Type: Computer-assisted training for Visicalc

System: 48K Apple II Plus, disk drive

Format: Three 16-sector disks

Summary: Well-designed training program in Visicalc fundamentals

Price: \$49.95

Manufacturer:

Cdex Corporation
5050 El Camino Real
Suite 200
Los Altos, CA 94022

I once plopped a coworker down in front of an Apple, handed her the *Visicalc* manual, and said something like, "Here learn this—it's easy." I lied a little. As good as the *Visicalc* tutorial is, it is really not that easy. But with *Cdex*, learning *Visicalc* on your own is definitely made easier. *Cdex* won't teach you advanced *Visicalc* techniques, but it should take you from *Visi*-innocent to competent user in a few hours.

Not Like a Book

The *Cdex* program comes on three diskettes, each of which presents a series of brief lessons. You need not take them in the recommended order, but the progression appears carefully planned, so you probably should. Also encased in the *Cdex* box is a small three-ring binder containing a 62-page manual. The manual is organized into three tabbed sections: *Visicalc* command reference, examples of seven *Visicalc* worksheets, and exercises.

Using *Cdex* is not like working through the *Visicalc* tutorial. This program is much more than a book displayed one monitor screen at a time.

L. L. Beavers

Text, graphics, and sound are all used—and used well.

The type font used in the text displays is large, easy to read, and pleasant to look at. The displays were designed by someone who understood how to use layout to communicate. There are no gaudy flashing or inverse characters to detract from the readability of the display, but the important points are clear at a glance.

The graphics are equally well done. The graphic displays are of two basic types. One is a very nice picture of the Apple keyboard (with a couple of characters missing—more about that later), to help you find the keys important to *Visicalc*. The other is a slightly shrunken image of the *Visicalc* display screen. This enables *Cdex* to show you what happens on the *Visicalc* screen when you type a command. What you see unfold on these displays is very close to what you will see when you try the same commands with *Visicalc*. The main difference is that events are slowed on the *Cdex* displays to give you time to see what is happening. The text accompanying these graphics points out what to look for, sometimes with the help of flashing arrows pointing to a

particularly important part of the display.

Cdex uses sound most effectively to alert you to watch the screen for some important event—just before the *Visicalc* graphic is to change, for example. Sound is also used to reward right answers to questions (happy beeps—TERRIFIC!), and to alert you to errors (not-so-happy beeps—NOT QUITE). The sounds used are not overly intrusive, though some may find the happy beeps a bit heavy handed.

Text, graphics, and sound are not only well handled individually, but they are well integrated. When something is about to happen on the *Visicalc* facsimile, text appears alerting you to what is about to happen. Then you press RETURN or type a command, you hear a beep, and you see the event take place on the same screen. Then more text may be added for emphasis. All of this is usually done without the discontinuity and annoying delay of erasing and reprinting the screen.

Using Cdex

A *Cdex* session begins with two title screens, the second of which asks for your name, followed by a main menu. I have reproduced the menus for the three diskettes as Figures 1, 2, and 3. Each menu item is a lesson on a particular *Visicalc* topic.

Figure 1.

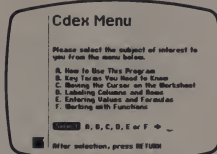
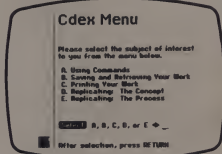


Figure 2.



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HMRS The Beatles	26-2504	59.95	23.99
HMRS 20,000 Leagues Under the Sea	26-2505	59.95	23.99
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HMRS The Beatles	26-2517	69.95	41.97
HMRS 20,000 Leagues Under the Sea	26-2518	69.95	41.97
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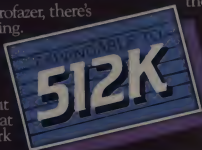
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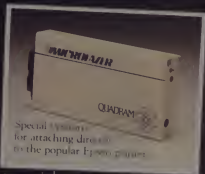
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CIRCLE 173 ON READER SERVICE CARD

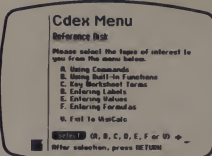


Figure 3.

Lessons generally begin with a brief review of relevant prior material, continue with a series of instructional screens, and end with a test question and suggested exercises. Throughout this process, user input seems to be extremely well error-trapped. Pressing **RETURN** causes the disk to re-boot, but I couldn't cause the program to end abnormally in any other way. Generally, responses not in the set of possibilities are ignored and do not appear on the screen.

Instruction Screens

The series of instruction screens presented for each menu topic contains the real substance of the lessons. I found them generally to be clearly and concisely written, well paced, and accurate in their representation of the behavior of *Visicalc*.

For instance, the replicate command (**R**) is probably the most conceptually difficult of the basic *Visicalc* commands. *Cdex* handles it in two lessons, one devoted to the concept and the other to the procedure. Take a look at Figure 4, which shows a review screen from the "Replicating—The Concept" lesson.

That's a nice, lucid review of the idea. It follows a series of other nice, lucid explanations, which together communicate very well the power and use of the replicate command.

Of course, there are a few places in the *Cdex* training program in which I think that the explanations are unclear or contain errors. I have compiled the ones I found in a "Quibble List" contained in the sidebar. Those evaluating *Cdex* for purchase should find it easy to scan this list and form their own opinions of the seriousness of the problems. Those using the programs should find some useful clarification in the list. In my opinion the quibbles listed don't significantly impair the usefulness of the program.

Quiz Time

After *Cdex* presents the instruction screens, it asks one test question. Since

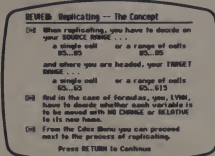


Figure 4.

each lesson covers a relatively small subject, and since the instruction screens often include some question-and-answer interaction, one question seems to be enough.

The question screen offers options other than the obvious one of entering the answer. You can ask for a hint, you can review the material in the lesson, or you can skip the question entirely. The hints seem to offer a good compromise

The best feature of the quiz routine is its error diagnosis.

between giving too much information and giving no help at all. The review option simply restarts the series of instruction screens over again. This review process can be frustratingly slow if all you are looking for is one item of information.

I think that the best feature of the quiz routine is its error diagnosis. Errors that show inadequate understanding of some part of the lesson are greeted with a message clarifying that point. For example, in *Visicalc* if you want a cell to have the same value as that in cell **B5**, you must type **=B5** to specify the value reference. If you omit the **=** and simply type **B5**, *Visicalc* treats it as a label (which has a zero numeric value) because the first character typed was alphabetic. When *Cdex* asked me a question about this, I intentionally omitted the plus sign. The program told me that I had forgotten it, reminded me of why it was important, and invited me to try again. Very nice.

Visicalc Exercise

At the very end of each lesson is a screen directing you to the *Cdex* manual for a guided practice session with *Visicalc*. You can skip this exercise, but I

suggest that you take advantage of it. There is nothing like hands-on experience to show you what you don't know. The exercises are short, and worth the time.

Cdex and the Visi-Innocent

I have used *Visicalc* extensively, so I am hardly a typical customer for the *Cdex* program; but my wife is. As a lending officer for a major bank, she does a great deal of financial analysis. *Visicalc* is well-suited for that kind of work, but she has never had a chance to learn it.

Predictably, her reactions to *Cdex* were a little different from mine. First there were matters of taste. *Cdex* starts each session by asking your name. My wife felt this a bit childish, so she gave it a scatological response. I recommend that everyone try this at least once—some of the resulting *Cdex* messages are hilarious. She also felt that the use of sound to indicate right answers was "dumb." "Correct" would be sufficient," she said.

She found the delay in drawing graphics displays sometimes annoying, but agreed that the graphics were well done and informative. She also pointed out some ambiguities that I had overlooked. They appear in the Quibble List.

She liked the organization of the program in small segments, pointing out that people using it in an office environment would be subject to interruptions. But this makes the ability to review the instruction screens rapidly even more desirable, and its absence more irritating.

Overall she thought *Cdex* a "good program." More to the point, she was able to acquire a practical working knowledge of *Visicalc* in about six hours. These hours were not in a single block, but were scattered over a one-week period, just as they probably would be in an office environment.

Summary

I agree with her evaluation—*Cdex* is a good program, and a very good value for its \$49.95 price. It should be very useful to those who need to learn the fundamentals of *Visicalc*. Having someone available to answer questions might be useful, but I think *Cdex* is easily good enough to stand alone if necessary.

Cdex is not (and does not claim to be) a substitute for reading and understanding the *Visicalc* manual. I suggest a careful reading of Part III (Visicalc Command Reference) of the *Visicalc* manual after completing the *Cdex* course. You will not then be a sophisticated *Visicalc* user—that only comes with experience—but you will have a solid foundation on which to build sophistication.

Quibble List

Below are some quibbles I have with the *Cdex* program. These quibbles fall into two broad categories: misleading or inaccurate statements regarding *Visicalc*, and unclear or ambiguous instructions. I have organized these in a rough order from most to least serious. I don't think that any of these problems, or even all of them taken together, is serious enough to significantly damage the usefulness of *Cdex* as a training tool—which is why I call them "quibbles."

Inaccuracies

Graph Format (/F*)

Cdex says that *Visicalc* rounds decimal numbers to integer values to determine the number of asterisks plotted. Actually the program truncates (*Visicalc* manual, p. 3-20).

Formula Calculation

The conventional way of resolving formulas uses a "hierarchy of operations"—multiplication and division operations are performed first, then addition and subtraction operations. For example, in Basic the statement PRINT 2+4/2 would give 4. *Visicalc* doesn't work that way. It resolves formulas from left to right, so that the formula 2+4/2 would give a *Visicalc* result of 3. Many *Visicalc* users expect the hierarchy of operations to be obeyed. *Cdex* should have alerted them that *Visicalc* behaves more like a hand calculator than a computer program in this respect. Worse, *Cdex* does not mention the function of parentheses in grouping terms (see pp. 2-69 to 2-70 and 3-72 in the *Visicalc* manual). I consider this important enough to label it an inaccuracy—by omission.

Overlaying

According to *Cdex*, when you are loading a file from your storage disk (/SL), the *Visicalc* screen must be clear. Actually, *Visicalc* has no such requirement, and if you adhere to it you will lose what overlaying capabilities *Visicalc* has (see pp. 3-60 to 3-61 of the *Visicalc* manual).

Keyboard Graphic

The *Cdex* graphic display of the Apple keyboard does not show two of the characters needed for *Visicalc* applications. One is the circumflex (^), which *Visicalc* uses to indicate exponentiation, and which is typed as SHIFT-N. The other is the @, which *Visicalc* uses as the first character of all function references, and which is typed as SHIFT-P.

Ambiguities

File Deletion (/SD)

In its discussion of the command to delete a file on the *Visicalc* storage disk, *Cdex* says that after the command is completed you can change your mind and resave the sheet with /SS. That is true if the sheet on the screen is the same as the file that was deleted. *Visicalc* will let you delete any file on the disk, and if the one you delete is not the one on the screen, the deletion is final.

Cell As Third Dimension

Cdex discusses a cell on the *Visicalc* worksheet as having "depth" and as giving *Visicalc* a "third dimension." I think this obscures a simple idea: a cell is just a place on the

worksheet into which you can write a label, a number, or a formula.

Forward Reference

Cdex has only a rather oblique reference to a common *Visicalc* problem, "If you reference a cell that *Visicalc* has not yet calculated, an error may occur." This is called a "forward reference" in the *Visicalc* manual (pp. 2-63 to 2-64), and it is an important source of error—especially for inexperienced users. *Cdex* also mentions the *Visicalc* commands to change the order of recalculation (/GOR and /GOC), without telling you why you would want to do such a thing. Avoiding forward reference is the reason (see pp. 3-22 through 3-25 of the *Visicalc* manual).

Printing (/P)

Printing a worksheet is one of the more complicated *Visicalc* functions, primarily because of the differences among printer configurations. One of the *Cdex* screens says that a setup string is used for producing special effects on the printer. Since those "special effects" include printing anything more than 40 characters on a line, the setup string may be essential to effective use of your printer. The *Cdex* manual notes this possibility (p. 12) and refers you to the *Visicalc* manual for details (I suggest pp. 3-40 to 3-48). If you read that section of the *Visicalc* manual, you may also notice that the *Cdex* discussion of the /PP option is not entirely correct. *Cdex* says that you must specify the slot number of the printer interface if it is any slot other than 1. According to the *Visicalc* manual, /PP causes *Visicalc* to output to the lowest numbered slot containing a peripheral communications card—not necessarily slot 1. You would have a problem typing /PP if you had an inactive peripheral on a lower-numbered slot than the one the printer interface is in, so you are better off to develop the habit of typing the printer slot number rather than /PP.

Visicalc Functions

The way the *Visicalc* functions are categorized on *Cdex* Disk 3 is not particularly clean. One of the categories is "List Functions," which is said to include @SUM, @MAX, @MIN, @COUNT, and @AVERAGE. From the name of this category and the functions in it, you might conclude that these are the functions that accept lists of *Visicalc* cells as arguments. But some of the logical functions do too (@AND and @OR), as does @CHOOSE. Also, while we're on the subject of functions, *Cdex* says that the result of the @MAX function is the "identity of the largest value." Actually, *Visicalc* just returns the largest value. What's the "identity of 4"?

Exercises

On *Cdex* Disks 1 and 2, the final screen of each lesson directs you to an exercise outlined in the *Cdex* manual. The directions presented on that final screen are out of order. Item 2 tells you to read and follow the printed exercise. But the printed exercise begins with the statement, "A blank *Visicalc* worksheet should now be showing on your screen." Item 3 on the *Cdex* display screen tells you how to boot the *Visicalc* disk, and so produce that blank worksheet. The printed instructions preceding the series of exercises in the *Cdex* manual also tell you how to boot *Visicalc*, but some users might still find the sequence on the display screen confusing. □



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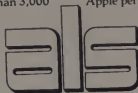
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CIRCLE 105 ON READER SERVICE CARD

A Picture Is Worth 1,000 Words But How Many Numbers?

L. L. Beavers

I like numbers. That makes me a little strange, because most people don't. In a sense, they're right: numbers don't communicate. Consider Ms. Big.

A Session with Apple II Business Graphics

As an executive with Chewie Gobbles Confections, Inc., you have been asked to design a presentation for Ms. Big, executive vice president of your parent company, International Munchies. Ms. Big is your basic bottom-line sort of person—she wants specifics, she wants to see them clearly and quickly, and she wants to know what they mean to her. You are supposed to turn some sales and margin numbers into a presentation that will make her smile. You have one hour.

First, feed the computer. You put the *Apple II Business Graphics* disk into drive 1 and a data disk you have named CHEWIE: into drive 2, and turn on the power. After some whirring of disks, and some noises that sound like the program disk is being initialized (one of Apple's technical support people assures me this is normal), you get a prompt.

You type EDIT to invoke the editor, and after a few seconds the number one and a question mark appear on the screen. You want time on the horizontal axis, so you enter the sales figure this way:

```
1:  ? "1977", 1.06
2:  ? 1978, 1.40
3:  ? 1979, 1.80
4:  ? 1980, 2.27
5:  ? 1981, 2.71
6:  ? END
```

The word END exits the editor, and the computer responds with:

```
5 LABELS LOADED
5 POINTS LOADED
```

You save the data with the command SAVE CHEWIE:SALES. Now you type CLEAR to clear the work file and EDIT to reinvokethe editor, and you enter your gross margin figures:

```
1:  ? "1977", 41
2:  ? 1978, 37
3:  ? 1979, 38
4:  ? 1980, 38
5:  ? 1981, 40
6:  ? END
```

You save these data on your CHEWIE disk with the command SAVE CHEWIE:MARGINS.

The computer now has all of your data.

creative computing SOFTWARE PROFILE

Name: Apple II Business Graphics
Type: Interactive business graphics package
System: 48K Apple II, at least two disk drives, language card or 16K add-on memory card.
Format: Disk
Language: Pascal
Summary: Excellent general purpose business graphics package
Developed By: Business & Professional Software, Inc.
Cambridge, MA
Distributed By:
Apple Computer, Inc.
10260 Bantley Dr.
Cupertino, CA 95014

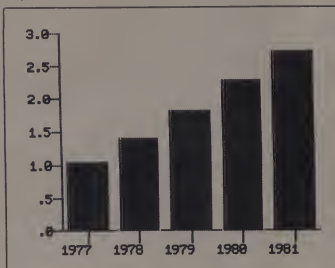
Business Graphics, continued...

Elapsed time: 5 minutes. You decide to look at the sales data first, so you type:

```
CLEAR
LOAD CHEWIE.SALES
The program responds with:
5 LABELS LOADED
5 POINTS LOADED
```

How about a bar graph? You type DRAW BAR, and the following graph appears on your screen.

Graph 1.

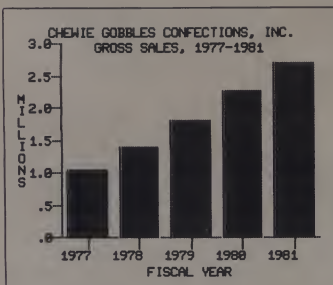


Now for some titles:

```
SET TITLE "CHEWIE GOBBLES CONFECTIONS, INC."
SET HORIZONTAL TITLE "FISCAL YEAR"
SET VERTICAL TITLE "MILLIONS"
The title should be more specific, so:
SET FLOATING TITLE "GROSS SALES, 1977-1981"
```

A box appears on the graphics screen, and you use the U (up), D (down), L (left), and R (right) keys to position the title under the title of the graph. The results look like this:

Graph 2.

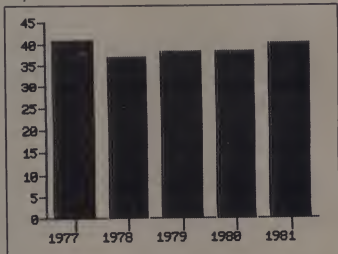


That looks fine. You save this display by typing SAVE. SCREEN CHEWIE.SALES. Elapsed time: 11 minutes.

Now for the margin figures:

```
CLEAR
LOAD CHEWIE.MARGINS
SET VERTICAL RANGE 0 45
DRAW BAR
What you get looks like this:
```

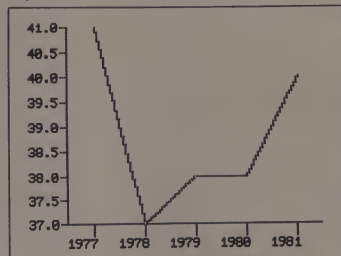
Graph 3.



Not so good. The fluctuations in the margin figures get lost among the trees. Maybe a line graph would be better.

```
CLEAR SCREEN
CLEAR VERTICAL RANGE
DRAW LINE
```

Graph 4.



Now we can see what's happening, and it isn't all good. Ms. Big should be told what happened in 1978:

```
SET FLOATING TITLE "1978 SUGAR UP 60%"
You position that title, and type in the remaining titles:
SET TITLE "CHEWIE GOBBLES CONFECTIONS, INC."
SET VERTICAL TITLE "% OF SALES"
SET HORIZONTAL TITLE "FISCAL YEAR"
SET FLOATING TITLE "GROSS MARGINS, 1977-1981"
```

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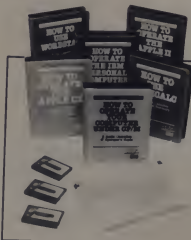
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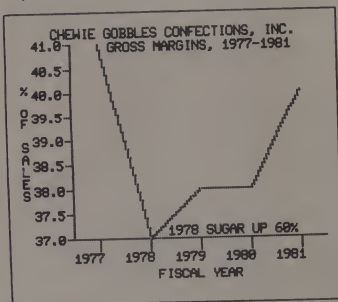
CIRCLE 178 ON READER SERVICE CARD



Business Graphics, continued...

The result of your efforts looks like this:

Graph 5.



You save the graph by typing, SAVE SCREEN
CHEWIE:MARGINS.

You are now ready to print the results for your boss's approval. Total elapsed time: 20 minutes. Have a cup of coffee.

Which Graphs You Need

The man who wrote of office buildings, "Form ever follows function," could have been talking about graphics. In graphics "function" means communication: communication between you and your data (interpretation), and communication between you and other people (presentation).

For both interpretation and presentation, you need three kinds of graphs: line graphs, bar graphs, and pie charts.

When you have few numbers and large differences between them, try a bar graph.

Line Graphs

You need line graphs to depict trends, and *Apple II Business Graphics* offers extensive line graph capabilities.

First, you want to be able to plot as many points as you need on a single curve. With *Apple II Business Graphics* the number of points is limited more by practicality than by the program. I have plotted as many as 400 points on one curve.

Second, you want to compare curves by plotting them on the same graph. Of course, the curves must be distinguishable. *Apple II Business Graphics* provides two methods: eight different symbols for the plot points and six different curve types. Here, too, practicality is the limit: you could plot 15 distinguishable curves, but no one would read them.

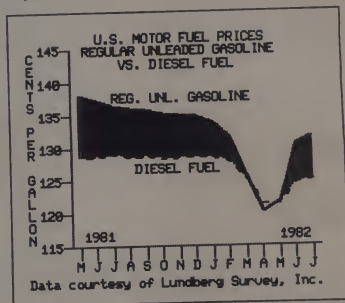
Third, you need control of the ranges of the numeric scales. The scale can have a tremendous effect on what a graph ap-

pears to say. Plot on a large scale and fluctuations and trends will look small; plot on a small scale and they will look large. *Apple II Business Graphics* lets you choose a scale that accurately represents your data.

Apple II Business Graphics offers one more option useful with line graphs. You can color in the area between a curve connecting your data points and the horizontal axis. This is called "shading."

One common use of shading is to emphasize the difference between two sets of numbers. Suppose I am interested in the prices of unleaded gasoline and of diesel fuel, and in the difference between them. Then I might use this graph:

Graph 6.



Data courtesy of Lundberg Survey, Inc.

Unfortunately, there is no command for filling in the area between curves. I did the display by first filling the area under the unleaded gasoline price curve. Then I filled the area under the diesel price curve with the color set to black, thus erasing that shading. The remaining shaded area is between the two curves. I then drew the two curves and drew a horizontal line at 115 (since the horizontal axis had been partially erased).

Those are the most important line graphing capabilities, and they are all available—though perhaps requiring a little fudging. But you don't want to draw lines for the rest of your life do you?

Bar Graphs

When you have few numbers and large differences between them, try a bar graph. Bar graphs are properly drawn from a zero baseline, so small differences get lost. That's why we rejected the bar graph of gross margins for Ms. Big.

As with line graphs, the ability to plot more than one set of numbers on the same bar chart is useful. *Apple II Business Graphics* limits you to four data sets per graph. If both scales are numeric, you can use overlapping bars and plot more data sets, but the need rarely arises.

The bars can be vertical or horizontal. They can be filled, outlined, or both. Furthermore the filling or outlining can be done in your choice of colors (green, violet, white, orange, blue, or black). Even with a black-and-white display, colors can be used to vary the density of lines and shading.

You don't have control over the width of the bars. Rejoice. You don't want it. The program scales the width based on the

october fest

MENU (disk directory)

educational section
tourist map - historical facts
gourmet guide - german vocabulary
game section
beer drinkers contest
haunted house - play old organ
quiz
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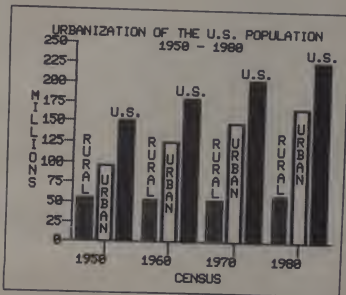
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Business Graphics, continued...

number of bars being drawn. Practical applications for variable width bars are rare, and doing the scaling yourself can be a major nuisance.

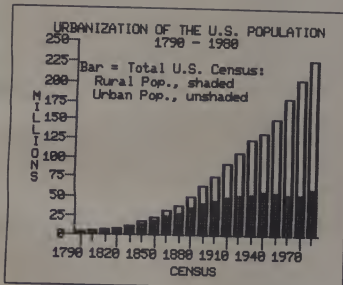
Also not available is one option you might want—segmented bars. The need for this kind of display is fairly common. It arises when you have a set of numbers that you want to show in a bar graph, but each number has two or more components that you also want to show. For example, suppose you are interested in the growth of the U.S. population, but you also want to see the urbanization of that population. You could represent the total population, the urban population, and the rural population as three data sets on a multiple bar graph, like this:

Graph 7.



The problem with this is that the reader can't see that the total is the sum of the urban and rural populations. Until the reader knows this, the increasing proportion of the population living in cities is obscure. A much better display would be the following:

Graph 8.

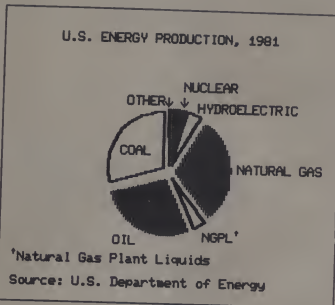


Besides being a clearer display of the data, this graph shows that cheaters sometimes prosper in computing. I said that *Apple II Business Graphics* has no option for producing segmented bar graphs, yet I have just shown you one. How? I cheat. First I entered the rural population data and drew a set of filled bars. Then I entered the total U.S. population data and drew another set of bars (in the same place) with the FILL set to OFF. The blank inside each bar is then the urban population.

Pie Charts

Another way to show fractional parts of an aggregate is with a pie chart. Normally you use a pie when only the relative sizes of the fractions interest you. For example, the following chart shows U.S. energy production by source.

Graph 9.



You don't control the size of the pie, nor can you overlay a pie on another chart. Unfortunately, neither can you highlight one of several slices by offsetting it from the rest.

But the essential capabilities are there. You can draw a pie with each slice clearly distinguishable from its neighbors. You can control the colors that create this distinction. The program automatically labels the slices, and you can put additional labels on the graph. You can even draw a pie with a slice missing, to show that your data don't cover the universe of interest.

Titles

One of the most appealing things about *Apple II Business Graphics* is the flexible way it handles titles for all these graphs. There are four flavors: a general title, a vertical title printed to the left of the vertical axis, a horizontal title printed below the horizontal axis, and floating titles—as many as you want—printed anywhere. Any of these titles can be printed in both upper- and lower-case characters, and 26 special characters (including trademark and copyright symbols) are also available.

The real beauty of this scheme is in the floating titles. You can print them horizontally or vertically, and you can use them to label curves in a line graph, bars in a bar graph, slices in a pie graph, or groups of points in a scatter plot. You can also use floating titles to add lines to the general title or a footnote below the graph.

Business Graphics, continued...

Other Features

In addition to drawing lines, bars, and pies, you can list descriptive statistics, develop a frequency distribution, "smooth" the data (unweighted moving average), or fit any of five curves (constant, line, parabola, logarithmic curve, or sine curve) to the data. You can even use the curve-fitting or smoothing options for forecasting, though I urge extreme caution—especially with parabolic and logarithmic curves.

There is also a "TAKE file" feature similar in concept to Apple DOS EXEC files: it automates a sequence of commands, executing them from a disk file as though the user had typed them from the keyboard. With this capability, *Apple II Business Graphics* has some of the features of an electronic slide show system.

Using the Program

We have discussed what *Apple II Business Graphics* can do, but how easy is it to make the program do it? We will look at that question in two parts. First, how easy is it to enter and manipulate the numbers? Second, how easy are the commands to remember and use?

Data Entry and Manipulation

Apple II Business Graphics defines data in terms of "points." A point is a pair of coordinates, specifying a unique location on any graph. Either or both of these coordinates can be a label or a number.

Once entered, the data can be changed in several ways.

You enter data to the program in a variety of ways. Most people will probably just use the program editor, but there are alternatives. For the *VisiCalc* fanatics in the audience, *Apple II Business Graphics* accepts data directly from *VisiCalc* print files. It also accepts files stored in the Data Interchange Format (DIF), and data from text files stored on DOS 3.2.1, DOS 3.3, or Pascal/Fortran disks. The manual includes details on the structure of these files.

But even fanatics will often find themselves using the editor. You probably got some idea of the editor from following the example for Ms. Big: you type the horizontal coordinate, type a comma, then type the vertical coordinate. An entry beginning with an alphabetic character is assumed to be a label, and numbers can be made labels by enclosing them in quotes.

Once entered, the data can be changed in several ways. You can CHANGE, DELETE, or INSERT with the editor. You can also transform the data mathematically by Adding, Subtracting, Multiplying, or Dividing either a constant or the values in a saved file. Logarithmic transformation is not offered, unfortunately. You also have a SHIFT function, which is equivalent to the "lead" and "lag" time-series functions. Finally, you have cumulative SUM and point-to-point DIFFERENCE functions available.

Command Language

By now you probably have a general feel for the commands *Apple II Business Graphics* accepts, but notice the language in which they are written. In both vocabulary and structure it is similar to English. Commands begin with English verbs like EDIT, SET, DRAW, and MULTIPLY. A noun and sometimes a modifier to either the verb or the noun may be added, and the result sounds like an English sentence: EDIT LABELS, SET COLOR

WHITE, DRAW PIE, MULTIPLY BY 100, and so on. Such a command language feels familiar, because it exploits the user's familiarity with his natural language.

Other advantages flow from the same source. For a language as flexible as this one, it is easy to learn and easy to remember. More important, it has the scope and simplicity that are jointly necessary for a comfortable, creative interaction with the computer. Since designing graphics is a creative process, this kind of interaction is a tremendous asset.

Output

With all of the above features, you should be able to draw almost any graph you need on the high-resolution graphics screen. (Those with 80-column cards should test compatibility with *Apple II Business Graphics*—not all 80-column boards can display high-resolution images.) But can you put the graphs on paper?

Apple II Business Graphics will output to Apple Silentype and Qume Sprint 5 printers and to some plotters, according to the manual. For other printers, there are programs designed to print a high-resolution picture from the Apple memory. If you have one that uses Pascal-format files, you can print from screen files saved by *Apple II Business Graphics*. If your print program expects DOS 3.3 files, you can still use it: 1. Draw your graph. 2. Put your print program in drive 1. 3. Press RESET. When you press RESET, *Apple II Business Graphics* tries to reboot, and boots your graphics printer instead. Your graph should be intact on hi-res page 1 of memory, and you can then print it.

File Management

Probably the weakest part of *Apple II Business Graphics* is the way it manages disk space. As in Apple Pascal, deleted files leave gaps on the disk. Files must be stored in a set of contiguous storage blocks, so gaps created by deleting smaller files are usually unavailable for storing larger ones.

Despite what the manual says, *Apple II Business Graphics* tells you only how much total space is left on the disk. So, one day you will try to save a screen file (requiring 16 blocks of storage space) on a disk with 21 free blocks, and the SAVE command will fail (? VOLUME IS FULL). This means that the largest chunk of disk storage has less than 16 contiguous blocks in it. Worse, there is no utility in *Apple II Business Graphics* comparable to Pascal's Krunch—so you can't fix the problem. If you have Pascal, you can run the Pascal Filer against your *Apple II Business Graphics* data disks. If not, use more disks.



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Business Graphics, continued...

Summary

I have offered both kudos and criticisms in this article. As Ms. Big might ask, "What's the bottom line?"

Of course that question is never as simple as it sounds. In this case I think three evaluations are important: 1. Does the program do what a graphics program should, 2. Is it easy to use, and 3. What are the extras offered and the limitations imposed?

My answer to part one is a unqualified "Yes." The essential business graphics are all there. The quality of your product is limited much more by the output device than by the program. With a pen plotter, you can produce professional quality business graphics.

The limitations tend to be more inconvenient than debilitating.

Not only can you do what needs doing, but you can get it done quickly and easily. I like the feel of using this system. It doesn't get in your way. Rather, it efficiently handles the drudgery, so that you are free to sit there and create.

As far as extras and limitations are concerned, there are some important instances of both; but I judge the balance to be far on the plus side. The extra capabilities tend to be very useful, while the limitations tend to be more inconvenient than debilitating. I suppose that the computer will become the ideal knowledge tool when the least sophisticated user is more limited by his own inogeneity than he is by the system he is using. We aren't there yet, but I think that *Apple II Business Graphics* is a significant step in the right direction. □

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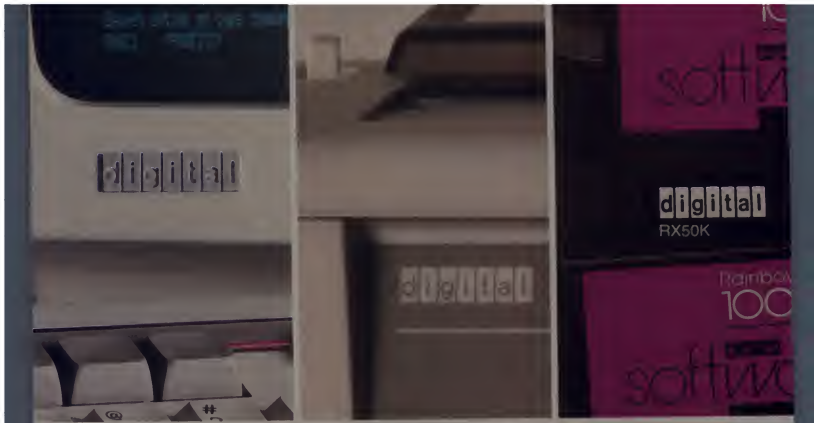
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Four Database Programs For The Color Computer

Among the most useful tasks a personal or household computer can perform are the storage, ordering, and selective retrieval of alphanumeric information. The information may consist of lists of addresses and telephone numbers, household inventories, or a variety of personal histories; it really isn't important which. The point is that the manipulation of this sort of data is an appropriate task for today's civilized micros.

It is possible for enthusiasts to write their own database programs, even if Basic is the only language available. However, it can take quite a while to develop a suitably flexible, bug-free program. Add to this the motivation of making computer-based information management available to non-enthusiasts, and you can see the desirability of ready-to-run database manipulation packages.

In this article, I will review four such packages which run on the Radio Shack TRS-80 Color Computer: Trans Tek's *C.C. File* (formerly known as *Quad Data Base*), Computerware's *Color Data Organizer*, Wizard Software's *E-Z File*, and Radio Shack's own *Color File*.

Scott L. Norman, 8 Doris Rd., Framingham, MA 01701.

Scott L. Norman

The popularity of the Color Computer is growing, and so is the list of database management systems for it. My selection represents software with which I have become familiar over a period of time. I believe that it represents a good cross section of the moderately priced software available.

The four programs differ in flexibility, in features, and in format. *C.C. File* and *Color Data Organizer* are available on both cassette and disk, *Color File* comes in a ROM pack and uses cassettes for data storage, and *E-Z File* is on disk only.

I have chosen the disk versions of the first two for convenience; in fact, my copy of *Color File* also resides on disk, but still uses cassette I/O. All of these programs will run on 16K machines. Finally, please note that these programs are intended for "stock" Color Computers, and do not require either of the advanced operating systems (Flex or OS-9) now being used by people who have modified their machines for 64K operation.

C.C. File

Trans Tek's Bill Dye has said that the Quad in the old name of this program stood for "Quick And Dirty," and it is true that the program is both easy to learn and relatively free of extra features. Don't underestimate it, though; *C.C. File* deserves high marks for flexibility and user-friendliness.

Its most attractive feature is the ability to accept data in free form. This

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SOFTWARE PROFILE

Name: C.C. File (formerly Quad Data Base)

Type: Database manager

System: 16-32K TRS-80 Color Computer

Format: Cassette and disk versions furnished on a single cassette

Language: Color Basic

Summary: Best buy of the bunch
Price: \$7

Manufacturer:

Trans Tek
194 Lockwood Lane
Bloomington, IL 60108

Databases, continued...

means that there is no predefined format for the records which make up a database file, and in fact the records within a given file do not even have to have the same structure. The various fields within a record do not have to be identified ahead of time as to their alphabetic or numeric character, either.

To appreciate the freedom which this gives the user, suppose that *C.C. File* were used to maintain a personalized address/telephone directory. You might begin with entries having the address before the telephone number, but you could switch at any time and reverse the order for part of the directory. If it suited you to have the number first, then the address, and then the name, that would be all right, too. The search routine finds a key string regardless of its position in a record.

I will get to the mechanics of all this in a moment, but first a few preliminaries: You receive both cassette and disk versions of *C.C. File* in ASCII format on a single cassette. Since the program is written in Basic, it is a simple matter to SAVE or CSAVE your working copies in conventional tokenized form.

As I mentioned, I have used only the disk version, and although the cassette version seems to offer the same options, I must admit to being devoted to the speed and convenience of a disk system for file manipulation.

In any case, when *C.C. File* is run, it begins by asking for the name of the database to be read. If you are starting from scratch, you enter NEW and are prompted to assign a name. Obviously, several databases can be stored on a single disk; a given database can consist of up to 300 records.

Once you have named the new database, you are presented with a master menu. There are only four choices, Search and Print, Search, Update, and Quit. The Update option is used for writing the initial data, as well as for changing it at any later time. Here is where you first encounter the joys of free

form data entry; each record is simply entered as a single alphanumeric string. The individual fields are separated by the @ symbol, which is replaced by a carriage return when the record is later printed or recalled to the screen by the search routine. As an example my entry in someone's electronic address book might be

Scott L. Norman@8 Doris Rd.
@Framingham, MA 01701@
(617)101-0101

(No, I don't really have a binary phone number!) This would be properly formatted when subsequently displayed.

The @ sign is one of only two special control characters in *C.C. File*. The other is the "greater than," >, which generates ten blank spaces in a printout or CRT display. This is handy for indenting code fields on mailing labels, for example. It is important to allow for the proper number of characters associated with @ and > when composing your entries, since a *C.C. File* record is limited to 250 characters overall.

If you make an error while entering a record, you merely backspace and type it again—just as in Basic. Once you have hit the ENTER key, though, it is necessary to get into edit mode to make corrections. The editing procedure will be familiar to users of Trans Tek's *C.C. Writer* word processor; it is more complicated to describe than to do.

First, return to the master menu with the Q (Quit) command. Next, select the Search option, and receive the prompt for keywords LOOK FOR>. Enter any string which unambiguously identifies the record you want to change and it will be displayed, fully formatted.

The bottom of the screen now contains a secondary menu with four choices: Delete, Print, Edit, or an arrow symbol. The first two are self-explanatory; the arrow indicates that the up and down arrows on the keyboard can be used to scroll back and forth through the database. The Edit option causes the displayed record to revert to the string for-

mat in which it was entered, complete with @ and > symbols. Now, however, there is yet another menu on the screen: (I)nsert/(C)hange/(D)elete.

The cursor can be positioned anywhere in the record with the arrow keys. Typing I causes the text to open up to receive insertions, the C lets you overtype and correct text, and each time the D key is pressed the character to the right of the cursor is deleted. You can recover the formatted version of the data by pressing ENTER and return to the master menu with the Q command.

In covering the editing procedure, I have actually touched on most of the

C.C. File provides a simple, inexpensive way to add rudimentary database management capability to the Color Computer.

features of *C.C. File*. As you have probably guessed from my description of the Search option there are no privileged keywords. The ability to search on any substring means that our hypothetical address book database could be searched by last initial, zip code, or telephone area code.

You can set up keywords if you wish, though. For example, you might make the convention that keywords are to be denoted by a leading asterisk or other special character (except @ or >, of course). You do pay a small price for this simplicity, though. For one thing, the match to a search key must be exact: uppercase and lowercase characters are distinct from one another. Also, it is not possible to logically combine search criteria with AND or OR; these would just be considered part of the search key by the program logic. A final point is that it is not possible to skip the search routine at any arbitrary stage. You must page through all successful "hits" resulting from your search criterion.

What about some of those other options? Recall that the Search routine gives you the choice of printing each hit or skipping to the next one. The master menu also has a Search and Print option, which prints each and every hit. If you enter a null line in response to the LOOK FOR prompt in this option, the entire database will be printed out. I have already mentioned the Q command for returning to the master menu from the edit routine: entering a Q from the mas-



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Databases, continued...

ter menu itself causes the database to be written to the disk or cassette in ASCII. You then exit the program and return to Basic.

Summing up, *C.C. File* provides a simple, inexpensive way to add rudimentary database management capability to the Color Computer. Its command syntax is easily learned (especially for *C.C. Writer* users), and the on-screen prompts make it difficult to get badly lost. To be sure, the program lacks the ability to sort and merge files, but in my opinion it remains a best buy.

Color Data Organizer

Computerware's *Color Data Organizer* is also written in Basic and has both a file sorting capability and a provision for selecting records according to numerical limits which the user sets on data fields. Unfortunately, there are rather stringent limits on both the length and format of records. Each can contain at most four fields: two numeric, two alphanumeric. The numeric fields may be up to nine digits long (the display switches to scientific notation for larger or smaller numbers), while the alphanumerics are restricted to 16 characters. As a result, the program is useful only for very restricted types of data. It would probably serve for home inventories, for example, but not for address book applications. The disk version of *Color Data Organizer* can handle up to 255 records; the cassette version can work with only half as many. Either will run in 16K, and in fact having a 32K machine is no advantage; this program lacks the dynamic memory allocation capability of *C.C. File*.

Like the other database managers reviewed here, *Color Data Organizer* uses nested menus to guide the user through the many options. The menu structure is fairly complex, however, and places responsibility for a surprising amount of detail on the user. For example, users must issue specific commands to open

and close disk files, a chore which is normally automated in such programs.

A fresh disk contains three programs: DATA-ORG, which is the *Color Data Organizer* program itself; DATA-CON, for converting cassette data files to disk format; and a sample database named DATAFILE. Before starting work with a 16K Color Computer, you must enter the commands `PCLEAR 1` and `FILIS 2` to allocate sufficient memory; this is unnecessary with a 32K machine. The first display is the Master Menu, with four entries: Storage Control, File Control, Sort-Print, and Basic.

Almost all responses are made with a single number. No matter what you are planning to do with *Color Data Organizer*, your first selection is Storage Control, which has its own menu: Open, Close, Directory, Create, and Return. The first two options open and close disk file buffers. Directory lists all files with DAT extension. Create defines the names of data columns for a new file, and Return brings back the Main Menu.

Here is the procedure for building a new file from scratch. Choosing the Create option of Storage Control, you are presented with a third-level menu which asks for the titles to be assigned to the four data fields. The numeric columns are specified first, and input data are later called for in this order. When you have entered and approved all four titles, you are asked for a filename. There is an explicit (if small) warning in the instructions not to specify an extension; the program assigns /DAT to all data files. With the filename and data column headings specified, the program writes the name onto the disk (drive 0 assumed). The Storage Control menu then returns.

Ready to enter data? Select the Open option of Storage Control and you are prompted for the filename. The disk is read and the Main menu returns, now select the File Control option. This time there are only three options on the second-level menu: Input, Look, and Return. As you might expect, Input is used for data entry. The third-level menu prompts you for the four data fields in turn, and upon completion, gives you the option of re-doing the whole record or approving it and going on.

There is also a running display of both the next unused record number and the total number of records still available for your file. When you have finished, an M command gets you back to the File Control menu. Before you can call it quits, though, you still must return from File Control to Main, then go back to Storage Control to give the Close command. Disaster awaits if you remove a disk or quit the program without closing the file buffers.

One quirk in the system: The program drops leading zeros from numerical data, which can make zip codes look rather strange.

What about some of those other options? The Look option of File Control is used for viewing, deleting, or changing data already stored in files. Once again, it is necessary to bounce back and forth between the Main, Storage Control, and File Control menus. The third-level menu for Look asks you for a beginning record number and then it displays a command line giving your options: (Forward one record, (Black one, (New record somewhere else in the file, (Change the displayed record, (Delete it, and (M)enu, which returns you to File Control. If you select C, you must re-enter all four fields—there is no finer selection or change process. The D option clears alphanumeric data fields to

Unfortunately, Color Data Organizer lacks a capability for selecting records according to keywords or other strings.

blanks and puts zeros in the numeric fields, but does not renumber subsequent records to close up the file.

The Main menu has one more selection which I haven't explained: Sort-Print. This is actually one of the better features of *Color Data Organizer*. The second-level menu gives you, naturally enough, Sort, Print, and Return (to Main menu) options. Sort causes the titles of the four data fields to be displayed and asks which one you wish to sort on; the sort will be in ascending order. The disk drive goes on as soon as you respond, since this option rewrites your file.

The sorting routine isn't especially fast, being written in Basic, but at least you have the option of using either numeric or alphabetic data to order your file.

The Print option is fairly versatile. First, you are given the choice of printing in a 40-column label format or an 80-column report format. The former prints each field on a separate line, in the entry order: both numerics, then both alphanumerics. The title of each field is printed to its left.

The 80-column format is more flexible, allowing the user to specify the order in which fields are to be printed. The four fields of each record are printed on

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SOFTWARE PROFILE

Name: Color Data Organizer

Type: Database manager

System: 16K Color Computer

Format: Cassette or Disk

Language: Color Basic

Summary: Restricted data format

Price: Cassette, \$19.95; disk, \$29.95

Manufacturer:

Computerware

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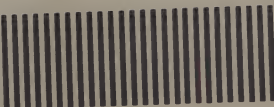
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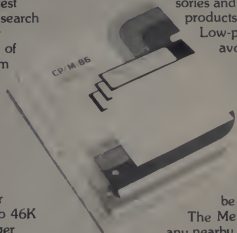
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Databases, continued...

a single line with titles at the top of the printout. You are also allowed a limited degree of selectivity in choosing the records to be printed. This takes the form of setting inclusive upper and lower bounds on the data in one of the fields. Finally, you can specify that the data in either of the numeric fields (but not both) be totaled at the bottom of the report.

Unfortunately, *Color Data Organizer* lacks a capability for selecting records according to keywords or other strings. The setting of bounds for print selection is your only option along these lines.

How to characterize this program? I must confess to being disappointed. The data format seems just too restricted to be of general utility, although I can imagine using it for some technical data, where the scientific notation feature might be appreciated. I also think that the ability to select records from a database for on-screen examination is absolutely essential, and that some sort of keyword capability should have been included.

Finally, although the whole Storage Control/File Control system is less cumbersome than it may have sounded from my description, it is still more cumbersome than it should be. In fact, this is my principal criticism of the program. I feel that database management systems should serve the user who is indifferent to the charms of the computer and who merely wants help in organizing his information.

E-Z File

This is a rather quirky, frustrating program. Although most of the operations of *E-Z File* are straightforward, there are just enough oddities to be annoying. In addition, there is one absolutely crucial omission in the documentation; if nothing else, I hope that this review can rectify that particular oversight.

The *E-Z File* disk contains three programs. A short loader called *GO* sets up the storage parameters and loads the main program, which is itself called *E-Z FILE*. The main menu of 16 options is then displayed. There is no printed documentation; instead, the user is advised to use the *Load File* command to call up *E-Z INST*, the third disk file. You can then display the complete set of instructions by invoking the *List File* option.

The instructions aren't especially long, and I am all for generous on-screen prompts, but, I do think that a set of written notes should have been included. It is possible to generate your own by using the *Print File* option, but the printed format is very poor. There is also ev-

idence that the program has been undergoing modification at a rate too fast for its own good. There are several discrepancies between the option numbers assigned by the on-screen menu and the instructions. The menu is correct in all cases.

It is probably simplest to run through the menu selections in numerical order. Number 1 is called *Give to New File* on the screen and *Create New File* in the instructions. At any rate, it is, indeed, the choice for starting out to build a new database. When you select it, the screen clears, and you are ready to enter the first record as a single string of up to 249 characters. A dark graphics block is set at the proper position to remind you of the length limitation, and the prompt *RECORD: 1* appears at the bottom. When you have finished with the first record, the *ENTER* key generates the prompt for the second, and so forth.

Unlike *C.C. File*, *E-Z File* does not use special delimiter characters to separate the different fields within a record. If you want a multi-line format at this point, you must enter a series of blank spaces to position the cursor. There is an easier way to go about this, and I will discuss it below when I get to the *Edit* option. Right now, though, I must bring up the documentation flaw that I mentioned.

There eventually comes a time when you have entered all the material for your database and want to return to the main menu to name and save it. But how? The instructions don't give you a clue. A null line (the *ENTER* key by itself) doesn't work—it just generates a blank record and brings up the prompt for the next one. Well, folks, it seems that *E-Z File* uses its own null character, and it's a beauty: two exclamation points separated by the number sign. That's right, the *!#!* combination terminates data entry. It doesn't actually get the menu back, though. It returns the first

record in your database, and you must then step through the whole thing (using any key) until you reach the end. Then, and only then, does the menu reappear.

The idea of using a special character or series of characters to mark the end of the data entry process may be worthwhile. However, I must take *Wizard Software* to task for leaving the user in the dark. I only stumbled upon the *!#!* combination because it is also used in the *Search* and *Replace* routine to indicate a null replacement string. Let's hope that future documentation corrects this error, because the overall performance of *E-Z File* is far from shabby.

Assuming that you have gone through the data entry phase and gotten back to the main menu, Option 2 (*Edit*) may be in order. The editing procedure is similar to that employed by *C.C. File*, with the same *Insert*, *Delete*, and *Change* options. The four arrow keys control cursor movement, and there is an auto-repeat feature.

You start with the first record in the file and advance by moving the cursor to the end of each record in turn. A prompting line at the bottom of the screen gives the numerical value of the current cursor position, the number of the record being edited, and the total number of records in the file.

The *Change* option is more flexible than that of *C.C. File*, since it can be used to add material past the end of the original record. This paves the way for better formatting. The idea is to place the cursor just in front of the last character in the original file, hit *C*, and start typing. In this mode, the *ENTER* key is recognized as a linefeed (instead of a call for the next record, as in Option *#!*). Thus you can use *ENTER* to set up a multi-line record.

The whole process is a little awkward, though. It calls for entering just the first line of data for each record on the first (Option 1) pass, and adding the rest on a second pass under Option 2. Is it worth it? It all depends on how much you care about the appearance of your database.

Option 3, *Add to Present File*, is quite simple. It just sets up the prompt for the next unused record number, and data entry proceeds as usual.

Option 4, *Search and Replace*. You are prompted for the target string for the search and for a replacement string. As in *C.C. File*, there are no privileged keywords. If you just want to examine your "hits," and not necessarily change them, you answer the second prompt with the notorious *!#!* combination. The program displays each hit in turn, and informs you of its entry number in the database and the cursor position at which the hit was found. Any key will advance you to the next hit, if there was

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SOFTWARE PROFILE

Name: E-Z File
Type: Database manager
System: 16-32K Color Computer
Format: Disk
Language: Color Basic
Summary: Not bad, but documentation is lacking in early versions
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Manufacturer:
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Databases, continued...

more than one. When you have reached the end of your hits, you get a DONE message; pressing any key will return you to the main menu.

If you know at the outset that you want to replace your target string, you enter the replacement in response to the initial prompt. Unfortunately, in this mode you never see the actual hits—just the DONE when the whole process is finished.

Options 5 through 7 allow you to kill, save, or load a data file. They are quite straightforward. You just supply a filename when prompted. Files are saved in ASCII format.

Option 8 is used to get a screen listing of a file after it has been loaded into memory. You get one record at a time, starting with the first and must scan through the entire file before you can do anything else. There doesn't seem to be

anything else. There doesn't seem to be

spend with ENTER, your insertion becomes the new entry #1. Of course, the sorting routine can be used to straighten things out later.

I have gone on at some length because of my distrust at the flaws in the documentation of *E-Z File*. To be sure, it isn't the perfect database manager; there are too many processes requiring the user to cycle through the complete file, for example. Still, the program deserves a fair shake. The naive user doesn't have to worry about a multitude of nested menus, and many of the operations are really rather straightforward. If future versions are supplied with adequate documentation, *E-Z File* could be a serious contender for your database dollar.

Color File

The last of my review subjects, Radio Shack's *Color File*, is the most powerful in many ways. It is furnished in a ROM pack, leaving almost all of RAM free for data. About 15,000 characters can be stored in a 16K computer. Of course, this means that cassettes must be used for data storage, which does slow things down. Based on the amount of tape used, I would assume that the files are recorded in ASCII. *Color File* is written in relocatable machine code, so that I was able to copy my version onto disk. Of course, I still have to use cassettes for data, but at least I am no longer required to unplug the disk controller every time I want to use the database system.

Color File has a fairly complete set of commands for re-ordering the records in a file, selecting records, and printing the results of the selection processes. On-screen prompts are always available and do a good job of keeping you informed of where you are in the menu hierarchy. As a final touch, the program comes with seven predefined file formats: Addresses, Warranties, Home Inventory, Investments, Auto Maintenance, Medical History, and Resume/Vita. You can

define your own formats, too.

When the program is fired up, it first asks if an old field is to be loaded. If you are starting afresh, you next get the menu of predefined formats. Let's work through the construction of an address file.

The next prompt is for a filename. Since this is a cassette-oriented program, the filename is not strictly necessary. It does make it easier to locate the correct file on the tape, of course, and is to be recommended. After you supply the name, hitting ENTER twice brings up the file structure (seven fields, plus their names) and a command line at the bottom of the screen.

At this point, the command line contains the master menu:

ADD CHG DEL SEL ORD TAP PR

Taken in order, these allow you to add a record to the file, change the current entry, delete it, select a group of entries for display, put the file in order, save the file to tape, and print selected entries. At this point, the ADD is highlighted, which indicates that it will be implemented if the ENTER key is pressed. In fact, that is the only option available for an empty file.

When you press ENTER, a cursor appears in the first position of the first field. At the same time, the command line changes to display the second-level menu. For the ADD command, this is:

ADD NO! MOR

with ADD highlighted again. Now it is time to enter data (name, address, city, etc.) for the first record, with the ENTER key generating a linefeed in the usual way. Only uppercase letters can be used for alphabetic entries, and at this point your editing capability is very limited. You can correct the current line by backspacing and overtyping, and that's all. When you reach the end of the first record, you can add it to the database by pressing ENTER once again, or you can invoke one of the other options with its first letter.

NO!, which also appears in several other second-level menus, cancels the current option and returns the main menu. MOR is used for general editing of a complete record before it is added to the file. Now the four arrow keys can be used by themselves to position the cursor, or in conjunction with the SHIFT key to perform editing functions such as insertion or deletion of spaces, or the deletion of a line. There is no auto-repeat function.

After each record is added to the file, you return to the main menu and are prompted with another blank form. When you are finished, you can move on by pressing the up arrow. The display shifts to a kind of title page, giving the

E-Z File could be a serious contender for your database dollar.

any way to break off in the middle of things. If you want a printed list, use Option 9; you are given the choice of deleting the record numbers from the printout. By the way, the print is single-spaced with no extra spaces between records. To spread things out, you must insert additional linefeeds with the Edit option.

Option 10, Auto Header, is used when setting up a new database. It allows the user to specify a header which will be repeated automatically at the top of each record. If this feature is desired, it should be the first option used in the setup procedure. It will call Option 1 after the header is specified.

Option 11 allows you to change the default disk drive number for loading, saving, or killing a file from zero to another value. Option 12 toggles the Verify command on and off.

An *E-Z File* database can be sorted into ascending order with Option 13. That's the good news. The bad news is that each record is treated as a single string and sorted from the beginning. There is no capability for sorting on an interior field, or for sorting into descending order. The sorting routine handles all ASCII characters, however.

Options 14 and 15 are used to modify existing databases by inserting or deleting individual records, while Option 16 returns you to Basic. If you choose to insert a record, you will be asked for the number of the entry after which you want to make the insertion. If you re-

creative computing

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Name: Color File

Type: Database manager

System: 4-16K Color Computer

Format: ROM pack

Language: Machine language

Summary: Powerful, flexible, uses cassettes for data storage

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Databases, continued...

name of your file, the total number of entries, and the first fields of the first and last entries. New users are often surprised to find that the database has already been sorted in ascending order according to the first field—machine language sorts can be very fast.

As I shall describe later, you can rearrange the order of records quite easily. You can review the database by using the arrow keys now. Press ENTER to leave the title page for the first record, then use the right and left arrows to move forward or backward through the file. The down arrow moves you to the

Color File makes it fairly simple to carry out all of the standard operations on a complete file.

final entry, and the up arrow returns the title page.

Color File makes it fairly simple to carry out all of the standard operations on a complete file. Pressing ENTER when the last record is on display gets you back to the ADD function to add another file, for example. If you want to change something you see when reviewing one of the records, enter C for the CHG option. You get the appropriate second-level menu: CHG NO! MOR.

CHG allows you to use the arrows and SHIFT key as before to perform editing. If you go all the way through a record and still want to do more editing, use the MOR option: you can't select CHG twice in a row for a given record. If you decide to delete a complete record, just select DEL. This has a simplified menu: DEL and NO!

The real advantages of *Color File* lie in its provision for sorting a database and selecting records from one. It is worthwhile to describe these operations in some detail.

The second-level menu for the Select operation is:

SEL NO! FLD ALL = # < >
At the right of the command line, in reverse video (dark on light, for this program), is a box reading FLD= followed by a number. This is a reminder of which field currently provides the basis for the selection process. The default is Field #1. The general procedure for setting up a selection operation is as follows (note that you can do this with any record on display, not just one which satisfies the selection criterion):

1. Define the selection field by entering F and responding to the prompt with

the field number. Items could be selected by zip code from the address book example by specifying Field 6, for instance.

2. The cursor moves to the first position of the designated field. Now enter the value to be used in the selection (the key). If there is any additional material in the key field of the particular record on display, clear the rest of the line.

3. Specify the selection criterion, using one of the last four options on the menu. You can designate "hits" as having a match with the key (=), as having a total mismatch (#), or as having the designated field greater than or less than the key (>, <). The selection criteria work with both numeric and alphabetic fields, with this ordering convention: Punctuation marks before numbers before letters. If you choose the = criterion for a numeric field, your hits will have to exhibit exact equality with the key. Alphabetic fields use a criterion like the Basic INSTR. A hit is made if the key appears anywhere in the designated field.

4. Use the Select option to perform the search.

The machine language search routine is very fast. The selected records form a separate database which can be re-sorted, printed out, or used as the basis for further selections. This allows you to combine search criteria. For example, it would be possible to find everyone in the address book whose last name begins with N and who lives in Massachusetts.

Using the selection routine does not cause any of the original data to be lost; you can get the whole database back by going to the second-level Select menu and choosing the ALL option.

What about changing the order of a file? This employs the ORD selection on the main menu, and generates the second-level menu

ORD NO! FLD ASC DES
plus an FLD= reminder like the one in SEL. The new options, ASC and DES, are used to specify ascending or descending order for the sort; the other options should be familiar by now. When you save a file, the last sorting criterion is saved along with the data.

The final options on the main menu are used for saving a file on tape and for printing it. TAP gives you the option of making two copies of your database. Note that it doesn't let you record a separate database, using records selected from a larger file, you always wind up with the whole file on tape. This is probably a reasonable safety feature.

The way to beat it, assuming you have already made a safety copy of your whole file, is to set up a selection criterion which picks out the records you don't want, then delete them, one at a time. Now the ALL option will combine this empty subset with the records left

behind by the selection process, which were the ones you wanted in the first place. Recording this should give you the desired subset on tape.

This has been pretty long-winded, but I think it demonstrates some of the real power that *Color File* has. The final touch is the ability to define your own record structure. You can specify up to seven fields, and will be asked for the numeric or alphabetic character of each. All of the *Color File* options are available to user-defined files.

Summing Up

As I mentioned at the outset, this review has treated just those personal database management systems which I myself have used. One thing I have learned is that in software reviewing, as in everything else, personal quirks and preferences play a major role.

I need the ability to select subsets of a database for examination and prefer not to be too constrained in data format. I am also a firm believer in the use of disk systems for maximum flexibility, although the Color Computer system has

It is considered bad form in some quarters to admit that you like a Radio Shack product.

enough foibles to make me question the wisdom of that.

Putting it all together, I rate Trans Tek's C.C. File an absolute jewel of a best buy. *Color Data Organizer* is just too constrained in format for my taste, and I think it needlessly burdens the user with operating system details. *E-Z File*, in my opinion, still needs work; I hope that the vendor sees fit to produce some printed documentation and fixes some of the rough edges, because there is a useful program in there somewhere.

And that brings me, kicking and screaming, to *Color File*. I like it. It is considered bad form in some quarters to admit that you like a Radio Shack product, rather like playing Mantovani records on a fine stereo system, but there you are. *Color File* is really quite powerful, and the screen prompts are generally enough to keep you on track. If all else fails, you can always get out of trouble by hitting ENTER a few times. My biggest reservation is the ROM pack/cassette storage combination. I encourage Radio Shack to follow up on their work with *Spectaculator* and *Color Scripts*, and issue a disk version of *Color File*; it's a good program. □

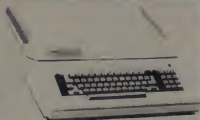
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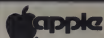
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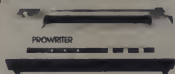
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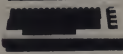
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CIRCLE 148 ON READER SERVICE CARD

Going Forth

The finest testimony I can give to Valpar International's ValForth language is this: In 20 hours' time I went from complete ignorance in the Forth language to writing my first Pong game, complete with player/missile graphics and sound. I owe it all to Valpar's great documentation, a book they recommended, and of course, the fast and versatile Forth language.

I have been programming on various micros for two years—all in Basic and assembly language. I had heard of Forth through a friend who worked in a similar language, Stolic. Forth offered many advantages over the languages I was familiar with, but one look at a typical program listing scared me off. I remember thinking that the program looked as if the programmer had been making up the language as he went along. And that turned out to be the secret of Forth—you make it up as you go along. Based on a set of more or less standardized commands, the programmer constructs his own words to meet his needs. This process builds on itself until the whole program can be run by executing just a few words. For example the word SANDWICH might be made up of the words GET-HAM and GET-CHEESE. These would be further defined as smaller and smaller words. Think of each word as a subroutine made up of ever-smaller subroutines.

I picked Pong for my maiden project because it used many of the features needed for most games—player/missile graphics with collision detection, full control over the standard Atari graphics, game controller interface, and sound. The game runs well, with speed

Thomas McNamee

far better than Basic, but only about half as fast as assembly language. The speed loss is barely noticeable, however.

The exciting thing is the composition time. Pong could easily have been written in an afternoon by someone who knew the language well. And the words I defined in Pong can be used in my next game if similar functions are needed. The Forth dictionary (really a library of commands) can be extended indefinitely.

I bought three modules from Valpar: ValForth (\$39.95), General Utilities and Video Editor (\$34.95) and a disk containing Player/Missile Graphics, a Character Set Editor and a Sound Editor (\$39.95). The last two require ValForth to run, and are extensions of the dictionary. Time-critical routines are coded in assembly language for speed. The disks are unprotected, so backups for personal use are allowed. **FORMAT** and **DISKCOPY** commands are provided, as is a command to produce your own programs on auto-booting, protected disks. Valpar supports programmers wishing to write programs for publication using ValForth, and requires only that credit be given them in the documentation or on the media.

ValForth 1.1

The primary disk contains all the main routines, the interpreter and the operating system for Forth. It features a basic glossary of words and a figForth editor for creating your own source programs. Graphics, color and sound commands are available on this disk as extensions to the dictionary. Many of the graphics words from Atari Basic

(DRAWTO, PLOT, etc.) have been copied here so that learning to use this section is easy.

As much as possible, Valpar has written this package so that what you already know about the Atari computer can be put to immediate use. The Atari operating system is supported with familiar words such as **OPEN**, **CLOSE**, **PUT** and **GET**. There is a group of words used for debugging Forth code, and words for floating point arithmetic are provided.

For applications in which time is critical, this disk contains a powerful 6502 assembler designed to be used with the Forth system. Macros, conditional branching, and conditional loops are supported, and access to the rest of the Forth language is easy. The assembler itself is worth the price of the disk.

General Utilities and Video Editor

The General Utilities and Video Editor disk contains a fine selection of string utilities, array commands, and **CASE** statements, and a fascinating group of

creative computing SOFTWARE PROFILE

Name: ValForth

Type: Language

System: Atari 400/800, 24K minimum

Format: Disk

Summary: Excellent implementation of an interesting language.

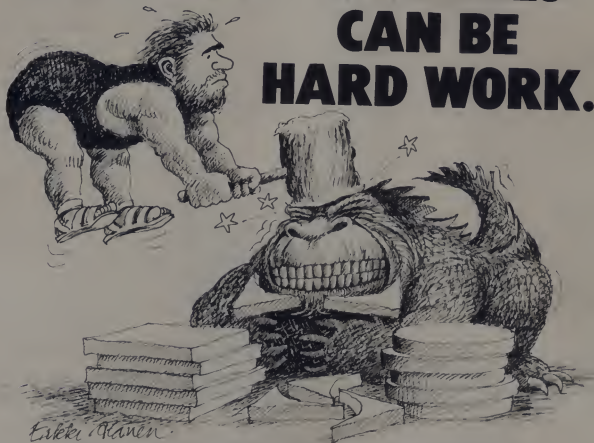
Price: \$39.95

Manufacturer:

Valpar International
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CIRCLE 277 ON READER SERVICE CARD

ValForth, continued...

words called High Resolution Text. Many Basic words appear in the string commands, such as LEFT\$, RIGHT\$ and INSTR. There are provisions for comparison, sorting, and formatted output. The string commands are all very fast, since the address of the string is manipulated instead of the string itself. Time is not wasted in what Basic programmers call garbage collection.

CASE structures are a powerful group of commands permitting decision making similar to ON...GOSUB in Basic.

The SET structure allows the same advantage for non-sequential numbers. The final word in this group is COND, which allows conditional execution based on true/false testing.

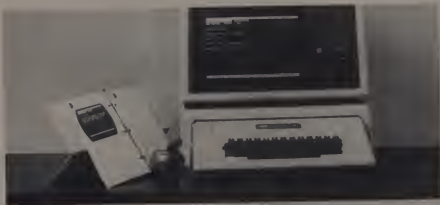
High Resolution Text is a feature permitting text to be displayed in Graphics 8 mode. Words for superscript, subscript, and overstrike are supplied. Using a combination of backspacing, subscript and overstrike, underlining can be accomplished. Graphics can still be drawn in this mode, so displays of mixed

text and graphics are very easy.

The ValForth video editor is a joy to use. Again, Valpar could have sold this all by itself and kept the price the same. It is used for entering Forth source code and has a powerful set of single-stroke commands for insertion, deletion, and buffer management. Each screen, of which there are 180 per disk, can be brought up and edited with ease.

When the source code is finished, you LOAD the screens you want to run. As they load, each word is compiled into the dictionary. If an error occurs during compilation, the WHERE command of the editor displays the screen on which the error occurred. The cursor is positioned over the word or character that caused the error.

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CIRCLE 257 ON READER SERVICE CARD

The ValForth video editor is a joy to use.

the screen. The user can set the number of lines it holds. Seven single-stroke commands support line move, line copy, and buffer clear operations. In this way, sections of code can be moved or copied using the SMOVE and COPY commands. The whole editor design encourages the composition of easy-to-read source code.

Player/Missile Graphics and Friends

The Player/Missile Graphics disk contains an extremely useful set of commands that are a must for any game programmer. Memory allocation, memory clearing, player/missile design, and movement are all reduced to single words. All modes are supported. Player size, multicolor players, and fifth player features are easy to implement. P/M graphics are not destroyed when switching from one graphics mode to another.

Movement is accomplished in two ways. You can either put the player at an absolute X,Y location, or you can move the player relative to its present spot any number of locations.

Collision detection is also available in two ways: boundaries and the standard Atari collision registers. Boundaries can be set for any player or missile. The movement of that character will then be limited to that area. In addition, a variable can be checked to find out when a boundary has been reached and where it is. The direction of movement can then be changed. This is how I made the ball bounce in my Pong game.

Missile-to-playfield, player-to-play-

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ValForth, continued...

field, missile-to-player and player-to-player collision detection are supported, and there is a general collision flag that is set when anything bumps anything else.

The character set editor allows for the creation of new character sets, as well as the words needed for switching and loading sets. These designs can easily be used in conjunction with player/missile graphics, since a command is available to change any player rapidly to another bit pattern.

The sound editor is a useful "audio palette" for creating single sounds on any of the four channels. Using joysticks, you adjust the frequency by moving horizontally, and change the distortion by moving vertically. A read-out at the bottom of the display shows the current values needed to re-create the sound. In addition, the AUDCTL register can be addressed to produce many interesting sound variations.

Documentation and Support

Each package comes with its own documentation, printed clearly on 8½ x 11 paper and punched for a three-ring binder. All together, there are about 200 pages of information, as well as the source code for each disk. The documentation is excellent, and is very easy

to use. It is not a tutorial of Forth, however. The functions common to the language are listed, but the language itself is not explained.

Valpar recommended *Starting FORTH* by Leo Brodie since I was a first time user, and it turned out to be great advice. I have read many technical works, but none as informative and enjoyable as Brodie's. I never met the man but I like him a great deal.

All of the ValForth documentation is written in a participatory style.

The ValForth 1.1 documentation of the main disk begins with simple loading instructions and then, very appropriately, a good section on errors, recoveries, and crashes. The next section is on formatting and copying disks. I recommend that anyone who buys ValForth be sure to have a box of clean disks on hand. Backups are encouraged and very

useful. After you have loaded all the features you are likely to use, you can create your own system disk. Forth requires a special disk format, so you will want three or four blanks to work on. Sections on graphics, editing and sound complete this package.

All of the ValForth documentation is written in a participatory style. You sit down and follow the instructions, and when the last page is turned, you know how it works. Technical jargon is kept to a minimum, but it is a good idea to keep Brodie's book nearby.

Any command peculiar to the Atari, such as graphics and sound, is explained fully with examples. There are even example programs on the player/missile disk which are valuable references. Each package is accompanied by a stiff command reference card for quick work look-up.

Before buying this package, I spoke to Mike White at Valpar about support. He was knowledgeable and polite, and he assured me that I could write or call anytime with my problems, and I would get help. He was enthusiastic about ValForth, and seemed to represent a company that sells a good product and stands behind it.

ValForth is an excellent implementation of a fast, expandable language. □



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CIRCLE 109 ON READER SERVICE CARD

Prism

creative computing SOFTWARE PROFILE

Name: Prism

Type: Storydisk-puzzle

System: 48K Apple II with disk drive and 3.3 DOS

Format: Disk

Summary: A poor children's story, but a great real-life treasure hunt.

Price: \$19.95

Manufacturer:

International Software Marketing
Suite 421, University Building
120 East Washington St.
Syracuse, NY 13202

If you think that \$19.95 is a reasonable amount to invest in a chance to win a prize valued at \$15,000, then *Prism*, a Storydisk released by International Marketing, is worth a look. If, on the other hand, you are looking for sheer entertainment for your children, then *Prism* is not for you.

This new disk, created by a team of programmers and editors at ISM, attempts to fulfill two purposes. One, quite reasonably, is to make money by offering Apple owners the opportunity to decipher a puzzle that will lead to the discovery of three solid gold, gem-encrusted keys which ISM has hidden in three secret locations in the continental United States. The reasoning is that people will come to the conclusion that

Brian J. Murphy

\$19.95 is not much to wager against a chance of winning \$15,000.

The other purpose of the disk appears to be to tell a children's story, using text and hi-res pictures. The program tells a story, but it fails in the attempt to make it interesting or readable.

The Storydisk is a new concept in software—a program that allows the user



to remain almost completely passive. All the user need do is to hit the arrow key to turn the pages back or forwards. As you "leaf" through the story, the screen fills with either text or hi-res art. The pictures, which are the best part of the program, were created by Mike Sullivan. His pictures are detailed and elegantly drawn; some feature a limited amount of animation. There are also some special effects thrown in which enhance the rather thin story line.

The Story

The story is about a little boy named Hubert who goes out one day to discover

the world being drained of color. A magical figure appears and takes him to the place where the Prism is kept. The three keys of the Prism have been stolen. Hubert is told, and he has been given the task of going to Yolvsa, the land of monsters, to bring color back to the world.

Hubert goes to Yolvsa and is captured in fairly short order by Grane, the head honcho of the monsters, whose dialogue is faintly reminiscent of Margaret Hamilton in *The Wizard of Oz* ("Resign yourself, whelp. Although you are an insignificant figure, you may yet furnish an interesting tidbit for my extremely large fangkat. Come my lovely...").

Hubert, who is carrying the Prism, uses its magic powers to snatch the keys away from Grane and to escape. At the last instant before departing Yolvsa, Hubert hurls the keys away to keep them safe from a threatening monster. Hubert soon arrives home, where it has been all a dream, and it remains for us to find the keys.

The major problem with the disk is the thinness of the story line and the over-written quality of the text. It is a story which I doubt would appeal to children. The writing is unprofessional. Had the children's story been better written, in crisper, less cluttered style, the program would have had the valuable extra dimension of literary merit.

The Storydisk format has real potential which is, unfortunately, not realized in *Prism*. Used creatively, as a vehicle for good children's writing, the Storydisk could become a valuable and powerful tool for promoting literacy with the computer. *Prism*, with its poor writing and lack of user involvement, has no value as a story. It's a good thing that the disk



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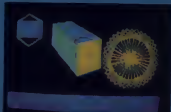
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Sound Editor: Simple independent control of 40K voices (one joystick per voice) and audio-control register. Create any single-sounding sound with graphical and tabular readout.

(Over 35 pages of documentation. Requires valFORTH.)

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CIRCLE 292 ON READER SERVICE CARD

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To all reps: Price changes on following items effective immediately:
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Take that, bud. (And retaliate fast. I know phone rates are low now, but game's cutting into sack time.)



Your computer's telephone. Hayes

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CIRCLE 169 ON READER SERVICE CARD

Prism, continued.

doesn't depend on the story, but on the
puzzle.

The Puzzle

The idea for the puzzle comes from the
British children's book, *Masquerade* by
Kit Williams. For those who solved the
riddles posed in his book there was the
promise of finding a solid gold rabbit
which Williams had buried "somewhere
in Britain" (incidentally, the rabbit was
found and the puzzle has been solved,
leaving only *Prism's* golden prizes remain-
ing to be found).

Aside from borrowing this idea from
Masquerade, *Prism* also borrows some of
the form of the book, if not the content,
framing the illustrations with inscriptions.
These inscriptions are used in both works
to further illustrate the story and to pro-
vide clues to the big riddle.

**As works of art and
collector's items the
keys will be worth from
\$30,000 to \$40,000.**

On to the clues! ISM says that the clues
could be anywhere on the disk, in the
text, the pictures, or the inscriptions. The
inscriptions are found to have, at irregular
intervals, certain letters drawn in different
colors from the majority. For example, in
the inscription framing picture number
one, "Up north lines meet, down south
fates greet," the letters I, M, P, S, R are in
orange. Unjumbled, they spell *Prism*.

Picture number ten is framed by the
words, "Excavation excites extreme
exhaustion." The letters I, V, X, X, X are
colored orange. They don't appear to
spell a word, but they could be combined to
make two Roman numbers, XXXIV
which is 34 and XXXVI which is 36. A
clue?

Some of the inscriptions seem to offer
number puzzles, again along the lines of
Williams's *Masquerade*. For example, in
Masquerade, there was the riddle, "One
of six to eight" in one of the inscriptions.
It referred to one of Henry the Eighth's
six wives. Get it? Now let's look at the
inscription around *Prism's* picture number
five: "Two of one one of two colors red
white and blue." What is the clue?

How about the inscription around pic-
ture number nine: "In at 7 out at 4 for-
wards eight and slightly more." What does
this mean? Then look at picture four's
inscription: "Many are my pretty facets 1
thru 3 of eight." What have we here?

In the pictures, what is the meaning of
the trigrams and the hexagram from the
Chinese book of prophecy and philoso-
phy, the *I Ching*? In three locations we
see the trigram Ken, which symbolizes an
arch, a mountain, a path, little stones, or
openings, depending on your interpreta-
tion. In one picture there is the hexagram
number 30, called by the *I Ching* "The
Clinging Fire." The hexagram symbolizes
resting on something the way plants rest
on the soil. Is that a clue, or is the number
of the hexagram, 30, more significant?

There are some rather off-beat names
in the text. For example, Hubert's dog
is named Vanna. As in Savannah, Geor-
gia? What about Grane, the monster
king and Yolvsa, the land of monsters?
Are these names anagrams? What does
the inscription, framing picture eight,
mean: "Not a roc, never hot, not fruit,
never locked."

If the storyline is thin, the puzzle is far
from it. There are clues galore to follow.
Some, I suspect, will lead you in the wrong
direction. You may also find yourself
mistaking parts of inscriptions, text and
illustration for clues when they are, in
fact, not riddles to be solved at all. That's
the charm and challenge of this kind of
puzzle, having to sort out the real clues
from the superfluous information.

I was unable to wrest any hints from
ISM. Are the keys more than one hundred
miles apart? Five hundred? No comment.
Are the clues in the pictures only, in the
pictures and inscriptions, or in the text,
pictures and inscriptions? No comment.
The only help I got, which I pass on to
you, is that the keys are in the 48 con-
tinuous states...somewhere.

If you find them, they will be worth, at
this writing, about \$15,000 on the basis of
their gold and gemstone content. ISM
predicts that as works of art and col-
lector's items the keys will be worth from
\$30,000 to \$40,000 and that makes a
puzzle worth solving. □





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TEXAS INSTRUMENTS

CIRCLE 203 ON READER SERVICE CARD

Apple Adventure and Arcade Action

One of the greatest fringe benefits of being a staff writer at *Creative Computing* is that I get to see most of the new games as they are released. Even though it is my job to review programs, I also spend a great deal of my free time playing my favorite games. Of the new games I "had to" play this month, *Aztec*, *Jawbreaker*, and *Spy's Demise* are the ones that keep me at my Apple long after hours.

Aztec

To be honest, adventure games have never really appealed to me. Wandering helplessly through screens full of text is not my idea of fun. Therefore, I was less than enthusiastic when *Aztec* appeared on my desk for review. Reluctantly, I booted the program and prepared to be



Owen Linzmayer

bored. It wasn't long, however, before I realized that *Aztec* is like no other adventure game I have ever seen. I love it.

What sets *Aztec* apart from most of the other adventures currently available for the Apple? It is a real-time game with hi-res animation which allows you to control an explorer using 21 command keys.

As the player, you represent a daring explorer who bears a striking resemblance to Indiana Jones from the movie, *Raiders of The Lost Ark*. Your challenge is to delve into a tomb that is eight levels deep in an attempt to retrieve a priceless golden idol. The chambers and anterooms are literally crawling with death in the form of scorpions, cobras, spiders, and seven other lethal guardians of the idol.

If you encounter a guardian, you may fight it or try to run away. When you enter the "fight mode," you must select the weapon you wish to use. The only weapons available are a machete and a pistol, both of which you must acquire in the tomb. Most guardians can be killed us-

ing only the machete, but some monsters can withstand multiple bullet wounds before they die. In general, the fighting controls are similar to those found in *Swashbuckler*, a program written by the same author, Paul Stephenson.

In addition to the guardians, there is a wide variety of traps designed to stop you as you weave your way into the depths of the temple. If you aren't careful, you will quickly find yourself dead. Some of the more clever traps include

creative computing

SOFTWARE PROFILE

Name: Aztec
Type: Animated adventure
System: 48K Apple II/II+
Format: Disk
Language: Assembly
Summary: Action-packed, innovative game
Price: \$39.95
Manufacturer:
Datamost Inc.
9748 Cozycroft Ave.
Chatsworth, CA 91311

BASIC VS. JRT PASCAL:

A NO-HOLDS-BARRED COMPARISON.

EASE-OF-USE By dividing programs into modules, JRT Pascal makes even very complex programs—of nearly any size—a breeze to manage. Pascal code is self-documenting; program sections are identified by meaningful names, not line numbers. Error messages are verbal, not number codes. JRT offers 12 data types (10 Basic's 2 or 3), and it has both regular and hex numbers.

POWER For power—the ability to write better, clearer programs, faster—Pascal is the run-away winner. Example: JRT simplifies programming by accomplishing complicated operations (for Basic) with one command:

Basic JRT Pascal
IF A\$ = "V" OR IF A IN ("V":Z) THEN...
A\$ = "W" OR
A\$ = "X" OR
A\$ = "Y" OR
A\$ = "Z" THEN...

FLEXIBILITY JRT's wide variety of data types reduces programming restrictions. And the data types are not all fixed in size. There are 3 looping statements (Basic has 1). With JRT, very large programs can be created and run, because program modules can be spread over many diskettes. Common modules can be used for several programs. Basic generally limits strings to 255 bytes; JRT strings go up to 64K.

EFFICIENCY Whereas Basic relies on a static, inefficient memory map to allocate storage, JRT's dynamic storage fills every available main storage area; there's no waste. With Basic, sub-routine modules must be linked together; with JRT, they can be linked—but don't have to be. JRT's more powerful commands run faster; typically, you'll write Pascal programs 3 to 10 times faster than in Basic. *Exclusive:* JRT lets you directly access the CP/M® operating system for better total system control.

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Structured programs	No	Yes
Separate compiled modules	"Chaining"	Structured procedures with auto-loading & purging
Arithmetic precision	Usually 6 or 7 digits	14 digits
Indexed files	No	Yes
Maximum string size	255 characters	64,000 characters
Loop statements	1	3
Data types	Usually 2 or 3	12
CASE statement	No	Yes
Introduced	1965	1980
Price	???	\$29.95!

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CIRCLE 199 ON READER SERVICE CARD

Apple Games, continued...

rooms that fill with water, ceilings that fall, and walls that slide together. The beauty of these traps is that they can be defeated with a little ingenuity. There is a sense of urgency as you play in real time because you must learn to act fast. Even on the easiest level, *Aztec* is extremely difficult. Too many times you lose a life at the mercy of the program rather than as a result of your own mistakes. This can lead to frustrating play.

The main appeal of this adventure is that it is a real-time, highly animated ar-

Aztec looks like a cross between Castle Wolfenstein and Swashbuckler.

cade game that allows the player to exercise an extensive range of options. The graphics are hi-res, but not too colorful. The animation is jumpy, as if the computer is flashing different images in sequence to suggest movement. *Aztec* looks like a cross between *Castle Wolfenstein* and *Swashbuckler*.

The thing that immediately turns off many prospective players is the large number of command keys. It took me about an hour of practice before I memorized the keys and "mastered" their use. I would wager that this game is nearly impossible to play if you aren't a touch typist.

Although there are a few unpolished edges in the program, *Aztec* is a fine package. If you enjoyed *Swashbuckler*, but felt that it lacked depth, *Aztec* is just what you are looking for. Any adventure player who wants a real challenge will find it in this game. Due to its complexity, I do have reservations about recommending it to kids under 14 or to gameplayers who believe themselves to be hopelessly uncoordinated.

Jawbreaker

You may be asking yourself "Hey, why review *Jawbreaker*? That game has been on the market for close to a year now." Well, that's only partly true. The old *Jawbreaker*, the one that plays like Pac-Man, has undergone a total transformation, and the result is a cute new game that goes by the same name.

The object of *Jawbreaker* is to eat the dots that line the maze. Unlike other mazes, this one is composed of five horizontal corridors laid on top of one another. The hallways are separated by walls that have sliding doors in them. As you play, the doors are constantly mov-



ing along the hallways. When a door reaches one edge of the maze, it reverses direction. To pass from one horizontal corridor to an adjacent hallway, you must slip through the sliding door as it goes by. It sounds easy, but the timing is tricky.

As you guide your jaws through the maze, you must avoid the rolling faces. These four guys are the only things keeping you from eating your way to

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SOFTWARE PROFILE

Name: *Jawbreaker*

Type: Arcade

System: 48K Apple II/II+ DOS 3.3
48K Atari 400/800

Format: Disk/cassette (Atari only)

Language: Assembly

Summary: Creative new maze game

Price: \$29.95

Manufacturer:

Sierra On-line Inc.
36575 Mudge Ranch Rd.
Coarsegold, CA 93614

obesity. If you touch a face, you lose a set of teeth. To chomp on the faces, you must first eat one of the energizers that are located in the four corners of the maze.

Jawbreaker can be played by using the keyboard, a joystick, or a joystick controller. If you choose to use the keyboard, you are allowed to define the keys that you want to control the action. The joystick with a switch-type joystick is the most responsive and accurate type of controller for this style game in which precise, four-directional movement is required.

The playscreen is depicted in colorful hi-res graphics. As the faces roam the hallways, they roll, giving the illusion of three dimensions. The best word to describe this game is *cute*. It is simple to play, yet not easily mastered. You don't get the feeling that the faces are out to get you, but rather, that you must sim-

ply avoid them. This makes for a very light-hearted atmosphere.

The game can be played at one of ten selectable difficulty levels. The lower the level, the slower everything moves. The default level is fast-paced and provides a challenge to even experienced players. As the game progresses, the faces become more aggressive, and the energizers do not last as long.

This new version of *Jawbreaker* is written by Charles "Chuckles" Bueche, and it is nothing like the first version. If you are looking for a good variation on the maze game theme, *Jawbreaker* won't let you down.

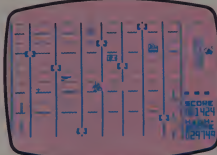
Spy's Demise

As you sit in the lobby of the Bangkok Hilton, you overhear two Russian KGB agents discussing an encoded message which holds the key to very valuable computer data. Each component of the message is kept on a separate floor of the Russian embassy. There is only one secret agent who can infiltrate the heavily

**The mission is yours,
whether you decide to
accept it or not.
Good luck.**

guarded Soviet embassy, and that spy just happens to be you. The mission is yours, whether you decide to accept it or not. Good luck.

Spy's Demise, written by Alan Zeldin, is a new arcade action game from Penguin Software. You play the role of a trustworthy spy attempting to steal an encoded message out from under the noses of Russian embassy officials.



You are portrayed in detailed hi-res graphics as a trenchcoat-clad figure who shuffles silently about. Scattered on the platforms are various spying tools which contain pieces of the encoded message. As you pass over them, you pick them up, but gain no points.

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CIRCLE 184 ON READER SERVICE CARD

Apple Games, continued...

creative computing

SOFTWARE PROFILE

Name: *Spy's Demise*
Type: Arcade action
System: 48K Apple II
Format: Disk
Language: Assembly
Summary: Fast-paced, addictive game
Price: \$29.95
Manufacturer:
Penguin Software
830 4th Ave.
Geneva, IL 60134

Basically, *Spy's Demise* is a "chicken" game, much like the popular Activation VCS cartridge, *Freeway*. You must stay out of the predictable paths of the oncoming guard elevators. The thing that sets *Spy's Demise* apart from similar games is the challenge of solving the encoded message. There is a strong incentive to reach each successive embassy floor.

Spy's Demise can be played by only one player at a time. You select what type of controls you prefer to use (paddles, keyboard, or Atari joystick). Moving your man left and right are the only two commands in this game. The thing that makes *Spy's Demise* difficult is that there is no way to stop the movement of your spy, which increases your chances of making a mistake.

There is very little happening in the sound effects department of the game. Each time a new man is introduced into the game, the computer plays a short musical tune. This is as complex as the sound routines get. The suspenseful game play more than makes up for this deficiency, however.

To succeed in reaching the advanced floors, you must have an incredible amount of patience and good timing. As mentioned before, when you climb to the top of a floor, you are shown a portion of the overall message. Each line consists of 16 strange characters. Even if you were able to pass the ninth level, you must still decipher the code to "win" the game. So far, I have seen eight lines of code, but the puzzle remains a mystery to me.

Spy's Demise is full of excitement. It is not a simple action game that relies strictly on dexterity, but rather, a game that requires a blend of coordination and mental ability. From the close shaves with the guard elevators to the thrill of acquiring each piece of code, *Spy's Demise* is a very addictive game.

May 1983 • Creative Computing

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Landing A Jumbo Atari

I thought the best way to test a program titled *747 Landing Simulator* would be to have a real Jumbo Jet pilot grab hold of the joystick and compare the Atari 800 to the Boeing 747. Unable to coerce 747-qualified volunteers, I found two willing guinea pigs who agreed to give it a whirl. Both are experienced co-pilots for major commercial U.S. airlines, one in the right seat of a 737, the other in a 727. Their reactions in a moment.

The *747 Landing Simulator* program, written by William Graham for the Atari 800, was one of the earliest offered through the Atari Program Exchange (APX), a valuable source for low cost Atari software. The program is written in Basic and is available either on cassette (24K RAM required) or disk (32K RAM). All controls are handled by a joystick and the row of numbers on the 800 keyboard.

The object of the simulation is to make a safe landing approach to a runway from 19 miles out at an altitude of 5000 feet. You need to follow the glide path onto the runway while slowing airspeed and making minor course corrections caused, presumably, by cross winds.

The view is out the cockpit window, with your instrument panel in the lower quarter of the screen. The ground is black, and the sky a bluish color, giving you the impression you are landing a little after sundown.

From the blackness of the ground flash runway lights—at first very small in the distance, ultimately filling out the whole area on final approach. The "flashing" of the runway lights is a clever way to allow the computer to update the runway display smoothly even though it does so in Basic, instead of much faster machine language.

While players may be tempted to

Danny Goodman

watch the runway lights, attention should really be focused on the instrument panel. Pilots are provided the following information: altitude in feet, range in feet to midway point of the 10,000 foot long runway, bearing deviation in degrees left or right, airspeed in feet per second, elapsed flight time in seconds, fuel units remaining, bearing and glide slope correction needed, and landing gear up/down. If you wander from the correct course, the letters for the affected instrument (e.g. RANGE) turn from yellow to white.

If you think that's too much to keep an eye on, you're right. Actually, you can forget about the time, fuel and landing gear indicators for most of the flight. But that still leaves an awful lot going on.

Controlling the plane is no picnic either. It takes a great deal of practice to learn the combinations of joystick direction and red button pressing to make the plane react as you want. You have the flexibility to climb and dive at both 50 and 3 feet per second, make turns, climb/dive during turns, drop/raise landing gear, activate autopilot, and abort landing.

Airspeed is controlled by the keyboard numbers, each representing airspeed in hundreds of feet per second. This is the easiest factor to control during landing because there are guidelines to follow in gradually slowing the plane from the starting 900 feet to zero on the runway.

If you don't follow the glide path correctly, several things may happen. The most common is the mid-air collision as your errant path crosses that of a nearby plane. You must be alert to the warning sound of impending danger, then

immediately determine corrective action and take it. Otherwise, it's good-bye, Ace. As (if?) you begin the final approach at the foot of the runway (your instrument panel politely indicates when this is), the sweaty palm part really begins. If you don't have enough fuel, or if you descend too quickly, you'll drop to the runway like a stone.

You can't dawdle, either, because you can overshoot the runway before the plane comes to a halt. If, at an earlier stage of the approach, you abort the landing, you see the runway pass below you as you veer away for another try.

A complete landing sequence takes between five and ten minutes, and the closer you get, the more you want to make sure you don't blow it. Successful landings or aborted landings earn scores, based on the difficulty level (instruments, IFR, or visual, VFR), amount of fuel and time used, and whether you invoked the autopilot. The program documentation provides the formula executed in figuring your score.

It took me perhaps 30 attempts before I made my first successful landing—and

Creative Computing SOFTWARE PROFILE

Name: 747 Landing Simulator

Type: Entertainment

System: Atari 800 24K (cassette) or 32K (disk), Basic language cartridge, joystick.

Format: Cassette or disk

Language: Basic

Summary: Tougher than the real thing

Price: \$17.95 either version

Manufacturer:

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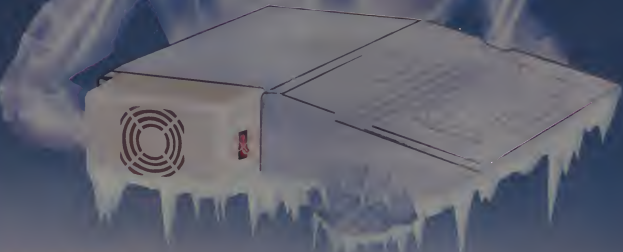
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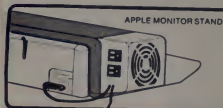
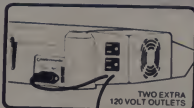
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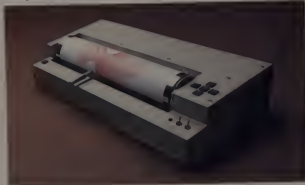
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Logo Ideas

Robert Lawler

Re-solving Problems

Some problems you want to put behind you—like having to do what you don't want to do, and not being able to do what you do want. Such problems should be resolved. Other kinds of problems have a friendlier face, and certain of them are worth solving and re-solving. Think about making a circle. Doing so is a classic Logo problem for beginners. Novice learners are typically asked to "do-it-yourself," to walk through the problem by simulating the turtle. Their typical explanation of what they are doing as they walk in a circle is that they go forward a little and turn a little and do it again. This explanation translates directly into the Logo circle:

```
TO CIRCLE  
FORWARD 1  
RIGHT 1  
CIRCLE  
END
```

The Logo circle is very easy to make with a Logo computer, but it would be difficult to make such a circle by drawing on a piece of paper. The Logo circle is very perimeter-focussed because the turtle knows nothing at all about "centers." (This leads to some interesting bugs and problems in turtle geometry procedures.) The Logo circle is natural in the sense that it is the path of an activity as familiar as walking is.

In plane geometry if you ask, "What's a circle?" the object, "the locus of all points in a plane equidistant from another point," is easy to construct with a compass and not even hard to construct without one. The Euclidean circle is as "natural" as the Logo circle in the following sense: imagine a person sitting; the figure traced by the farthest reach of his arms is as circular as the path followed by any person imitating the Logo turtle. The Euclidean circle is center-focussed, and the circle is the boundary of the center's territory.

Can you get a computer to draw a Euclidean circle? There are several ways. If your computer speaks "polar," you can specify the definition of a circle with the simplest of equations, $\text{radius} = \text{constant}$. Descriptions of circles in polar coordinates are simple, but they get complicated quickly if located away from the coordinate system origin.

While the description of a circle in polar coordinates still keeps in mind the relation of the circle to its center, and to a process a person could use unaided to make a circle, the description of a circle in a system of Cartesian coordinates becomes remote from the process of generating a circle:

$$X^2 + Y^2 = C^2$$

This algebraic equation for an origin-centered circle (of radius C) specifies that the circle is the set of all point pairs (X, Y) in a Cartesian coordinate system which satisfy the equation. The primary relationship between the circle and "something else" is here between the circle and the Cartesian reference frame. This contrasts with the Logo circle (where the primary relation was between the circle and its process of creation) and the Euclidean circle (where the primary relation was between the circle and its center). The Cartesian description of the circle and other curved lines, although central to the development of modern mathematics and science, seems relatively unnatural as compared to the Logo and Euclidean circles because of the extent to which the person is removed from the description of the circle.

Summary

Scientists have recommended re-solving problems through the ages. Descartes recommends that whenever you encounter a new idea, you bring it into comparison with all the other ideas you hold as valuable and try to appreciate their interrelations. Feynman, a famous physicist of our time, relates that his practice as a student was typically one of solving a problem whatever way he could, then, with a worked out solution to guide him, to re-solve that same problem in as many different other formalisms or frames of reference as he could.

Sometimes You Need Another Idea

One of the most famous problems in the history of ideas puzzled the mathematicians of ancient Greece. They knew how to count very well (even though they used letters of their alphabet to represent numbers). They even knew about fractions, and this is where the puzzle came up. They knew about numbers like 1, and $\frac{1}{2}$ and $\frac{1}{4}$, but they wondered if there were any numbers that couldn't be represented by whole numbers or fractions made from whole numbers. The puzzle became a hot issue for them after the discovery of the Pythagorean theorem. They could prove that the areas of two squares constructed on the edges of a right triangle was equal to the area of a square

constructed on the longer line (the hypotenuse), through the use of a technique such as shown below:

Hypotenuse Square



rotating
pieces
around
their
corners

Two Side Squares



This proof helped make the problem more critical because it raised a specific question. If you start with a square one unit long on the side, and make a triangle by drawing the diagonal of the square, the sum of the areas of the two squares constructed on the side will be two units of area; but how long must be the hypotenuse, H , of the triangle made from half a unit square? H must be greater than 1 and less than 2. It must be more than $\frac{1}{2}$ and less than $\frac{3}{4}$.

Greek mathematicians suspected no fraction of whole numbers would result in the number 2 when multiplied by itself, and they began the attempt to prove there was no fraction of whole numbers equal to H . They tried to represent the number H as a fraction of two whole numbers, T (the top number) and B (the bottom number). They knew that H times H had to equal 2 and developed these equations:

$$\text{first, } H \times H = 2$$

$$\text{then, } \frac{T}{B} \times \frac{T}{B} = 2$$

$$\text{or, } \frac{T^2}{B^2} = 2$$

$$\text{finally, } T^2 = 2B^2$$

Having reduced their relation of the possible whole numbers T and B to this simplest form, they were stuck. What else is there to do? Where can you go from here with this one idea? Think about it for a while. Can you go on from here?

Another idea is needed, another whole different way of looking at what T and B might be. The trick is to look "inside" T^2 and B^2 . What must they be made of? No square can be a prime number (squares are made by multiplying at least two other numbers together). The factors of a square must be two (in number) if the roots are prime or some multiple of two if the roots are not prime, as in the example below:

Square	25	36	64	100
Prime Factors	5×5	$(2 \times 3) \times (2 \times 3)$	$(2 \times 2 \times 2) \times (2 \times 2 \times 2)$	$(5 \times 2) \times (5 \times 2)$
Count of Factors	2	4	6	4

Any number is either a prime number or can be decomposed into prime factors. Therefore every square must have an even number of factors. But think back about the equation: $T^2 = 2B^2$. Doesn't that imply there is at least one square, T^2 , which must have an odd number of factors? It surely does, and therefore it must be wrong. Consequently, there must exist numbers, like the square root of 2, which can not be expressed as the ratio of two whole numbers. That is, irrational numbers exist.

This mathematical proof was a difficult one for men to discover. Then someone realized that a new idea was needed, a new way of looking at the problem. Once a second way of describing the problem was brought to bear, its solution was relatively straightforward, almost obvious. When you have a very difficult problem, maybe you ought to think about whether some other description of the problem could help you with it. Finding the right description isn't always easy; it may, however, be necessary. $\square$

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Picture utilizing Prestel's low resolution graphics capability.



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Standardized Page Display

All information on Prestel is designed to be read in pages, or screens, consisting of 24 lines of 40 characters. Both upper- and lowercase alphanumeric characters are supported, as well as two special graphics sets of 64 characters each. All characters can be displayed in any one of seven colors against any one of seven background colors, and can also be displayed in double height or flashing mode.

To use Prestel, you must purchase a special terminal that supports the display protocols, or buy hardware or software products to adapt a personal computer to Prestel. Currently, the Apple II and TRS-80 Model III can be adapted for black and white display simply by running special software. Combination software/hardware packages exist for color adaptation of Apple II, IBM, and S-100 bus personal computers.

Use of a standard display means that there are never awkward line wrap-around problems, and important information never scrolls off the top of the screen. All information on Prestel is transmitted as one or more complete pages that are written on the screen from top to bottom.

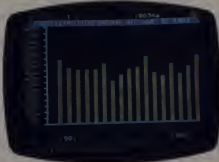
Although color may not seem important for textual information, many Prestel information providers make excellent use of contrasting colors for emphasis or to lead the eye. And the combination of color, lowercase characters, interesting page layouts, and graphics makes Prestel a true *communications* medium, not simply a database.

As a former advertising agency creative director, I may be especially sensitive to the visual design capabilities of Prestel, but when I give demonstrations of both The Source and Prestel to my university classes, the students

Many Prestel information providers make excellent use of contrasting colors for emphasis.

overwhelmingly favor the visually more exciting Prestel display. To a generation brought up on mass media and video games, it is not enough that computers provide information, the method of presentation must be as design oriented as a new arcade fad, a slick publication, or a pair of bluejeans.

Graph showing number of new subscribers each month over past year and a half. Growth has been slow, but steady, with an average 500 new subscriptions each month.



Menu Driven Access Structure

The model for Prestel information retrieval is print. It is a library of regularly updated periodical information. Indexes are used to find specific information. By keying numbers next to index entries, you can quickly move through more and more specific index layers to the information you seek. Numerical labeling of menu choices allows Prestel to be accessed with a simple numeric keypad. This speeds up menu selection and allows one to sit back in an easy chair with a keypad smaller than most TV remote controls.

If menus seem like a slow way to retrieve information, remember that Prestel is designed to be received at 1200 bits per second (bps) and that an extremely efficient operating system assures a consistent response time of less than two seconds from the time a key is pressed until the page begins to appear. The response is so instantaneous that some people who have used my terminal can hardly believe they are online to a computer in the U.K.

Since all Prestel pages are numbered, once you have used an index to locate specific information, you can repeatedly go back to selected pages with a direct call to the individual page numbers. This ability to jump from any part of the Prestel database to any other part in less than two seconds is an invaluable time saver. Though competitors sometimes criticize Prestel for a lack of keyword search capability (a time-consuming disk-intensive feature), using indexed and numbered pages is far more natural and convenient for most people.

The most general indexes on Prestel are alphabetic indexes by subject matter and by name of information provider. To locate gold prices using the subject index, for example, you first call up a page that simply lists all of the letters in the alphabet. Then you key the number next to the letter G. The next screen dis-

Graph showing growth of total subscription since beginning of regular Prestel service following two years of field tests.





NOBODY EVER PLAYS JUST ONE HAND OF STRIP POKER.

There's no such thing as a quick game of *Strip Poker*. With two captivating female opponents, this fast-paced program features graphics and game play so realistic that players tend to lose track of time. Decorum forbids that we actually show you what happens on the screen. Suffice it to say that our sophisticated software gives you ample incentive to stretch your poker skills to the limit!

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Example of Prestel response page, in this case used by Holiday Inn for taking reservations.

plays subsets of character strings starting with G (e.g., Gab-Gam, Gar-Ger, etc.). Keying the number adjacent to Go produces a new menu page showing a series of words starting with Go... Keying the number for Gold accesses a menu listing all of the information providers presenting information about gold. Another keystroke takes you directly to the commodity quotation pages.

Although this process usually takes a little over a minute, the number of menu layers can be cut almost in half by using the more specialized Business Information Index to find gold prices. An even more direct Commodities Index can shorten the search time to under 30 seconds. And Prestel has 17 specialist indexes covering such diverse categories as agriculture, auto industry, medicine, microcomputing, shipping, travel industry, and viewpoint industry. Since each electronic "publication" on Prestel has its own mini-index of current stories or data; once you have located these individual publications you can go directly to those pages without having to use any of the general indexes.

Up through January 1982, an extensive printed directory of the Prestel database was available on a quarterly basis from the Financial Times (London). They recently discontinued this service, but there are indications from Logica, the U.S. sales representatives for Prestel, that another such publication may soon become available.

The paged structure of Prestel points up its primary mission to be a mass information medium rather than a computer timesharing utility. Prestel is not designed for word processing, managing home finances, or calculating mortgage payments. Some of the information providers have skillfully indexed their material to simulate a timesharing util-

ity. For example, there is a multiple-choice quiz you can take to find out what kind of dog would be the best pet for you. At the end you are presented with a list of suitable breeds. The list may appear to have been computer prepared on the basis of a real time analysis of your answers. In fact, each question with its numbered answers is simply a menu that helps guide you to one of a series of prepared "answer" sheets.

Some time-share utilities will become available on Prestel as information providers gradually make use of newly developed gateway software that allows

perceived as a defect by some, but it does keep the service from being cluttered with the kind of trivia that has characterized some U.S. electronic bulletin boards. Prestel users can order products using special response pages with multiple choice selection of items to permit ordering with a numeric-only keypad. Users with full alphanumeric keyboards can also send electronic mail to other Prestel subscribers. Since Prestel is currently being accessed in 25 countries, this benefit should not be underrated.

A Publisher's Clearinghouse

An information service is no better than the information it provides. The ultimate benefit of Prestel is its range and quantity of information. This is the result of a two-tiered information provider (IP) structure that makes it attractive for publishers both large and small to use Prestel. Major publishing organizations—either electronic publishing entrepreneurs or traditional publishers seeking new channels—can become full-fledged IPs by paying a yearly \$10,000 membership fee and agreeing to rent at least 100 pages. But many of these larger providers broker their pages in smaller lots to Sub-IPs who may only put up a dozen or so pages.

As of this writing there are 169 major IPs and 801 Sub-IPs—a total of 970 publishing organizations in all. When you consider that each of the 970 databases consists of information de-

Prestel is not designed for word processing, managing home finances, or calculating mortgage payments.

information stored in computers outside the Prestel network to be formatted, in real time, for Prestel display. This will permit bank-at-home services (now being tested) and other utilities requiring processing beyond ordinary page retrieval.

Prestel supports no bulletin boards or user-entered classified ads. This may be

Advertising pages often utilize color and graphics. Ford Escort graphic shows use of separated graphics font in which each element within each graphic character is isolated and surrounded by the background color.



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CIRCLE 136 ON READER SERVICE CARD

Prestel, continued...

signed specifically for videotex display using color and graphics, the uniqueness of Prestel becomes apparent.

U.S. computer information utilities (The Source, Compuserve, and Dow Jones) lack the range of publishers and topics, not to mention the display capabilities, of Prestel. Competing viewdata systems having even greater graphics capability—Canada's Telidon and France's Antiope, for example—have yet to put up any kind of substantial database, much less offer their services in the U.S. Lest the Prestel user fear the low-resolution character graphics of Prestel are too limiting for sophisticated "office of the future" applications, it should be noted that Prestel plans to offer a series of tiered graphics enhancements in the future, including full photographic image transmission.

My enthusiasm for the Prestel service is tempered by one grim reality: the cost.

Priced for Business

My enthusiasm for the Prestel service is tempered by one grim reality: the cost. Prestel is being marketed as a *business* information service. It was not always so. When Prestel was field tested in the U.K. (starting in 1977), it was intended to be an electronic newspaper for the masses. The 24 x 40 display was selected because it was the maximum resolution that could be displayed on a home TV receiver using a modulated RF output from the terminal. But when Prestel was offered to the British public, at a price much lower than that now charged in the U.S., most citizens still deemed it too expensive to replace (or augment) the family newspaper.

Although one can still find some games and recreational information on Prestel, 87 percent of the present Prestel users are businesses. All U.S. marketing efforts, which began in January 1982, have positioned the service as a business utility carrying a business price tag.

There are three types of charges on Prestel. The first is a \$50 per month membership fee. This is not a minimum use charge, but a flat fee added to all time and page charges. Second, there is a charge for connect time: 30 cents a minute if you don't use Telenet (you must call a Boston area number) or 45 cents a minute if you access Prestel through Telenet. This rate applies any

Sources Of Prestel Related Products

Logica, Inc.
666 Third Ave.
New York, NY 10017
(212) 599-0828

Eriesson Programmatic
301 Route 17 North
Rutherford, NJ 07070
(201) 933-2111

Metrotech Dynabyte
Waterloo Rd.
Uxbridge, Middlesex
UB8-2YW England

Modular
Computer Systems
P.O. Box 6099
1650 West McNab Rd.
Fort Lauderdale,
FL 33310
(305) 974-1380

Radofin Electronics
(USA) Ltd.
887 Oak Grove Ave.
Menlo Park, CA 94025
(415) 326-9715

Wolfdata
P.O. Box 31
Ithaca, NY 14850
(607) 273-8666

Zenith Radio Corp.
1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-8181

Sales agents for Prestel in the U.S. Distributors of Owl Computer Appletel software products and color board for the Apple II, terminal software of their own design for the TRS-80 Model III, and Sony terminals.

Makers of CCITT V.23 standard modems FCC certified for use on U.S. phone lines, and Prestel adapter boards for the Apple II.

Makers of Prestel compatible display boards for S-100 computers.

Distributors of Bishopsgate terminals in the U.S.

Makers of Radofin terminals (with built-in V.23 modem) and accessories.

Makers of stand-alone Prestel terminals and Prestel adapters for the IBM Personal Computer.

Makers of stand-alone terminals for Prestel.

time of day or night, 300 or 1200 bps. Still a third charge is the frame charge. Some information providers charge you to read their pages. If you access these pages from a menu page, you will be told the charges before you call up a page. These charges can run from 1/4p. to 50p. per page (British currency (about one cent to one dollar, U.S.)). The average charge is usually in the 5p. to 10p. (10-20 cent) range. The vast majority of pages on Prestel are free, however, and in my own experience I find that frame charges are a negligible part of my otherwise substantial quarterly bill.

Prestel Terminals

Prestel can be accessed in the U.S. using any one of three data modem standards: Bell 212 (or equivalent), Bell 103, and CCITT V.23.

The Bell 212 standard is the most common U.S. 1200 bps standard, but

modems for it are expensive. Also, most systems for adapting Prestel to personal computers at 1200 bps require *hardware* additions (beside the modem), and are therefore quite expensive.

Currently, the Apple II, IBM Personal Computer, and most S-100 bus computers can be adapted to access Prestel with a 212 modem. Stand-alone terminals from Zenith, Bishopsgate, Sony and Wolfdata are also available in the U.S. for connection to modems using this full duplex 1200 bps standard. Bell 212 users can reach Prestel directly via a Boston area concentrator, or via Telenet.

Bell 103 service, the widely used 300 bps standard, is available for Prestel via Telenet only. Software programs that make the Apple II (with D.C. Hayes Micromodem) and Radio Shack TRS-80 Model III a Prestel terminal use this standard. Though I find 300 bps a tedious data rate, the low cost of these

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Built-in standard
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Optional

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Microsoft BASIC
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standard
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Software

The H-100 is easy to build—the step-by-step Heathkit manual shows you how. And every step of the way, you have our pledge—"We won't let you fail." Help is as close as your phone, or the nearest Heathkit Electronic Center.

And what better way to learn state-of-the-art computing techniques than to build the world's only 16-bit 8-bit computer kit? To run today's higher-speed, higher-performance 16-bit software, you need an H-100. It makes a big difference by processing more data faster.

Dual microprocessors for power and compatibility. The H-100 handles both high-performance 16-bit software and most current Heath Zenith 8-bit software.

Want room to grow? The H-100's standard 128K byte Random Access Memory complement can be expanded to 768K bytes—compared to a 64K standard for many desktop computers.

And the industry-standard S-100 card slots support memory expansion and additional peripheral devices, increasing future upgradability of the H-100.

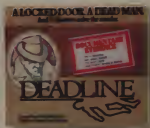
High-capacity disk storage, too. The H-100's 5.25" floppy disk drive can store 320K bytes on a single disk. The computer also supports an optional second 5.25" and external 8" floppy disk drives. And an optional internal Winchester disk drive will be available soon.

For more information, circle the reader service number below. Better yet, visit your Heathkit Electronic Center for a demonstration!

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Judging from the public's reaction, it's worth the wait. For instance, *Creative Computing* welcomed DEADLINE™ as "thoroughly engrossing and realistic," while a *Softalk* readers' poll recently voted ZORK™ I and ZORK II the most popular adventures of 1981.

And now, for the moment, your wait is over. ZORK III, your final

step in the underground trilogy, and STARCROSS™, an exploration of a new dimension in science fiction, are ready for you.

Look at them up there, the little worlds of Infocom. As our universe expands, companions will come to help fill that vast expanse of white space. Till then, they'll continue to stand alone as the best of all possible worlds.

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Prestel, continued...

programs, \$85 and \$50 respectively, may make them attractive for some users.

In Europe, Prestel communication uses the CCITT V.23 format, an asymmetrical system in which the pages are transmitted to the user at 1200 bps, but typed responses from the user are received at only 75 bps (still a fast typing speed). This standard is available for Prestel in the U.S. by direct dialing the U.S. data concentrator ports. Telenet does not currently support V.23 modems.

Although I began using Prestel with the Appletel software for my Apple II, I quickly switched to a very low cost terminal from Radofin Electronics. This remarkable device includes a built-in V.23 modem and memory autodialing. It produces a modulated RF video output, so it can be connected to any color TV set.

The color saturation and character sharpness are superior to that produced by any other video RF system I have seen. All color photographs of Prestel screens accompanying this article were made using the Radofin connected to a Sony TV set.

The Radofin terminal has a cassette port for permanent storage of pages. Options include a low cost printer and an alphanumeric keyboard. The list price of

the basic Radofin (without options) is around \$500 (the firm seems indefinite about exact single unit pricing). It is rumored that another low cost Prestel adapter (terminal plus internal V.23 modem) may soon be available in the U.S. and carry a \$200-\$300 price tag. This competition may ultimately bring down the cost of the Radofin.

It is rumored that another low cost Prestel adapter may soon be available in the U.S.

Here Today

Most industry analysts agree that neither Prestel, nor any other viewdata service, is about to take the world by storm in the immediate future. But many new communications technologies have had to endure a slow acceptance before realizing sudden growth. Cable television, FM radio, and color television come to mind. All took over a decade, in some cases over two decades, to become

popular. Although an impressive service, Prestel is not yet the comprehensive office-of-the-future information/communication system envisioned by futurists. By future standards, I am sure it will appear crude, just as early telephone service seems crude compared to today's multi-function phone systems.

But Prestel is the most comprehensive videotex information service presently available in the United States (or anywhere else). Its display standards can be implemented at low cost and are probably satisfactory for many business applications. The recent announcement by IBM of their own videotex system supporting a Prestel compatible display format may well mean that we will soon see many other Prestel-like services coming on the scene. A de facto standard based on Prestel may emerge before AT&T manages to develop a service based on its much publicized, and expensive to implement, presentation level protocols. And since Prestel already has the lead in quality of service and range of information available from any electronic publishing service, it just might be that with continued research and development supported by the British government, the enhanced information system of the future might also be called Prestel. □

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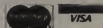
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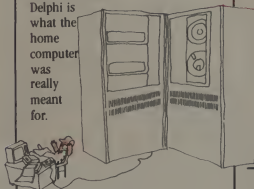
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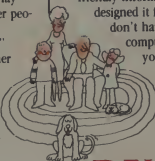
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That's just the beginning.



What the home computer was really meant for.

YOU CAN BE PART OF THE DESIGN COMMITTEE.

We're continually adding new services. But only services we think you and your family will use and enjoy.

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No matter what home computer you have, you can use Delphi. Unlike other systems, Delphi is compatible with all makes and is easily adaptable to any screen size. And you can use just about any acoustic coupler or direct connect modem to connect Delphi to your telephone.

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CIRCLE 249 ON READER SERVICE CARD

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Part 1

Donald T. Piele

I saw a geoboard for the first time in 1968 as a graduate student in mathematics. The circumstances were a bit unusual. I had volunteered, through a program called SEED, (Special Elementary Education for the Disadvantaged), to help a class of elementary school kids in San Diego discover modern mathematical ideas—"the new math." Project SEED was a statewide program that grew out of the work that William Johntz had begun in Berkeley, CA. Graduate students in mathematics volunteered for the project, which, in effect, was a substitute for their duties as college teaching assistants.

Instead of helping college freshmen with their calculus, SEED volunteers went into elementary schools and investigated mathematical ideas using the "discovery" method. We were free to investigate any topic in mathematics, since our daily classes were intended to enrich rather than substitute for the regular elementary mathematics curriculum. It was in this setting that I first discovered the geoboard.

All it takes to make a geoboard is a small square piece of wood, 25 nails, and a hammer. Draw five equally spaced vertical lines and five equally spaced horizontal lines. Hammer a nail at each of the 25 intersection points and, you have a geoboard. To use it, however, you need one other item—rubber bands.

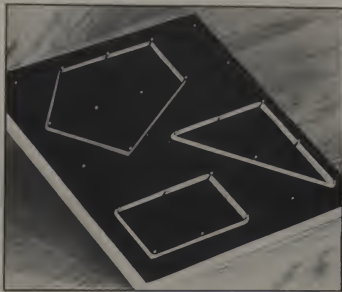
What For?

You probably will not find geoboards in many elementary schools today. They are not an essential tool in everyday life, and I doubt that a movement will spring up to push for "geoboard literacy." But their use in an elementary school classroom has some similarities with the way computers are used today to encourage creative problem solving.

Like a computer, a geoboard is an interactive tool. Students use rubber bands and stretch them around pegs to form polygons of different shapes and sizes. Like a computer, a geoboard does nothing on its own, and, without problems, it is a useless piece of hardware. We used it in our classroom investigations as a "visithink" device and posed "what if" types of questions. Books such as Donald Cohen's *Inquiry In Mathematics Via The Geo-Board*, were helpful in suggesting many good problems for investigation.

This month, I would like to resurrect the geoboard and bring it back to life in an electronic form. The activities presented here for the electronic version will be different from typical geoboard activities.

Our first problem will deal with creating an electronic geoboard and simulating simple operations. The programs will



be written in a structured format with names given to each procedure. This should make it possible for anyone to follow the logic of the programs without having to read code designed for a specific system or written in a specific language. Each procedure will also be worked out in Applesoft Basic. Constructing the programs for other microcomputers with graphics capabilities will be left to the reader.

All of the problems presented in this article are designed for beginning and intermediate programmers and are presented for the purpose of developing computer problem solving skills. I hope that the problem solving spirit of the original geoboard activities will not suffer in the translation.

Electronic Geoboard I

Let's begin with the most basic problem:

Write a program that will display a geoboard.

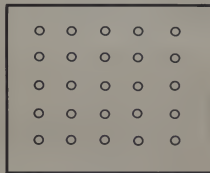


Figure 1. Electronic Geoboard I.

A standard geoboard has 25 pegs arranged in five rows of five columns. It can be drawn graphically as follows:

Donald T. Piele, University of Wisconsin-Parkside, Box 2000, Kenosha, WI 53141.

How To Solve It, continued...

Procedures

1. Set graphics mode
2. Set color blue

3. Draw border

4. Draw pegs

Applesoft Program

```

10 GR
20 BLUE = 2 :
   COLOR = BLUE

30 HLINE 0,38 AT 0:
   VLINE 0,38 AT 38:
   HLINE 38,0 AT 38:
   VLINE 38,0 AT 0

40 FOR I=5 TO 35 STEP 7:
   FOR J=5 TO 35 STEP 7:
     PLOT J, I:
   NEXT J:
 NEXT I

```

The Applesoft program on the right is separated into individual procedures which are given names and listed on the left. The Basic language is not naturally structured, but with a little planning we can at least simulate this quality. Doing so not only helps us read our own programs, it also helps other people translate our programs into a different language.

In the solution to the Electronic Geoboard I, each procedure is carried out in sequential order. In more difficult problems, the same procedure may be needed over and over again. Using Basic, which is not designed to encourage programmers to name and recall procedures by name, we must rewrite the procedure every time we use it, or use confusing branching techniques with dangerous GOTOS.

The only alternative is to construct subroutines. Let's see how the above program would look if we decided to build subroutines first, and then use them to build the program.

To simulate a procedure in Basic using a subroutine, we need to add a RETURN statement to the end of each of the routines

already constructed. For example, the procedure SET COLOR in the above program can be modified into an Applesoft subroutine as follows:

Procedure

2. Set Color Blue

Applesoft Equivalent

```

20 BLUE = 2:
   COLOR = BLUE: RETURN

```

Thus, one way to build a structured solution to the Electronic Geoboard I is as follows:

Procedures

1. Set Graphics mode
2. Set color blue

3. Draw border

4. Draw pegs

Applesoft Program

```

1 GOTO 100
10 GR:RETURN
20 BLUE = 2:
   COLOR = BLUE: RETURN
30 HLINE 0,38 AT 0:
   VLINE 0,38 AT 38:
   HLINE 38,0 AT 38:
   VLINE 38,0 AT 0: RETURN
40 FOR I=5 TO 35 STEP 7:
   FOR J=5 TO 35 STEP 7:
     PLOT J, I:
   NEXT J:
 NEXT I: RETURN

```

* Main Program *

```

Set graphics mode
Set color blue
Draw border
Draw pegs
End

```

```

100 REM *** MAIN PROGRAM ***
110 GOSUB 10.
120 GOSUB 20.
130 GOSUB 30.
140 GOSUB 40.
200 END

```



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Notice that the first statement in line 1 instructs the program to jump over the subroutines and begin the main program at line 100. It may appear to beginners that all we have done is take an easy problem and make it hard. Indeed, that is true if this is the only program about geoboards that one intends to write. But, by employing subroutines to define procedures, it is much easier for the reader to understand what was done. Let's see how this works with the next problem.

Electronic Geoboard II

Write a program that will choose pegs on a geoboard by allowing the user to input a row number and a column number and then change the corresponding peg to a different color.

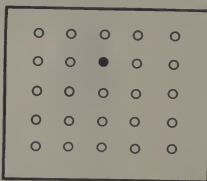


Figure 2. Electronic Geoboard II

Since we have already constructed the board in the previous problem, we need only add the ability to identify the pegs. Where are the pegs located on the low-resolution graphics screen?

Problem Solving Strategy

Examine the procedure DRAW PEGS. Notice that in the top row the pegs are placed at the following positions:

Row. Column	1,1	1,2	1,3	1,4	1,5
-------------	-----	-----	-----	-----	-----

Screen Position (Y,X) 5,5 5,12 5,19 5,26 5,33

Look at the pattern of screen position numbers. How do they relate to the ROW and COLUMN numbers? Did you discover the following relationships?

$$X = \text{COLUMN} * 7 - 2$$

$$Y = \text{ROW} * 7 + 2$$

It is a simple matter to extend the previous program to ask the user to identify a row and column from 1 to 5, plot each identified point white, and continue this process as long as the user enters a (ROW,COLUMN) between (1,1) and (5,5). As soon as a point is entered outside of this range, terminate the program. To implement this change, it is sufficient to create three additional procedures and attach them to the previous program.

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How To Solve It, continued...

Electronic Geoboard II Applesoft Program

Procedures
1. - 4 Same as in I

5. Set color white

```
50 WHITE = 15:
   COLOR = WHITE : RETURN
```

6. Choose peg
(range = 1,1 to 5,5)
Point = row, column
Read a point

```
60 PRINT "CHOOSE A PEG ON THE BOARD"
61 PRINT "BY ENTERING A ROW,COLUMN"
62 PRINT "BETWEEN 1,1 AND 5,5"
```

7. Check range

```
63 INPUT ROW,COLUMN
64 Y=ROW#7-2:
   X=COLUMN#7-2 : RETURN
70 INRANGE1 = 0
71 IF ROW > 0 AND ROW < 6 AND
   COLUMN > 0 AND COLUMN < 6 THEN
   THEN INRANGE1 = 1
72 RETURN
```

* Main Program *

Set graphics mode

Set color blue

Draw border

Draw pegs

Set color white

While peg is in range

Choose peg

Check range

Plot peg

End

```
100 REM *** MAIN PROGRAM ***
110 GOSUB 10
120 GOSUB 20
130 GOSUB 30
140 GOSUB 40
150 GOSUB 50
160 GOSUB 60
170 GOSUB 70
180 IF INRANGE1 THEN PLOT X,Y
200 END
```

Notice how much easier it is to read a program if procedures are named.

Let's continue developing the Electronic Geoboard by adding the ability to choose two pegs and shade in the rectangular region that they define.

Electronic Geoboard III

Write a program that asks the user to choose two pegs on the electronic geoboard and then shades in the rectangular region determined by these two pegs. For example, if 2,1 and 5,4 are the two pegs chosen, then the rectangle determined by these pegs is

2,1 . . 2,4

. . . .

5,1 . . 5,4.

Notice that this same rectangle could also be identified by the two points 2,4 and 5,1.

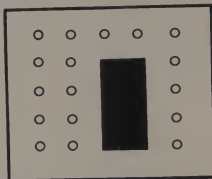


Figure 3. Electronic Geoboard III. Rectangle defined by 2,3 and 5,4.

Problem Solving Strategy

The problem we must first solve is this: Given two pegs, how do we shade in the rectangular region determined by them?

Let's begin by defining how to do this at the procedure level.

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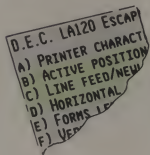
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How To Solve It, continued...

Procedure

Shade rectangle

(Peg1 = R1,C1)

Peg2 = R2,C2

From row R1 to R2

Draw horizontal line between columns C1 and C2
Next row)

The SHADE RECTANGLE procedure tells us what to do but it does not tell us how to carry it out in a specific language. It is a blueprint that the architect has designed and left to the builder to create. Here are the critical problems that the builder must solve:

- How do row and column numbers relate to screen positions X,Y?
- How do you draw the horizontal lines?
- How do you loop between row R1 and row R2 if R1 is larger than R2?

The first problem was solved in the previous procedure

X = COLUMN * 7 - 2

Y = ROW * 7 - 2

The second problem can be solved in Applesoft Basic with one simple statement

HLIN X1,X2 AT Y

The third problem can be solved by adding a direction to the FOR/NEXT loop. If R1 <= R2, then we want to step forward by one row each time we draw a horizontal line. If R1 > R2, then we need to step backward one row each time. The expression (R1 <= R2) (R1 > R2) does the trick. When R1 <= R2, then the logical expression (R1 <= R2) is true and hence set to 1, while the second term (R1 > R2) is false and is set to 0. If the reverse is true and R1 > R2, then the values are switched, and we end up with an answer of -1. Thus, we can fill

in the rectangular area as follows:

FOR Y = Y1 TO Y2 STEP (R1 = R2) - (R1 > R2)
(DRAW HORIZONTAL LINE)

NEXT Y

Now we are ready to collect our routines and add them to the previous program to solve the third problem.

Electronic Geoboard III

Applesoft Program

Procedures

1. - 7. Same as in II

8. Shade Rectangle

(Vside 1

Vside 2

Hside 1

Hside 2

From HSide1 to HSide2

Draw horizontal line
between
VSide 1 and VSide 2)

* Main Program *

Set graphics mode

Set color blue

Draw border

Draw pegs

Set color white

Choose peg1 until in range

Plot peg1

Choose peg2 until in range

Plot peg2

Shade rectangle

End

80 X1 = C1 * 7 - 2

X2 = C2 * 7 - 2

Y1 = R1 * 7 - 2

Y2 = R2 * 7 - 2

81 FOR Y = Y1 TO Y2 STEP

(R1 = R2) - (R1 > R2)

82 Y=ROW * 7 - 2

83 HLIN X1,X2 AT Y

84 NEXT Y

85 RETURN

100 REM *** MAIN PROGRAM ***

110 GOSUB 10

120 GOSUB 20

130 GOSUB 30

140 GOSUB 40

150 GOSUB 50

160 GOSUB 60

170 GOSUB 70

171 IF NOT INRANGE1 THEN 160

172 R1=ROW + C1-COLUMN

173 PLOT X,Y

174 GOSUB 60

175 GOSUB 70

176 IF NOT INRANGE1 THEN 174

177 R2=ROW + C2-COLUMN

178 PLOT X,Y

180 GOSUB 80

200 END



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How To Solve It, continued...

Exercises

One of the advantages of developing each program in a structured format is the ease with which they can be changed. Below is a small list of problems for your investigation. They can all be solved by making minor changes or additions to the sub-routines in the programs displayed above.

1. Write a program that will display a 36-peg Electronic Geoboard.
2. Write a program that uses a game paddle to choose points on the Electronic Geoboard. This can be done by taking the output of the game paddle (an integer between 0 and 255) and dividing it into 25 equally likely parts (try $Q = \text{INT}(\text{PDL}(0)/10.5)$). Each one of these integers represents a peg on the board.
3. Write a program that allows the user to choose a color and two pegs and then shades the rectangle determined by these two points the color specified. Design the program so that it will allow the user to continue to shade rectangles with different colors on the same screen.
4. Modify the program in exercise 3 to allow the user to either shade the region determined by the two pegs or the complementary region (everything but the rectangle determined by the pegs).
5. Modify the program in exercise 4 to allow the user to shade several rectangles different colors and then fill in the background a final color.

Conclusion

A criticism often made of the Basic language is that it is not structured. As we have seen, imposing a structure is possible, but is not a straightforward task. I could more quickly have written each program independently, not bothering to define

separate procedures. In fact, that is how I wrote them originally.

So, why did I bother to do things the hard way? Because programmers of the future will need to know how to write structured programs. Then why didn't I use a structured language? Because Basic comes with most machines; Logo and Pascal do not. Also, the Electronic Geoboard is easier to handle in a coordinate based graphics system as opposed to a turtle graphics system.

Next month, we will continue our investigations of Electronic Geoboard but move into high-resolution graphics.



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CIRCLE 181 ON READER SERVICE CARD

Program Your Home Against Burglary



P. KRAMER

Riding the crest of the current crime wave, the burglary rate is climbing even faster than the sales curve of personal computers. Throughout the country, in cities and suburbs and towns, hard-working burglars are jimmying locks, kicking in doors, peeling safes, and doing everything but sliding down the chimney.

If you own a personal computer, you have something they want.

Your computer makes you a target. It is a portable high-ticket item with a strong resale market. Furthermore, people who own computers are a presumably affluent lot, given to owning other articles worth a thief's attention. Small wonder, then, that gangs and individual burglars have begun to make a specialty of computer burglary.

For several years now I have been writing mystery novels about Bernie Rhodenbarr, a fictional burglar who solves murders when he's not going out a window with somebody's coin collection in tow. In the name of research I've learned as much as one can about burglary without getting arrested, and I'd like to share some of it with you.

There are three basic ways in which you can program your computer against burglary. First, you can avoid attracting a burglar's attention. Second, you can make your dwelling difficult to enter. Finally, if the burglar does get in, you

Lawrence Block

can render his mission as unrewarding as possible.

How do you stay off a computer burglar's hit list? What you don't do is advertise the fact that you have something he'd be happy to steal. Don't be too quick to tell strangers about the remarkable piece of expensive hardware you've acquired. Avoid bumper stickers and similar items that tell the world you own a computer.

Avoid bumper stickers and similar items that tell the world you own a computer.

When you're away from home, don't let it show. Stop milk, mail and newspaper deliveries on all extended absences. Set electrical timers to turn lights on and off around the house. (But remember that the lone light burning day and night can draw burglars like moths. "How considerate of them," Bernie mused in one such instance, "to leave a light for the burglar.")

During short term absences, a glowing television screen in the living room sug-

gests that someone is home watching it. It may not ward off a burglar who already has his eye on you, but it can help discourage a casual prowler.

Don't let your answering service give the game away. An over-solicitous operator can tell a burglar more about your schedule than you want him to know. The same goes for those I'm-not-home-now messages on your answering machine. Don't make them too specific.

More Trouble Than It's Worth

These basic precautions won't guarantee that a burglar won't turn up. That's why you must make your home as hard to get into as possible.

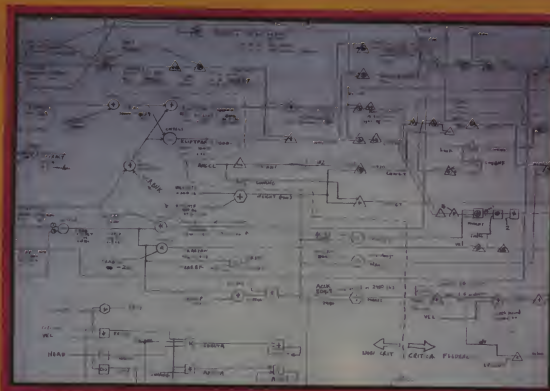
You can't hope to make it absolutely burglar-proof. "A top thief could get into Fort Knox," former FBI chief Clarence M. Kelley has pointed out, and my friend Bernie Rhodenbarr agrees. "There's always a way in," he insists, "but sometimes it's more trouble than it's worth."

You can make your residence too much trouble for most burglars, and it's worth the trouble it takes you to do so.

The first step is lock the doors.

Sound obvious? In last year's two million residential burglaries, 25 percent involved entry through unlocked doors. People leave doors unlocked because they are careless, or because they are only going to be out for a few minutes, or because it's the middle of the afternoon and they are home. Then one day they are grilling hamburgers in the back

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Burglary, continued...

yard while a thief is luging their computer out the front door.

While any lock is better than none, a sophisticated burglar can open some of them almost as quickly as if he had a key. The kind that locks automatically when you shut the door is child's play for any burglar worthy of the name. If you don't have to lock your lock with a key, he can open it with a plastic card or a screwdriver. Make sure you have sound deadbolt or drop-bolt locks on every outside door, and make sure you use them.

Burglars have several ways of dealing with locks. They spread door frames with portable jacks. They pull the lock cylinder out with vise-grip pliers. They work a prybar between door and jamb and jimmy the lock. Here's where a consultation with an expert locksmith becomes worthwhile. Let him examine your locks. He may recommend replacing some, reinforcing others with escutcheon plates, and installing angle irons to prevent jimmying. A police lock, featuring a steel bar braced against or across the door, provides further protection against the brute-force burglar.

Speaking of doors, make sure yours are equal to the task. All the locks in the world won't keep out a burglar if he can break a window pane and reach through to unlock them from within. Doors should be solid wood; the hollow-core type is too easy to kick in.

Got an attached garage? The burglar can get into it effortlessly—so treat the door leading from the house to the garage as if it were an outside door. Make sure it can stand up, and provide

it with adequate locks.

Basement windows let in more burglars than sunshine. It's surprising how many homeowners overlook them, perhaps because they appear too small to admit a burglar. But human beings can wriggle through much smaller openings than you'd think. Steel mesh over those basement windows will let the light in while it keeps the burglar out.

If locks and doors are your first line of defense against burglars, second is a good alarm system. Your dealer can survey your premises and recommend the ideal system. You might choose a silent alarm, designed to ring either at police headquarters or at the offices of the

It's tough to make a home computer look like an electric frying pan.

security company, or the sort which makes a hellish racket to alert the neighbors and frighten off the burglar before he gets in. The silent alarm is more likely to lead to apprehension of the criminal, but I would think it less desirable if the burglar should pay his visit while you are at home and asleep. When that happens, you want something that will wake you up while it scares him off, not something to bring the police trotting along behind him.

The *creme de la creme* of the house-breaking profession—a Bernie

Rhodenbarr, say—can frequently outwit any burglar alarm. Just as there is no such thing as a pickproof lock cylinder, neither is there an utterly impregnable alarm system. But the vast majority of burglars will steer clear of a home once they determine that it is protected electronically. If they don't spot the device in advance, they'll skedaddle once it goes off.

Some homeowners have provided themselves with the deterrent effect of a burglar alarm at a fraction of the cost by displaying a sticker announcing that the premises are protected by an alarm system. It's been argued, though, that a burglar with street smarts can spot a phony sticker fifty yards off. You pay your dollar and take your choice.

Cut Your Losses

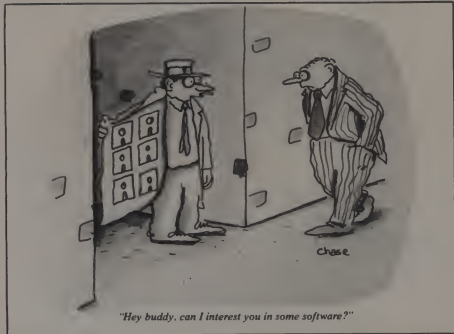
Suppose a burglar gets into your home in spite of your best efforts to keep him out. How can you cut your losses?

For a start, you can best protect your computer by participating in a program called Operation Identification. Your local police will provide you with an etching tool and show you how to mark valuable articles so that they can be instantly identified as your property. They'll also furnish you with a window sticker announcing that you participate in the program, and thus warning potential burglars that they'll have a tough time reselling anything they steal from you.

A burglar might overlook your Operation Identification decal, and might be undeterred by your etching efforts. He can always keep your computer for his own use, or give it to his cousin for Christmas. So it's worth your while to make it just a little bit harder to steal. If you always keep it in a particular position on a particular desk or table, why not bolt it in place so the thief can't carry it off?

If that's not practical, it might be worthwhile to get in the habit of camouflaging your computer when you're away from home. There's a limit to what you can accomplish in this direction—it's tough to make a home computer look like an electric frying pan—but by throwing some sort of cover over it you keep a burglar from spotting it at a glance. Remember, burglars are in a hurry. They rarely have time to take a detailed inventory. If you can tuck your computer out of sight or screen it from view, you can increase the likelihood that a thief will overlook it entirely.

By the same token, you can minimize your loss of cash and other valuables by hiding them where a burglar won't think to look. And most other valuables are a lot easier to hide than a computer.



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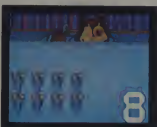
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Burglary, continued...

If you keep cash around the house, don't hide it in the refrigerator. That's where most people stash it, for some curious reason, and burglars know it. Don't use kitchen canisters, either, as a hiding place for cash or jewelry. Don't hide things in the top of the toilet tank, or in desk or dresser drawers, or on closet shelves. That's not as bad as leaving them in plain sight, but it's not much better.

Instead, use your ingenuity and devise hiding places of your own. In *Burglars Can't Be Choosers*, Bernie's own apartment gets ransacked. But his cash remains untouched because he has hidden it a bill at a time between the pages of books in his library, even glueing pages together so that shaking a book won't send bills fluttering to the floor. You can use books in this fashion, or tape bills to the undersides of drawers, or—well, use your imagination. In *The Burglar Who Studied Spinoza*, a fence of Bernie's acquaintance keeps cash in an old telephone. You'd have to take it apart to find it, and what burglar would think to do that?

If you're a fair amateur carpenter, you can build false bottoms into drawers and closet shelves. And a mail order house has lately taken to offering the cleverest wall safe I've ever seen. It looks for all the world like a standard baseboard electrical receptacle, indistinguishable from the sort you plug lamps and radios into. At the turn of a key it pulls out from the wall and reveals itself as a hiding place just large enough for a handful of jewelry or a wad of cash. Now a burglar wouldn't need a key to open it, he could pop it from its moorings in a minute, but how would he know to do it?

There's a danger, of course, in getting too clever for your own good. Just recently the papers carried a story about a young man in New Jersey who found a secret compartment in his mother's tea cart and stowed his coin collection there. He never told anybody, and one day she sold the thing for \$25 in a yard sale. Away it went, along with \$1500 worth of coins. If you do secret things around the house, a list of the articles and their hiding places belongs in your safe-deposit box, or with your attorney.

If you come home while a burglary is in progress, slip silently away, use a neighbor's phone, and call the police. If anything makes you even slightly suspicious, don't hesitate. Better to risk a false alarm than a confrontation.

Bernie Rhodenbarr is unarmed and committed to non-violence. But his real life counterparts don't always share this commitment. So don't take chances. Your personal computer, however much you treasure it, can always be replaced. But you're the only you you've got. ☐

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Computers Against Crime

If you can't afford German shepherds, accordion wire and guard towers, here are some halfway measures.

Recently my high school math department purchased four TRS-80 computers at a cost to the school board of approximately \$3500. When they found out that their insurance was \$1000 deductible, they decided to have an alarm system installed at a cost of another hundred dollars or more.

When I discovered this, I thought, why not have the computers monitor themselves to make certain that they don't get stolen?

The first step was to check with the local Radio Shack manager to see if it would harm a computer to be left on overnight. A negative answer gave me the go-ahead, so I thought about what I would like the computer to do as it sat idle night after night. The first and most important function that came to mind was to "watch" the rooms to see if a door was open or a window open or broken. I realized that the computer would have to do something other than just make a loud noise if there were a break-in, so I tried to think of a way to make the machine call the police (or any other number) and play a pre-recorded message.

The dialing was the easy part as I had previously worked on a program which would dial my home phone for me. The hard part was figuring out how to have the computer tell the police that there was a break-in occurring. The first thing I considered was to have the computer pick

Kel Hess

up the phone and play the tape aloud, but that wouldn't work since the person breaking in would hear the recording and stop it from playing. After much thought, I came up with the following system.

Monitoring the Doors and Windows

This is the part of the alarm that took the most time to prepare for final operation. First I had to wire all the doors and windows in the room with magnetic switches so that if a door or window were opened it would trip the alarm. Then, since I wanted to make certain that no

The computer would have to do something other than just make a loud noise if there were a break-in.

windows were broken, I had to run window foil around all the windows.

After installing all the switches, I had to wire them in series so that if anyone tried to break in, he would open a switch or break the foil on the windows, thereby tripping the activator hooked to the computer. See Figure 1 for a schematic of this activator.

The computer sends an oscillating pulse to the amplifier which is then sent back into the computer. If the signal makes it back to the computer, then port 255 reads

191 which means that everything is okay. But if the circuit is broken, the signal never makes it back to the computer, and port 255 changes to 63. So if port 255 is ever 63, it means a break-in is occurring.

The Phone Dialer and Message Player

When a person dials on the telephone all he really does is send a series of electronic pulses over the line, ranging from one pulse (representing a 1) to ten pulses (representing a 0). Therefore, to make the computer dial the telephone, I wired the cassette remote control to not only start the tape player but also to pick up the phone and dial it. I wrote the program so that it would first pick up the phone by completing the circuit between the telephone line and an isolation transformer (see Figure 2).

The remote plug connects the circuit long enough to get a dial tone, then dials the local police emergency number 911 by pulsing out through connecting and disconnecting the circuit at the right intervals. At the rate the telephone equipment in my area can handle these pulses, I found that the computer can dial 911 in just a few seconds. (This will work on any type of phone line, either dial or touch tone service.)

At the same time, the cassette control also starts the cassette tape player which repeats a pre-recorded message telling the police where the break-in is occurring.

To keep the burglar from hearing the message, I hooked the ear plug of the tape recorder to the other side of the transformer (see Figure 2) which enabled the recording to go directly over the phone lines without being heard in the room.

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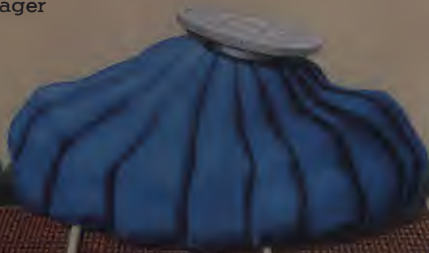
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Crime, continued...

The only problem was that if the emergency number was busy, the computer wouldn't know the difference, and would play a recording to a busy signal.

To solve this problem I programmed the computer to play the message three times, hang up, wait a minute, then call the number again and replay the message. Just in case it was still busy, it would go through this cycle one more time. All told, the computer would contact the police and tell them of the break-in a total of three times.

Another possibility was that the telephone might be ringing at the time of the break-in. The computer would still pick up the phone, dial, and start the record-

ing. If a burglar knew the system he could conceivably call ahead and get the phone ringing; then the computer couldn't dial out.

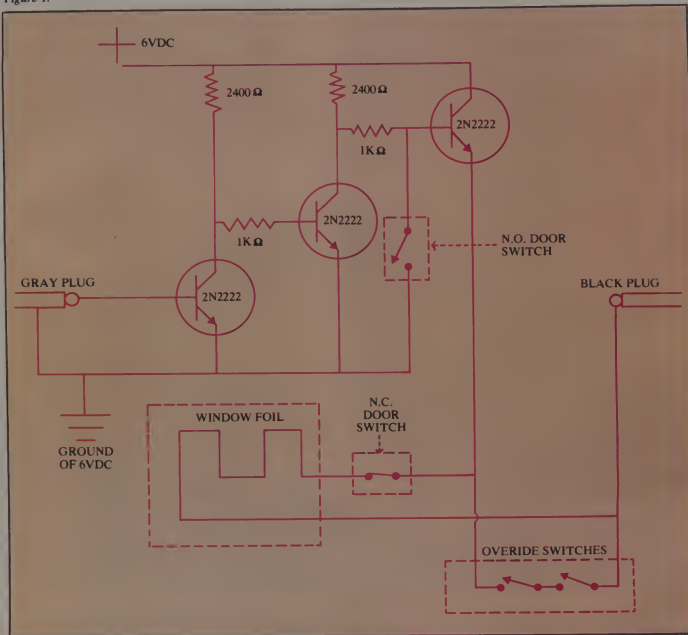
To combat this the program instructs the computer to pick up the phone before dialing (to answer any possible ringing), hang up again, then immediately pick up the phone again and dial the emergency phone number.

The only aspect I haven't covered yet is how the teacher gets into the computer room in the morning without setting off the alarm. The answer to this is simple. All I did was connect two key switches that were wired in series, and wire the two in parallel with all the alarm switches

(see Figure 1). I put two key switches in the circuit so that if one key was somehow duplicated, the door still could not be opened. It takes both keys to open a door, making it twice as hard to break in. When both of these switches are closed, the other switches are overridden so that when the door is opened, the circuit is still closed and the alarm does not go off.

Also in the first line of the program there is a statement that reads POKE 16396,23. This statement freezes the BREAK key which makes certain that even if the intruder knows to stop the computer by pressing the BREAK key, it won't work. The program continues to do its job whether that means monitoring

Figure 1.



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Crime, continued...

the room or calling the emergency number and alerting the police.

Hardware

The activator is an amplifier which amplifies the output of the computer (what is normally fed into the cassette from the computer) and after amplification sends it back into the input (what is normally sent into the computer from the cassette). If a door switch is opened, or a window is opened or broken, the circuit opens, and the computer no longer hears the signal that it is sending out. When someone comes in the room in the morning, after they close both key switches, the circuit is kept closed and the computer continues to hear itself.

The telephone dialer and cassette starter are two devices in one. Both devices are activated by the cassette-control remote plug. When the computer activates its relay, it in turn energizes either two SPST relays (as pictured) or one DPST relay. One set of terminals goes straight to the cassette player to start it; the other goes to a 1:1 ratio (isolation) transformer which is hooked to the telephone lines (see Figure 2).

When the computer clicks out a digit, this relay pulses out the needed pulses to simulate a telephone being dialed. So that the person on the other end of the phone line can hear the recording without the person in the room hearing it, I used an isolation transformer which sends this recording directly over the telephone lines.

To set the volume control to the correct level you first have the computer call a friend, then adjust the cassette player to the correct level. This isolation transformer not only protects the cassette tape player from the telephone lines, but it also protects the telephone equipment from the cassette tape player.

The Program

Line 0 freezes the BREAK key so that no one can stop the computer once it is started. The only way of stopping it is to either turn off the power or press the reset button. Both of these buttons can be protected by a small cover of some type. (What about pulling the plug?—Ed.)

Line 10 dimensions the maximum length of the phone number to be dialed.

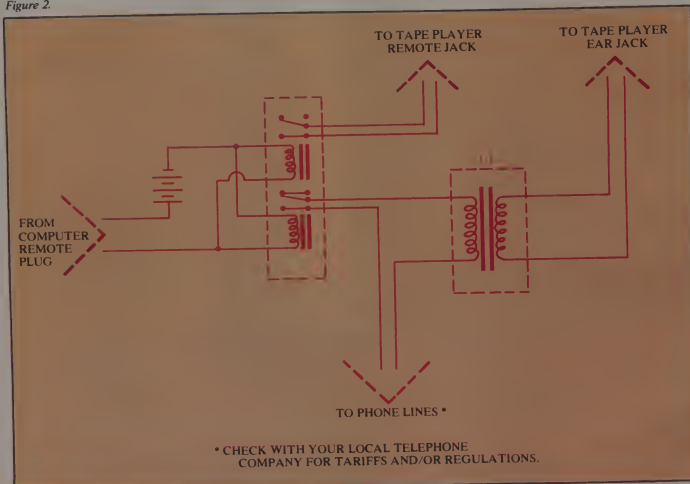
I have it set for 15 digits (including pauses) but this length can easily be changed.

Lines 40-50 keep a constant check on the cassette port (255) to see if there has been a break-in. Line 40 sends a signal to the amplifier, and line 50 checks to see if the computer is receiving the signal (191) or not (63). If the computer is receiving the signal, then it will just keep looping here, checking the amplified signal until it goes off.

If there is a break-in, the computer gets ready to call the emergency number. Line 110 contains the telephone number that is going to be dialed. In this case it is 911, but if the alarm is inside an office where 9 must be dialed to get a dial tone, the computer must know to dial 9, then pause before dialing the emergency number. So wherever a pause is needed, insert a hyphen. For example, the emergency number programmed in the computer now would be stored as 9-911. Or if this does not provide enough time, you might need to store the telephone number as 9-911.

Lines 150-200 decipher the telephone number stored in A5. Line 170 checks to see if there are any pauses, and if so

Figure 2.



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Crime, continued...

converts them to 99's. If the digit called for is a zero, then to dial a zero the computer must send ten pulses over the phone lines; so line 180 changes all 0's to 10's. All of these digits are stored in B(1) to B(x), x being the total number of digits and pauses. For example a number being stored as A5."9550123" would be stored in B(1) through B(9) as 9,9,5,5,5,10,1,2,3.

Lines 210-230 just have the computer pick up the phone for a second, hang up, and then pick it up again before it starts dialing. This cycle is in case the telephone is ringing at the time of the break-in. The computer would actually hang up on whoever was calling and then proceed to call the emergency number.

Lines 240-330 are the dialing routine. Line 250 checks to see if there is a pause needed. If so, the computer pauses, then continues with the next digit. Lines 270-300 disconnect and connect the circuit to cause the dialing. The computer goes through this cycle the number of times equivalent to the digit being dialed, then waits at line 320 for a second and then goes on the next digit.

When all the digits have been dialed, the computer leaves time in line 340 for the pre-recorded message to be played; it

then hangs up, waits a minute, and starts all over again. After a total of three times, or as indicated by line 140, the computer unfreezes the BREAK key, and waits for someone to arrive.

As for the pre-recorded message being sent over the telephone lines, I suggest the Radio Shack 20-second endless-loop blank tape (stock number 43-401), which is used for answering machines. Make a 20-second emergency message saying something like this...

"This is an emergency call, there has been a break-in at 1234 Fifth Street, in room 67, on the 6th floor."

Be sure to give all the information the police will need. Then adjust line 340 so that during each call the recording is placed two or three times.

Some possible ways of changing this program would be to have the computer dial more than one person in case of a break-in. For instance, have the computer call the police, then the owner, then the programmer, then the police again. There are probably many different ways the program could be changed to better fit the needs of a specific business, but this program gives you the basics that you need. □

```

0 POKE 16396:25:
10 CLS:CALL 100:DOIME(15):50:GOTO 10
20 PRINTCHR$(23)
30 PRINT0534:"A R M E D":
40 OUT255:8:OUT255:10
50 IF INP(255)=19 THEN041:
60 CLS
70 PRINT CHR$(23)
80 PRINT 8304:"THE POLICE ARE"
90 PRINT0512:"B E T N C C A L L E D N O W"
100
110 AS="911:"
120
130
140 FORER=1TO31:
150 FOR=1TOLEN(AS)
160 IF MID(AS,R,1)=1:
170 IFER="":THENER="99":
180 IFER="9":THENER="10"
190 GOTO 19VAL(ER)
200 NEXT
210 PRINT0P:US1:FOR=1TO300:OUT255,12:NEXT
220 PRINT0P:041:FOR=1TO300:OUT255,11:NEXT
230 PRINT0P:US1:FOR=1TO400:OUT255,12:NEXT
240 FOR=1TOLEN(AS)
250 IF(1)=99 THENFORR=1TO75:IN1TGOTO2901:
260 FORK=1TO10:
270 PRINT0P:041:OUT255,11
280 FOR=1TO15:NEXT1:
290 PRINT0P:US1:OUT255,12:
300 FOR=1TO15:NEXT1:
310 NEXT
320 FOR=1TO300:NEXT1:
330 NEXT
340 PRINT0P:US1:FOR=1TO2400:OUT255,12:PRINT0P:11:"99":IFER="9":GOTO 19:NEXT:
350 WHEN ALL DIGITS ARE DIALED
360 PRINT0P:12:"11PRIN0P:041:FOR=1TO200:OUT255,11:NEXT:
370 COMPUTER HANDS UP, WAITS
380 NEXT ER1:
390 AND STARTS AGAIN.
370 G:PRINTCHR$(23):
380 PRINT0408:"T H E R E H A S B E E N"
390 PRINT0506:"A B R E A K - I N"
395 PRINT0P:041:
400 POKE 16396:2011:
410 GOTO 410
1000 0=CHR$(188)+CHR$(140)+CHR$(140)+CHR$(140)+CHR$(188)+STRING$(4,CHR$(24))+CHR$(26)+STRING$(3,CHR$(15)):
1010 0=CHR$(140)+CHR$(131)+CHR$(131)+CHR$(131)+CHR$(131)+CHR$(140)+STRING$(4,CHR$(24))+CHR$(26)+STRING$(3,CHR$(15)):
1015 0=856
1070 RETURN

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The Secret Code Machine

Millions of dollars are spent every year by governments, east and west, on computers to make and break secret codes. Using a century-old technique on a modern microcomputer, the user of the program described in this article can encipher and decipher secret messages and may also get a taste of the fascinating history of cryptanalysis.

The Playfair Cipher

The ideal cipher should be very simple to construct but impossible to break. One of the simplest, and most effective (though by no means unbreakable with modern methods) is the Playfair Cipher. Invented more than 125 years ago, this cipher retains its utility for casual use today, having made its mark on history in helping save the life of a future president of the United States.

The inventor was a British genius, Charles Wheatstone. Wheatstone had many and varied interests. Among other accomplishments, he invented that charming musical instrument, the concertina. He produced some of the earliest stereoscopic or three-dimensional drawings, and he published numerous papers on the science of acoustics. He also improved the electric dynamo and gave his name to a method, still in use today, for the very accurate measurement of electrical resistance.

For his many achievements, Wheatstone was knighted by Queen Victoria. He was elected to the Royal Society, and named professor of experimental philosophy at King's College, London, despite

Gordon Ritchie

the fact that this remarkable man was so shy he almost never appeared in person to give a lecture.

At the center of his interests lay telegraphy. He constructed an electric telegraph well before Samuel Morse succeeded, and made a contribution to the study of underwater telegraphy. Finally, and most important for this article, he devised an entirely new method for encoding secret messages to be sent by telegraph.

The cipher was ultimately named after Wheatstone's friend, Lyon Playfair, first Baron Playfair of St. Andrews. He first demonstrated what he described as "Wheatstone's newly-discovered symmetrical cypher" at a very private dinner in London in January 1854. The select company that night included Queen Victoria's husband, Prince Albert, and the Home Secretary (and late distinguished Prime Minister), Lord Palmerston. The demonstration was received with great interest. Indeed, several days later, while Playfair was visiting Dublin, he received letters from several of that night's guests, encoded, naturally, in the new cipher which had proved so easy to master.

The event marked the introduction of a method of enciphering letters in pairs such that the result depended upon the interaction of both elements. Today, this is recognized as the first "literal, digraphic" cipher in history.

The Playfair cipher begins with a 5 ×

5 grid. Each block of the grid holds one of 25 letters of the alphabet (the j is dropped, to be replaced as needed by an i throughout).

The initial letters of this array, in the usual order (left to right along each row from top to bottom) are taken from a keyword known to both sender and receiver. This can be any word or phrase whatsoever. Its letters are arrayed in order of the first appearance. Thus, the key word "playfair" would be read as "p l a y f i r." The remaining letters of the alphabet follow, in alphabetical order, to make up the codesquare. Thus, using the keyword "playfair," the codesquare is:

```
P L A Y F
I R B C D
E G H K M
N O Q S T
U V W X Z
```

The secret message is processed through this codesquare, in pairs of letters. First, all j's are replaced with i's. Then the message is broken down into pairs. If both letters in a pair are identical, a dummy (an x) is inserted. A dummy is also used to round off the message to an even number of letters. Thus, the short message, "a good cipher is the playfair" becomes:

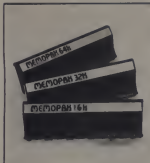
```
AG / OX / OD / CI / PH / ER / IS
TH / EP / LA / YF / AI / RX
```

The rules for encoding a message are simplicity itself. Each letter in a pair is found in the codesquare. It is replaced by the letter on the same row but in the column of the other letter of the pair. Thus, AG becomes LH, OX becomes SV, etc. There are two special cases:

- If both letters are on the same row (e.g., YF), each is replaced by the letter

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Code Machine, continued...

to the right, scrolling around to the beginning of the row as required (i.e., YF becomes FP).

• If both letters are in the same column (e.g., EP), each is replaced by the letter below, scrolling to the top of the column (i.e., EP becomes NI).

Our sample message, using the keyword "playfair" thus becomes: LHSVTR DRAEGI CNQMNI AYFPBV. (The grouping of letters is purely arbitrary, to mislead prying eyes.) The reader may wish to double-check—it is really rather easy once you understand the method.

The power of the cipher can be seen in the way that O is enciphered S in one place and T another, while A in the ciphertext stands for P in one case and L in the other. The result is that the simplest method of attack on secret ciphers, frequency analysis, is made much more difficult.

The two most frequent letters in English are e and t which together account for more than 20 percent of all normal usage. By contrast, the two most common di-graphs, th and he are found less than 6 percent of the time. This method of enciphering in pairs can be broken by modern methods, to be sure, but not without some skill.

The proof of this came in the rescue of an American sailor who later became president of the United States of America. When PT 109 was rammed and sunk in August 1943, the coastwatchers were on the alert. A member of the Australian naval volunteer reserve hidden in the Solomon Islands saw the explosion.

That morning, he received a message in Playfair cipher using the keyword "Royal New Zealand Navy" which said, "PT boat one owe nine lost in action in Blackett Strait two miles SW Mersu Cove X Crew of twelve X Request any information X." He reported his sightings and over the next few days he and his brave comrades on different islands exchanged a stream of messages about the probable whereabouts of the survivors.

Five days later, he learned that two natives had, indeed, found the sailors, and he fired off a message, using a Playfair cipher with the keyword "physical examination" to report eleven survivors and call for a rescue. In the heart of Japanese-controlled territory, with the radio waves continuously monitored, the use of a simple Playfair cipher kept the proceedings secret until the rescue could be effected.

The Playfair Program

You don't need to be on a South Sea island surrounded by enemy forces to

use and enjoy the Playfair cipher. The following program was written for Boy Scout Martin Ritchie of Ottawa, Canada, as part of his requirement for a green star. The user simply inputs an appropriate key word and the computer does the rest of the work, enciphering or deciphering the secret message.

```

100 REM ***** PLAYFAIR *****
110 REM ***** WRITTEN BY JOSEPH RITCHIE FOR HIS BOY SCOUTS *****
120 REM ***** AT OTTAWA, 5 DECEMBER 1983 *****
130 REM ***** AN OPERATING SYSTEM MESSAGE WHICH IS A STANDARD MESSAGE BEING A MESSAGE *****
140 REM ***** THE MESSAGE SOURCE TECHNIQUE BEING USED IN THIS MESSAGE *****
150 REM *****
160 REM ***** THREE VARIABLES *****
170 REM ***** KEY *****
180 REM ***** IF *****
190 REM ***** MESSAGE *****
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```

The program was originally written on the 6502 system of a SuperPet with disk drives and a CBM printer. It can be easily adapted to other Commodore machines or, with a little effort, other 6502-based systems using disk or tape. (A neighbor is running a version on a tape-supported CBM 2032.)

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Code Machine, continued...

Unlike the Waterloo Basic of the 6809 chip, which the SuperPet also supports, Commodore's Basic 4.0 is not structured, nor does it permit "pretty printing." The program has, however, been written in modular format, with extensive use of subroutines and a proliferation of REMs to make it easily readable by the novice programmer. Pseudo pretty printing has been used as well.

All this adds to the intelligibility, but also the memory requirement of the program. Users faced with limited memory capacity may wish to shorten the message array (DIM in line 680) as a first step. If the program is to be compressed, care should be taken with branching to REM statements.

The program is relatively foolproof. It also uses input time to do the main processing so that it appears to do the encipherment instantly (a useful technique known as "parallel processing").

Program Organization

Lines 10 to 310 provide a synopsis of the program using REM statements.

Lines 500 to 680 introduce the program to the screen and establish DIM, character sets, etc.

Lines 700 to 1000 accept the keyword input, strip it of J's and repeats and set up the magic square while waiting.

Lines 1200 to 1200 display the magic codesquare for the user.

Lines 1210 to 1350 accept the input of the secret message to be enciphered/deciphered and do the job while waiting.

Lines 1360 to 1500 print to the screen both the original message and the enciphered/deciphered version.

Lines 2000 to 2150 close the operation with a set of printout options to the CBM printer.

The remaining lines comprise subroutines for everything from turning the page to enciphering the secret message, all clearly marked with REMs. The basic algorithm for enciphering the letter pairs is in the 15000 block, calling subroutines for special cases in the 20000 block.

Further Information

Readers whose appetite has been whetted to learn more of the fascinating history of cryptanalysis are encouraged to get *The Codebreakers* by David Kahn or *Secret and Urgent* by Fletcher Pratt. Both provide thrilling accounts of cryptanalysis in action and a good technical guide to many of the basic techniques.

Readers who prefer not to type in the following listing may obtain a copy of the Playfair program—either version: 80-character plus instructions on disk; or 40-character on disk or tape. Just send \$5 with your name and address to me at the address printed at the beginning of the article. □

```

10000  HE T H
10050  IF = 12 + 88  REM * THREE IN JUDGING
11000  HE T H
11050  REM * RUN SETS UP MESSAGE
11100  FOR V = 1 TO 5
11150  FOR Y = 1 TO 5
11200  FOR X = 1 TO 5
11250  M(Y,X) = MID$(SECRET, (Y-1)*5 + X, 1)
11300  NEXT X
11350  NEXT Y
11400  HE T V
11450  RETURN REM * BACK TO 1350
11500  REM *****SOURCE PRINT SUBROUTINE*****
12000  FOR Y = 1 TO 5
12050  FOR X = 1 TO 5
12100  PRINT M(Y,X)
12150  NEXT X
12200  NEXT Y
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AN ECONOMICAL ALTERNATIVE

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Eastern Front (C/D)	\$23	Delaxian	\$32
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747 Land Sim (C/D)	\$17	Macro Asa & Edit	\$65
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Crassie (R)	\$12	Worl (C/D)	\$45
Delaxian	\$32	Gizzard of War (C/D)	\$32
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Macro Asa & Edit	\$65	Sky Eggs (C/D)	\$20
Assembler Editor (R)	\$45	Snakers (C/D)	\$20
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Worl (C/D)	\$45	Bandits (C/D)	\$27
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Sky Eggs (C/D)	\$20	Snooper Troops #1 (C/D)	\$30
Snakers (C/D)	\$20	Snooper Troops #2 (C/D)	\$30
Way Out (C/D)	\$27	Pilot (Educ)	\$21
Bandits (C/D)	\$27	Snoorm Machine (C/D)	\$23
First Entry (R)	\$27	Face Maker (C/D)	\$23
SPINNAKER		Shattered Alliance (C/D)	\$28
Snooper Troops #1 (C/D)	\$30	Tiger in Snow (C/D)	\$28
Snooper Troops #2 (C/D)	\$30	Battle of Norm (C/D)	\$27
Pilot (Educ)	\$21	Galactic Gladiator (C/D)	\$27
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C-Basic Software			

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Color II	\$650	CROSSFOOT	\$255
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NEC			
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192K W/Parity	\$449	IBM Jostack (TG)	\$44
256K W/Parity	\$559	IBM Jostack (Kraft)	\$48

IBM SOFTWARE

Viscalc (256K)	\$169	Data Reporter	\$159
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VIC 64	\$149	1530 RECORDER	\$64
VIC 20	\$149	1600 MODEM	\$92
1541 DISK DRIVE	\$149	1600 MODEM	\$92
1525 PRINTER	\$149	1600 RAM	\$88

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802	\$2595	802H	\$4445
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NEC

PC-8001 Computer	\$709
PC-8012 I/O Unit	\$469
PC-8031 (Dual Drive)	\$709

NORTH STAR

Advantage	\$2595
Advantage (5M Byte H.D.)	\$3799

TRS-80

MOD III (2 Drvs, 48K)	\$1649
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3080 PRINT
3090 RETURN      REM * BACK TO 11270

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May 1983 • Creative Computing

S-100 MEMORY BOARDS

64K STATIC RAM - Jade

Uses new 2K x 8 static RAMs; fully supports IEEE 696 24-bit extended addressing 200ns RAMs; lower 32K or entire board phantomable 2716 EPROMs may be disabled low power typically less than 500ma

MEM-95152B Bare board	\$49.95
MEM-95152K Kit less RAM	\$99.95
MEM-95152K Kit with RAM	\$199.95
MEM-95152K 50K Kit	\$299.95
MEM-95152K 64K Kit	\$299.95
Assembled & Tested	add \$50.00

256 RAMDISK - SD Systems

Expandable RAM (up to 256K) using 64Kx1 RAM chips, compatible with CPM MP/M QDOS & most other 2.80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software

MEM-55064A 64K A & T	\$474.95
MEM-55128A 128K A & T	\$574.95
MEM-55192A 192K A & T	\$674.95
MEM-55256A 256K A & T	\$774.95
SFC-5509000F RAMDISK software CPM 2.2	\$44.95
SFC-5509000F RAMDISK with EXRAM III	\$24.95

64K RAM BOARD - C.C.S.

IEEE S-100, supports front panels, bank select, fail-safe refresh A-MUX, extended addressing, list price \$575.00 - less than half price!

MEM-64565A	\$199.95
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LETTER QUALITY PRINTERS

LETTER QUALITY PRINTER - COMREX

Uses standard duty wheels and ribbon cartridges, 16 CPS bi-directional printing, semi-automatic paper loader (single sheet or fan fold), 10/12/15 pitch, up to 16" paper, built-in noise suppression cover

PRO-11001 Centronics parallel	\$99.95
PRO-11002 RS-232C serial model	\$98.95
PRO-11000 Tractor Option	\$119.95

380Z by Data Terminals & Communications

Based on the same quality mechanism as the Comrex printer the 380Z contains electronic enhancements that allow it to print at speeds up to 32 CPS. Other features include a 48K buffer proportional spacing and Diablo 1640/1650/630 compatible protocol. Comes with pinfeed/ribbon and users manual. Serial, parallel, and IEEE 488 interfaces standard

PRO-11300 380Z printer	\$1295.00
PRO-11000 Tractor option	\$199.95

32K PROM/RAM BOARD

The 32K S100 PROM/RAM board can hold up to 16 each 2716 static EPROMs, 6116 static RAMs, or 8 each static EPROMs. This board was designed to fit into older S100 systems as well as the newer IEEE-696 machines. Uses 5 volt only EPROM/RAM, allows operation as a 2K to 32K board, meets IEEE-696 S100 proposed standard, addressable as two 16K blocks on any 64K page, supports Cromemco as well as Northstar bank select, perfect for MP/M systems

MEM-95152B Bare board w/ manual	\$49.95
MEM-95152K Kit with No RAM	\$89.95
MEM-95152A A & T with No RAM	\$139.95
MEM-95152K Kit with 16K RAM	\$129.95
MEM-95152A A & T with 16K RAM	\$179.95
MEM-95152K Kit with 32K RAM	\$179.95
MEM-95152A A & T with 32K RAM	\$229.95
Call Us For Lowest Prices on EPROMs - 2732s	\$4.90

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THE BUS PROBE - Jade

Inexpensive S-100 Diagnostic Analyzer

See what computer is doing. And you don't have an oscilloscope. And you don't have a front panel. You're not alone, most computers have their occasional bad days. But without diagnostic equipment such as an oscilloscope (expensive) or a front panel (expensive!) it can be very difficult to pinpoint the problem. Even if you have an extender board with a superfast logic probe you can't see more than one signal at a time. You're stuck right?

Not anymore! Jade is proud to offer our cost effective solution to the problems mentioned above. **THE BUS PROBE** Whether you're a hobbyist with a cantankerous kluge or a field technician with an anxious computer owner breathing down your neck, you'll find **THE BUS PROBE** speeds your repair time remarkably. Just plug in **THE BUS PROBE** and see all the IEEE S-100 signals in action. **THE BUS PROBE** allows you to see inputs, outputs, memory reads and writes, instruction fetches, DMA channels vectored interrupts, 8 or 16 bit wide data transfers, plus the three bus supply voltages.

TSX-200B Bare board	\$59.95
TSX-200B Kit with Manual	\$129.95
TSX-200A A & T	\$159.95

I/O-4 - SSM Microcomputer

2 serial I/O ports plus 2 parallel I/O ports	\$35.95
IOI-1010B Bare board w/ manual	\$179.95
IOI-1010K Kit with Manual	\$249.95
IOI-1010A A & T	

I/O-5 - SSM Microcomputer

Two serial & 3 parallel ports, 110-19.2K Baud	
IOI-1015A A & T	\$288.95

INTERFACER 4 - CompuPro

3 serial, 1 parallel, 1 Centronics parallel	
IOI-1840A A & T	\$314.95
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S-100 EPROM BOARDS

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer	
MEM-95010K Kit with manual	\$154.95
MEM-95010A A & T with manual	\$218.95

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with software	
MEM-99520K Kit with software	\$186.95
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DUAL DISK SUB-SYSTEMS

Disk Sub-Systems - Jade

Handsome metal cabinet with proportionally balanced airflow system, rugged dual drive power supply, power cable, kit power switch, line cord, fuse holder, cooling fan, never mar rubber feet, all necessary hardware to mount 2 8" disk drives, power supply, and fan does not include signal cable

Qual 'B' Sub-Assembly Cabinet

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END-000424 A & T w/ 2 FD100-80s	\$985.00
END-000433 Kit w/ 2 SA 801Rs	\$999.00
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'B' Sub-Systems - Double Sided Double Density

END-000428 Kit w/ 2 D T-8s	\$1224.80
END-000427 A & T w/ 2 D T-8s	\$1242.99
END-000436 Kit w/ 2 SA 851Rs	\$1274.00
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8" SLIMLINE SUB-SYSTEMS

Dual Slimline Sub-systems - Jade

Handsome vertical cabinet with scratch resistant baked enamel finish, proportionally balanced air flow system, quiet cooling fan, rugged dual drive power supply, power cables, power switch, line cord, fuse holder, cooling fan, all necessary hardware to mount 2 8" slimline disk drives, does not include signal cable

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END-000820 Bare cabinet	\$59.95
END-000822 A & T w/ 0 drives	\$179.95

Dual 'B' Slimline Sub-Systems

END-000923 Kit w/ 2 SS DD	\$919.95
END-000924 A & T w/ 2 SS DD	\$949.95
END-000923 Kit w/ 2 DS DD	\$1149.95
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S-100 CPU BOARDS

SB-C-200 - SD Systems

4 MHz, 2-80A CPU with serial & parallel I/O, 1K RAM, 8K ROM space, monitor PROM included

CPC-30200A A & T	\$329.95
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2 or 4 MHz switchable 2-80 CPU board with serial I/O, accommodates 2708, 2716, or 2732 EPROM, baudrates from 7.5 to 9600

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2 or 4 MHz Z-80 CPU with serial I/O port & on board monitor PROM, front panel compatible

CPU-30400A A & T with PROM	\$299.95
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CPU-Z CompuPro

2 or 4 MHz Z80A CPU, 24 KHz A & T

CPU-30500A 24 MHz A & T	\$279.95
CPU-30500C 3 MHz CSC	\$374.95

8085/8088 - CompuPro

Both 8 & 16 bit CPUs, standard 8 bit S100 bus up to 8 MHz, accesses 16 Megabytes of memory

CPU-20510A 8 MHz A & T	\$385.85
CPU-20510C 8 MHz CSC	\$497.95

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MSM-551001	\$219.95 ea. 2 for \$399.95 ea.	
Shugart SA400L	single sided double density 40 track	
MSM-104000	\$234.95 ea. 2 for \$224.95 ea.	
Shugart SA455	half size double sided 48 TPI	
MSM-104550	\$349.95 ea. 2 for \$269.95 ea.	
Shugart SA465	half size double sided 96 TPI	
MSM-104650	\$399.95 ea. 2 for \$379.95 ea.	
Tandon TM100-2	double sided double density 48 TPI	
MSM-551002	\$294.95 ea. 2 for \$269.95 ea.	
Shugart SA450	double sided double density 35 track	
MSM-104500	\$349.95 ea. 2 for \$329.95 ea.	
Tandon TM100-3	single sided double density 96 TPI	
MSM-551003	\$294.95 ea. 2 for \$269.95 ea.	
Tandon TM100-4	double sided double density 96 TPI	
MSM-551004	\$394.95 ea. 2 for \$374.95 ea.	
MPI B-51	single sided double density 40 track	
MSM-155100	\$234.95 ea. 2 for \$234.95 ea.	
MPI B-52	double sided double density 40 track	
MSM-155200	\$344.95 ea. 2 for \$334.95 ea.	

5 1/4" Cabinets with Power Supply	
END-000218 Single cab w power supply	\$64.95
END-000220 Dual cab w power supply	\$94.95

S-100 MOTHERBOARDS

ISO-BUS - Jade

Silent, simple and on sale - a better motherboard

MBS-061B Bare board	\$22.95
MBS-061K Kit	\$39.95
MBS-061A A & T	\$59.95
12 Slot (8 1/2" x 8 1/2")	
MBS-121B Bare board	\$34.95
MBS-121K Kit	\$69.95
MBS-121A A & T	\$109.95
18 Slot (14 1/2" x 8 1/2")	
MBS-181B Bare board	\$54.95
MBS-181K Kit	\$99.95
MBS-181A A & T	\$149.95

8" DISK DRIVES

Siemens FDD 100-8	single sided double density	
MSF-201120	\$274.95 ea. 2 for \$249.95 ea.	
Shugart SA801R	single-sided double density	
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MSF-10851R	\$554.95 ea. 2 for \$529.95 ea.	
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SMART BUY IN MODEMS - Signalman

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Basic Cryptography: SBOEPN DJQIFST

The personal computer is a powerful tool for cryptography. With a bit of simple programming you can encipher secret messages to your friends so securely that it would take the efforts of a mathematical cryptographer to unravel the system. But with the proper keyword a friend can use his computer to decipher and read your message.

There have been several programs for simple cryptography published in the major computer magazines. Some of these programs, unfortunately, have used very weak systems for enciphering the messages. Anyone with a little knowledge of cryptanalytic techniques could break the system and read the messages without knowing the keyword.

This article explains the principles of computer cryptography and demonstrates the use of the Basic random number function for enciphering messages. Versions of the program are included for the Apple II, the TRS-80 Models I and III, IBM PC, and the Atari 400 and 800.

Cryptography by Addition

Letters are represented in computers as numbers. This makes it easy to use the arithmetic operations of Basic to transform the letters. The simplest system is just to add a constant number to the character code for each letter. If the result is too large, subtract the number of characters being used so that the result is again a valid character code. Suppose, for instance, that you want to use three as the constant and that your messages consist of only capital letters. Then

**Daniel D. Wheeler
and
Elisheva Perri**

each letter in the message will come out as the letter three letters further on in the alphabet. The letter A (ASCII code 65) will appear as D (ASCII code 68), B (66) becomes E (69), and so forth. At the end of the alphabet, X (88) becomes the ASCII code 91. But 90 is Z and 91 is beyond the end of the alphabet. So 26 (the number of characters we are using) is subtracted from 91 to produce 65. Thus X wraps around to the beginning of the alphabet and becomes A.

The Basic statements necessary to do this are quite simple. If the letter to be transformed is stored in the string A\$, you can do it with:

```
100 X = ASC(A$)
110 X = X + 3
120 IF X > 90 THEN X = X - 26
130 A$ = CHR$(X)
```

The ASC(A\$) function converts the character to a numeric variable so that the arithmetic can be done in the next two statements. The CHR\$(X) function converts the numeric result back into a string.

To decipher the message, change lines 110 and 120 to:

```
110 X = X - 3
120 IF X < 65 THEN X = X + 26
```

This system is called a Caesar cipher because Julius Caesar is said to have used it. It may have fooled the Gauls, but now any bright elementary school student (maybe with a hint) can break the system. Part of the title of this article is in the Caesar cipher, but not with an offset of three.

Better Systems

The weakness of the system comes from the use of the constant. There are only 25 possible constants to try and once you figure it out it is easy to decipher the whole message. You can improve the system by changing the offset for each character. You might try adding one to the offset each time you encipher a character and then subtracting 26 from the constant whenever it gets too large. This will produce a cipher that is much more difficult to break.

There are many possible schemes for changing the offset. Any scheme will work to make the cipher more difficult to break. But if the scheme is simple (like adding one) and repeats at fairly short, regular intervals, then it is not very difficult to figure out the pattern and break the cipher. A smart high school student could do it.

What you need is an irregular pattern that doesn't repeat within the length of the messages you are interested in sending. The random number function in Basic provides a very irregular series of numbers. They do repeat eventually, but the cycle is much longer than any messages you will ever send on your computer.

If the random number function were truly random, it would not be useful for our purpose. Once you have enciphered a message, your recipient must be able to generate the same sequence of numbers to decipher the message. Fortunately, most versions of Basic provide some way to "seed" the random function so that it generates the same sequence of numbers.

In Applesoft, for instance, calling the random number function with a negative argument, such as RND (-99), seeds the

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Cryptography, continued...

Listing 1. Apple II version of the random cipher program.

```

10 REM DEMONSTRATION OF RANDOM ENCIPHERING ON THE APPLE II
20 REM BY DANIEL D. WHEELER AND ELISHEVA PEERT
30 DIM INS(255)
40 HOME
90 REM
100 REM INITIALIZATION OF RND() FUNCTION
110 INPUT "ENTER A NEGATIVE NUMBER: ";N
120 IF N < -1 THEN 110
130 X = RND (N)
190 REM
200 REM SELECT ENCIPHER OR DECIPHER
210 PRINT "SELECT (1) ENCIPHER OR (2) DECIPHER"
220 INPUT "ENTER 1 OR 2: ";CH
230 IF CH < 1 OR CH > 2 THEN 220
290 REM
300 REM INPUT MESSAGE
310 PRINT "ENTER YOUR MESSAGE:"
320 I = 1
330 GET AS: PRINT AS;
340 IF AS = CHR$(13) THEN 380
350 INS(I) = ASC (AS)
360 I = I + 1
370 GOTO 330
380 ON CH GOTO 400,500
390 REM
400 REM ENCIPHER THE MESSAGE
410 FOR J = 1 TO I - 1
420 X = INS(J) + INT ( RND (1) * 59)
430 IF X > 90 THEN X = X - 59
440 PRINT CHR$( X);
450 NEXT J
460 END
500 REM DECIPHER THE MESSAGE
510 FOR J = 1 TO I - 1
520 X = INS(J) - INT ( RND (1) * 59)
530 IF X < 32 THEN X = X + 59
540 PRINT CHR$( X);
550 NEXT J
560 END

```

Listing 2. TRS-80 version of the random cipher program.

```

10 REM DEMONSTRATION OF RANDOM ENCIPHERING ON THE TRS-80
20 REM BY DANIEL D. WHEELER AND ELISHEVA PEERT
30 DIM INS(255)
40 CLS
90 REM
100 REM INITIALIZATION OF RND() FUNCTION
110 INPUT "ENTER A NUMBER BETWEEN 1 AND 32767: ";N
120 IF N<1 OR N>32767 THEN 110
130 POKE 16554,0
140 POKE 16555,INT(N/256)
150 POKE 16556,N-INT(N/256)*256
190 REM
200 REM SELECT ENCIPHER OR DECIPHER
210 PRINT "SELECT (1) ENCIPHER OR (2) DECIPHER"
220 INPUT "ENTER 1 OR 2: ";CH
230 IF CH<1 OR CH>2 THEN 220
290 REM
300 REM INPUT MESSAGE
310 PRINT "ENTER YOUR MESSAGE:"
320 I=1
330 AS=""
340 AS=INKEY$:IF AS="" THEN 340
350 PRINT AS;:IF AS=CHR$(13) THEN 390
360 INS(I)=ASC(AS)
370 I=I+1
380 GOTO 330
390 ON CH GOTO 400,500
395 REM
400 REM ENCIPHER THE MESSAGE
410 FOR J=1 TO I-1
420 X=INS(J)+RND(59)
430 IF X>90 THEN X=X-59
440 PRINT CHR$(X);
450 NEXT J
460 END
500 REM DECIPHER THE MESSAGE
510 FOR J=1 TO I-1
520 X=INS(J)-RND(59)
530 IF X<32 THEN X=X+59
540 PRINT CHR$(X);
550 NEXT J
560 END

```

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Cryptography, continued...

Listing 3. Atari version of the random cipher program.

```

10 REM DEMONSTRATION OF RANDOM ENCRYPTING ON THE ATARI
20 REM BY DANIEL O. WHEELER AND ELISHEVA PEERI
30 DIM IN(255),AS(255)
40 PRINT CHR$(125): REM CLEAR SCREEN
50 REM
60 REM INITIALIZATION
110 PRINT "ENTER A NUMBER BETWEEN 1 AND 99999:"
120 INPUT CH
130 IF N<1 OR N>99999 THEN 110
140 N=N/100000
150 REM
200 REM SELECT ENCRYPTER OR DECRYPTER
210 PRINT "SELECT (1) ENCRYPTER OR (2) DECRYPTER"
220 PRINT "ENTER 1 OR 2: ";INPUT CH
230 IF CH<1 OR CH>2 THEN 220
240 REM
300 REM INPUT MESSAGE
310 PRINT "ENTER YOUR MESSAGE:"
320 INPUT AS
330 L=LEN(AS)
340 FOR I=1 TO L
350 IN(I)=ASC(AS(I))
360 NEXT I
370 ON CH GOTO 400,500
380 REM
400 REM ENCRYPTER THE MESSAGE
410 FOR J=1 TO I-1
420 N=N*997-INT(N*997)
430 X=IN(J)-INT(N*59)
440 IF X>90 THEN X=X-59
450 PRINT CHR$(X);
460 NEXT J
470 END
500 REM DECRYPTER THE MESSAGE
510 FOR J=1 TO I-1
520 N=N*997-INT(N*997)
530 X=IN(J)-INT(N*59)
540 IF X<32 THEN X=X+59
550 PRINT CHR$(X);
560 NEXT J
570 END

```

generator to start at a definite place in the sequence. If you agree beforehand on a number to use as the seed, your friend will be able to decipher your message by generating the same sequence of numbers to use as offsets.

Demonstration Programs

Listings 1, 2, 3, and 4 show programs to demonstrate these techniques for four popular microcomputers. Each of the programs enciphers or deciphers a one-line secret message. Instead of enciphering just the letters of the message, these programs encipher everything: letters, numbers, punctuation marks and even spaces. (The ASCII code for the space is 32. It is just as much a character as any of the others. You must be especially careful in typing the enciphered message to get all the spaces exactly right.)

The program lines in the 100's initialize the random number generator. For the Apple this is simply a matter of calling the random number generator with a negative argument. The variable X in line 130 is included only to make a complete statement; the value stored in X is never used.

Setting the random number seed on the IBM PC is a trivial process, as the RANDOMIZE function allows automation of the seed generation. By omitting an argument in the RANDOMIZE command in line 110, the PC will return with the default input statement, Random Num-

ber Seed (-32768 to 32767)? You may then input your cipher base value. The message is input with an INKEY command, so backspacing is impossible. It should also be noted that messages for enciphering must be input in upper case, for proper decoding. The rest of the program follows other Microsoft versions closely.

There is no instruction to initialize the RND() function in TRS-80 Level II Basic, but it can be done with POKES into memory. Lines 130-150 show how to do it. POKES can only be done with numbers smaller than 256. The instructions in lines 140 and 150 break the larger seed (stored in N) into two parts, each less than 256.

We couldn't figure out how to seed the RND() function in Atari Basic, so we'll show you how to write your own random function. The initial seed must be a decimal fraction between zero and one. In lines 110-140 the program gets a number and then divides by 100,000 to make it a fraction.

The lines in the 200's allow you to select whether the message will be enciphered (by adding the random numbers) or deciphered (by subtracting the random numbers).

The next section of the program (300's) allows you to enter your message. For the Atari this is a straightforward INPUT statement. Then the loop in lines 340-360 converts the characters

Listing 4. IBM PC version of the random cipher program.

```

10 REM RANDOM ENCRYPTING ON THE IBM PC
20 REM FROM WHEELER AND PEERI. TRANSLATED BY JOHN ANDERSON
30 DIM IN$(255)
40 CLS
50 REM MAKE SURE CAPS LOCK IS IN ALL CAPS POSITION
60 REM
100 REM INITIALIZATION OF RANDOM FUNCTION
110 RANDOMIZE
120 REM THAT'S ALL YOU NEED TO SAY. PC TAKES IT FROM HERE.
130 REM
200 REM SELECT YOUR MODE
210 PRINT "Select (1) encipher or (2) decipher"
220 INPUT "Enter 1 or 2: ";CH
230 IF CH<1 OR CH>2 THEN 220
240 REM
300 REM INPUT MESSAGE
310 PRINT "Enter your message:"
320 I=1
330 AS=""
340 AS=INKEY$: IF AS="" THEN 340
350 PRINT AS: IF AS=CHR$(13) THEN 390
360 IN$(I)=ASC(AS)
370 I=I+1
380 GOTO 330
390 ON CH GOTO 400,500
400 REM
410 REM ENCRYPTER THE MESSAGE
420 FOR J=1 TO I-1
430 X=IN$(J)+(INT(RND*59))
440 IF X>90 THEN X=X-59
450 PRINT CHR$(X);
460 NEXT J
470 END
500 REM DECRYPTER THE MESSAGE
510 FOR J=1 TO I-1
520 X=IN$(J)-(INT(RND*59))
530 IF X<32 THEN X=X+59
540 PRINT CHR$(X);
550 NEXT J
560 END

```

to the numeric (ASCII code) values and stores them in the array IN(). But neither the Apple nor the TRS-80 allows commas within input strings. The comma is used to separate multiple items in the input. Since we wanted to include the comma as an allowable character we used the single character input commands. These are GET on the Apple and INKEY\$ on the TRS-80. The program loop starting at line 330 accepts single characters, converts them to numeric form, and stores the ASCII codes in the integer array IN\$().

When the message is completely entered, the program goes to the section either to encipher (400's) or decipher (500's) the message. There are 59 possible characters from "space" (ASCII 32) to Z (ASCII 90). To encipher the message we should add a random integer up to 59 to each of the character codes. This is easy on the TRS-80.

The RND() function with arguments larger than one returns integers in the range from one to the value of the argument. Thus RND(59) returns integers from 1 to 59. These are added to the character codes in line 420. Line 430 subtracts 59 if the result is out of the allowable range. Line 440 converts the numeric code to a character and prints it. The loop in lines 410-450 repeats this for each character in the message.

The Apple RND() function returns decimal fractions between zero and one.



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The Trapdoor Algorithm

David Block

Methods of secret writing have been used for centuries to keep communications secure from prying eyes. And for centuries men have been devising means to break the locks, to tear the secrets from these cryptic messages. The first practical electronic computers, the British series called Colossi, were special purpose devices which were used successfully during World War II to decipher the German *Geheimschreiber* and Enigma messages.

When Alan Turing visited the United States electronic computer EDVAC, the men who proudly explained its workings to him had no idea that he had been working with a functioning computer for years. The secrecy which cloaked that British project continues to this day. From the small amount of information which has been released we can only guess that the operation of the machine involved heuristic methods; the actual decrypting consisted of a search for patterns by the computer, with that search being guided by the operator into paths indicated by intermediate results of the search. This synergistic relationship of man and computer, the trust and best use of these electronic giants, combines the speed and accuracy of digital circuitry with the incredible powers of the human brain. The German cipher machines could not withstand that attack.

It has long been considered axiomatic that no cipher is secure against a determined attack; consequently the publication of the method called the trapdoor algorithm took the cipher experts by surprise. Professor Donald Knuth reports (*Semimerical Algorithms*, second edition, p. 386) that this method was discovered by R.L. Rivest, A. Shamir, and L. Adleman in 1977. A trapdoor algorithm is a mathematical function which goes in only one direction. In the case of ciphers, it is the rules for making a ciphered message, rules which do not

tell you how to decipher the message. This article will explain how the method is applied and give a worked example, along with Basic programs useful in cryptography.

A practical advantage of the method is that the keys used to make the cipher can be public knowledge. Your agent in a foreign country does not have to memorize the keys but can write them down, since it will not help the enemy to discover them. A serious disadvantage of the method is that it requires for security that the keys be very large numbers. This means that a special computer program is necessary.

The arithmetic of the algorithm can be explained in a few words. You will remember that we are dealing throughout with only whole, positive numbers. First, the process of exponentiation, or raising a number to a power, is just multiplying a number by itself several times. For example, 5 times 5 times 5 is equal to 125. That is called raising 5 to the third power.

Second, the process of modulating a number is just finding the remainder after another number has been subtracted as many times as possible from the first number. Thus 9 mod 2 is 1; 27 mod 12 is 3. If your Basic doesn't have the MOD function, you can do it in one line:

50 IF A > B then A=A-B: GOTO 50:
REM A becomes A mod B

Third, prime numbers are only those numbers which are measured only by themselves and by 1. Nine can be measured by 3 (divided into 3's with no remainder) so it is not prime. Twenty-nine cannot be divided evenly into any smaller number of groups, so 29 is a prime number. (As an aside, consider the illogicality of saying that 3 divided into 9 is 3. On reflection it is apparent that what is meant is that 9 can be divided into 3 groups of 3.)

Now we are ready for the trapdoor algorithm. Take two prime numbers, which we shall name P and Q. Multiply these numbers and call the result N. Now subtract one from P and one from Q. Call this new pair R and S, and find their greatest common divisor (GCD), the largest number which measures each of them evenly.

The next step is to multiply the GCD by the product of R and S. The result of adding one to this product may, surprisingly enough, turn out to be the product of another pair of prime numbers. Call this new pair D and E. One of these numbers is your private key, D. The other number and N make up your public key.

To send a message to someone, convert the message into groups of numbers. Then raise each group to the E power and modulate it with his N. When he receives the cipher he will divide it into groups, raise each group to his D power and modulate with N. It will then be a simple matter for him to convert the resulting numbers back into the original message.

The reason this is called the trapdoor algorithm is that when the numbers chosen are sufficiently large, it is practically impossible to calculate D, even though you know what E and N are. In this case sufficiently large has been defined as numbers containing 200 digits. To calculate D would require factoring N, a process which would take over three million years worth of CPU time on a Cray-1 computer. Thus Messers Rivest, Shamir, and Adelman have come up with a method of encrypting messages via computer which depends for its security only upon safeguarding the private key, D.

There have been indications that publication of research on advances in ciphers has been discouraged by government agencies. In the case of this trapdoor algorithm an additional difficulty has been the fact that the high precision arithmetic required, calls for computer

Trapdoor Algorithm, continued...

programs not generally available. The development of the following trivial example was possible through the use of special abilities of the muMath/muSimp program. That program was developed by Albert Rich and David Stoutmeyer of The Software House in Honolulu and is distributed by Microsoft in versions for CP/M, Apple II, and TRS-80 Models I and III. A practical example with a 200-digit N could be worked out in a reasonably, short time only by using a large mainframe computer with a computer algebra program. MuMath is reviewed in detail in the October '82 issue of *Creative Computing*.

Although the muMath program can work with numbers containing over 600 digits, the pair of prime numbers we start with must be small because, as we shall see, the intermediate steps in the algorithm will produce numbers much larger than the primes we start with. We begin our example by generating the prime numbers between 2 and 100, using the Basic program in Listing 1.

This is an implementation of the process called the Sieve of Eratosthenes, based on that ancient Greek mathematician's observation that multiples of prime numbers cannot themselves be prime numbers. (The Greek mathematicians did not consider 1 to be a

number and of course did not admit the existence of 0. How can nothing exist?)

The table, which contains intermediate results as well as the pair of keys associated with each candidate for N, shows us that several combinations of the prime numbers we are investigating are unusable. Several pairs, such as 19 and 29, do not produce keys. Other pairs, such as 19 and 37, produce a key so large that we cannot handle it with

muMath. The result of raising 999 to the 2333 power is a number containing almost 7000 digits. We shall choose the pair of keys, 37, 109, resulting from the pair of primes 29, 37.

The message to be enciphered must be transformed into numbers. We shall assign two-digit values to the letters: A=11, B=12, ..., Z=36. Spaces will be given the value 37. See Figure 1. (In an actual case, a more secure cipher

Listing 1.

```

10 A=1:I=A
15 REM: Set up an array representing one to one hundred.
20 DIM A(100)
30 N=10
40 I=I+A
50 IF A(I)=A THEN 40 ELSE IF I)N THEN 100
55 REM: Label every multiple of I with a one.
60 FOR J=I+I TO 100 STEP I
70 A(J)=A
80 NEXT J
90 GOTO 40
95 REM: Print out the unlabeled numbers.
100 FOR K=2 TO 100
110 IF A(K)=0 THEN PRINT K;
120 NEXT K
130 END
    
```

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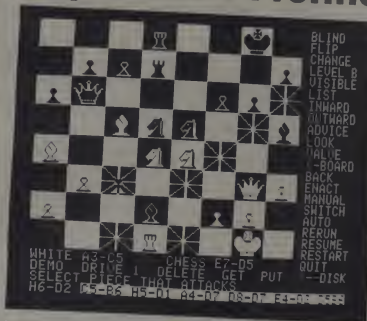
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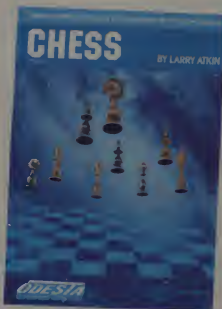


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 - ◀ Chess suggests a move
 - ◀ Show moves Chess thinks you will make, and its responses
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 - ◀ Return to board or switch to command menu
 - ◀ Take back a move (repeatable)
 - ◀ Play move suggested by look-ahead search
 - ◀ Chess plays neither side
 - ◀ Switch sides
 - ◀ Chess plays against itself—one level against another
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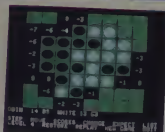
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Black to move and win
(From Checkers documentation)



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CIRCLE 168 ON READER SERVICE CARD

Trapdoor Algorithm, continued...

would be obtained by not using a regular order for numbering the letters.)

Listing 3 can be used to do the conversion, but we must now abandon Basic because the precision arithmetic required would call for slow and complicated Basic programs.

Working With muMath

Figures 2 and 3, which show muMath

at work, require a little explanation. The machine prompt, the symbol telling the operator that the program is waiting for a command, is the question mark. The operator uses a colon for assignment and a semicolon to request a printout, with a left bracket to indicate exponentiation. The commercial at symbol (@) is a variable equal to the last answer the machine gave.

Figure 1.

C	O	M	E	H	O	M	E	E	T
13	25	23	15	37	18	25	23	15	37
132	523	153	718	252	315	371	530		

Figure 2.

```
D:37;E:109;N:1073;
@: 37

? @: 109

? @: 1073

? 132[D;
@:
289224750177183227558122231949191437419911681339284019128060958
0272599886200832

? MOD(@,N);
@: 169

? 169[E;
@:
691274923611494487506935190275674518754102142159505486469575983
897862558301410522788850470569636823308772505594223920522776430
57917479617475815606834844012813870652591728984884069778523785
097207349030191594180374014910139398996767476956645129

? MOD(@,N);
@: 132

?
```

Figure 2 shows the process of enciphering and deciphering the first group, 132, in detail. The first four lines show the values muMath has been given for D, E, and N. Lines 7 and 8 show that raising 132 to the 37th power yields a 79-digit number, which is then reduced mod 1073 to the cipher group 169. The work sheet goes on to reverse the process, calculating the 243-digit result of raising the code group 169 to the 109th power, then reducing that answer mod 1073 to 132, thereby recovering the original message group.

Figure 3 shows the process applied to the entire message in a more compact form, without printing out the intermediate values.

This example of ciphering shows the mathematical operations of the method, but the short key numbers used destroy security. Anyone knowing the key num-

Figure 3.

```
MOD((132[D,N);
@: 169

? MOD((523[D,N);
@: 523

? MOD((153[D,N);
@: 856

? MOD((718[D,N);
@: 792

? MOD((252[D,N);
@: 400

? MOD((315[D,N);
@: 944

? MOD((371[D,N);
@: 297

? MOD((530[N);
@: 530

?
```

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Trapdoor Algorithm, continued...

bers N and E could factor N quickly, using the method in Listing 2, and so recover D. A little experimentation would show him that the message had

been divided into groups of three digits: only when he calculated groups of three raised to D, mod N, would he recover a range of about 26 two digit numbers.

Listing 2.

```
10 PRINT #0
20 DIM A(250),B(100),PR(45),X(10)
30 L=1
40 FOR I=1 TO 10: REM Read the prime values into array X.
50 READ X(I)
60 NEXT I
70 GOSUB 410
80 FOR I=1 TO 9: REM Get the different combinations of primes
90 FOR J=1 TO 10
100 A=X(I):B=X(J)
110 N=A*B: REM Form the product, called N.
120 PR=(A-1)*(B-1)
130 PRINT #0,USING"*****",A;B;N;A-1;B-1;
140 GOSUB 230
150 PR=PR/A+1
160 PR(L)=PR:L=L+1
170 PRINT #0,USING "*****",PR;
180 GOSUB 330
190 NEXT J
200 NEXT I
210 END
220 DATA 19,23,29,31,37,41,43,47,53,57
230 REM EUCLID'S GREATEST COMMON DIVISOR
240 A=A-1:B=B-1
250 IF A>B THEN T=A:A=B:B=T
260 C=B-INT(B/A)*A
270 IF C=0 THEN 310: REM: A is the greatest common divisor
280 IF C=1 THEN 320: REM THE NUMBERS ARE RELATIVELY PRIME
290 B=C
300 GOTO 250
310 PRINT #0,USING "****",A;:RETURN
320 PRINT #0,USING "****",1;:RETURN
330 REM FIND THE FACTORS
340 FOR Q=1 TO 55
350 D=B/Q
360 IF D=0 THEN 390
370 IF PR/D=INT(PR/D) THEN PRINT #0, USING"*****",D;PR/D:RETURN
380 NEXT Q
390 PRINT #0
400 RETURN
410 A=1:L=A:M=0:Q=250:N=16
420 FOR M=2 TO 250
430 IF A(M)=1 THEN NEXT M:GOTO 490
440 FOR J=M+M TO Q STEP M
450 IF J>250 THEN NEXT M:GOTO 490
460 A(J)=A
470 NEXT J
480 NEXT M
490 FOR K=2 TO Q: IF A(K)=0 THEN B(L)=K: L=L+1
500 NEXT K
510 L=0:I=L
520 RETURN
```

Listing 3.

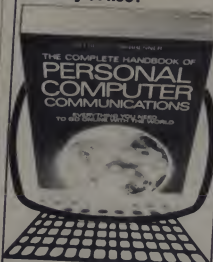
```
10 PRINT "This program converts messages into three=digit groups."
20 PRINT "Use only capital letters and spaces, spelling out num="
30 PRINT "bers and punctuation."
40 INPUT LINE A$
50 DIM A(LEN(A$))
60 L=LEN(A$)
70 FOR I=1 TO L
80 A(I)=ASC(LEFT$(A$,I))-54
90 A$=MID$(A$,2)
100 IF A(I)=-22 THEN A(I)=37
110 NEXT I
120 FOR J=1 TO L STEP 3
130 A=(A(J):B=A(J+1):C=A(J+2)
140 B=INT(B/10)
150 PRINT USING "****", 10*A+B:1
160 PRINT USING "****", 100*(B-10*B)+C
170 NEXT J
```


Worse still, a cryptographer looking at the cipher message would know immediately that some type of polyalphabetic substitution had been used. The methods of solving that type of cipher are well known and do not depend on a knowledge of the key. With a longer message, repetitions and frequency counts would provide valuable clues.

Returning to the trapdoor algorithm, I have one further point to make. The method requires obtaining D and E from P and Q. The security of the method de-

pends on choosing $P \cdot Q = N$ large enough that N cannot possibly be factored in a reasonable time. But D and E were obtained by factoring $GCD((P-1)(Q-1)+1)$, a number which will approach N in size. It looks, then, as though we shall find it as hard to select our keys as it would be for someone else to break our cipher. And as Table 1 illustrates, we could choose P and Q unwisely, in which case we would lose the labor we expend in trying to factor a prime number.

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Table 1.

P	Q	N	R	S	GCD	PROD	D	E
19	23	437	18	22	2	793		
19	29	551	18	28	2	1009	13	61
19	31	589	18	30	6	3241	7	463
19	37	703	18	36	18	11665	5	2333
19	41	779	18	40	2	1441	11	131
19	43	817	18	42	6	4537	13	349
19	47	893	18	46	2	1657		
19	53	1007	18	52	2	1873		
19	57	1083	18	56	2	2017		
23	29	667	22	28	2	1233	3	411
23	31	713	22	30	2	1321		
23	37	851	22	36	2	1585	5	317
23	41	943	22	40	2	1761	3	587
23	43	989	22	42	2	1849	43	43
23	47	1081	22	46	2	2025	3	675
23	53	1219	22	52	2	2289	3	763
23	57	1311	22	56	2	2465	5	493
29	31	899	28	30	2	1681	41	41
29	37	1073	28	36	4	4033	37	109
29	41	1189	28	40	4	4481		
29	43	1247	28	42	14	16465	5	3293
29	47	1363	28	46	2	2577	3	859
29	53	1537	28	52	4	5825	5	1165
29	57	1653	28	56	28	43905	3	14635
31	37	1147	30	36	6	6481		
31	41	1271	30	40	10	12001	11	1091
31	43	1333	30	42	6	7561		
31	47	1457	30	46	2	2761	11	251
31	53	1643	30	52	2	3121		
31	57	1767	30	56	2	3361		
37	41	1517	36	40	4	5761	7	823
37	43	1591	36	42	6	9073	43	211
37	47	1739	36	46	2	3313		
37	53	1961	36	52	4	7489		
37	57	2109	36	56	4	8065	5	1613
41	43	1763	40	42	2	3361		
41	47	1927	40	46	2	3681	3	1227
41	53	2173	40	52	4	8321	53	157
41	57	2337	40	56	8	17921		
43	47	2021	42	46	2	3865	5	773
43	53	2279	42	52	2	4369	17	257
43	57	2451	42	56	14	32929	13	2533
47	53	2491	46	52	2	4785	3	1595
47	57	2679	46	56	2	5153		
53	57	3021	52	56	4	11649	3	3883

The Apocalypse Equations

The last book of the Bible is that of Revelation or Apocalypse. It describes the end of this world with the Battle of Armageddon and the advent of the next and perfect world. Engendered by the growth of nuclear weaponry over the last 35 years and by massive and skillful Kremlin-fanned propaganda, there is a widespread fear of starting Armageddon by accidentally launching an armed nuclear missile from either the United States or Soviet Russia.

In the *Harvard Magazine* for March/April, 1982 appeared a letter by one Bradford Lyttle, of Chicago, presenting three forms of an equation which he says gives the probability of such an accidental Armageddon. The Apocalypse program, which follows, presents these equations so you may investigate the presumed probability of Apocalypse.

Probability is often expressed as a decimal between zero and one. A probability near zero indicates that the chances of a given event occurring are considered very low. A probability near one says that the chances are very high that the event will occur. Probabilities exceeding about 0.95 are often considered practically certain. Probability is expressed as a percentage in this program: 100% = 1.00, a certainty.

The Equations

The three equations use these symbols:

AP is the Probability of Apocalypse, that is, the probability over a period of time that the accidental launch of one nuclear missile by either the United States or the Soviet Union would falsely trigger a nuclear World War III.

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U is the total number of strategic missiles in the U.S. arsenal. The program suggests 1900. You may wish to adjust this.

S is the total number of strategic missiles in the Soviet arsenal. The program suggests 2200; again, you may adjust this value.

P is the probability of the accidental launching of an armed strategic nuclear missile by either the U.S. or the Soviet Union during any 24-hour period. The program suggests that there is one

**Run the program and
find out what the future
holds—if anything.**

chance in one hundred million of this: $1E-8$. Change this if desired.

N is the number of days in the period considered. You may enter whatever period you wish: the program suggests 14,600 days—40 years. You may consider that the clock started ticking perhaps 20 years ago, with a much smaller number of missiles.

The three equations given by Mr. Lyttle are:

Approximate:

$$AP = 1 - (1 - P(U + S))^N$$

Closer approximation:

$$AP = 1 - e^{-NP(U + S)}$$

Exact Form:

$$AP = 1 - (1 - P)^{NP(U + S)}$$

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It turns out that the values given by the first two equations are usually very close to one another, while the exact equation gives a slightly smaller value.

Program Structure

The Applesoft program consists of 14 sections or routines ranging from 1 to 12 lines each in length. In approximate order of operation, the main routines are:

1000-1090 Introduction
800- 890 Menu
600- 720 Entries
300- 370 Approximate Equation
400- 470 Closer Approximation
500- 570 Exact Equation
140- 180 Results

Brief routines handle such operations as centering phrases on the screen, rounding numbers, rejecting out-of-line values, and beeping three times. The Entries subroutine is designed to minimize number re-entries; after the initial entries, each re-entry with the same value can be made with one keystroke. The program is fairly well bullet-proofed and includes many REMARKS.

Variations

While the program considers strategic missiles of the U.S. and Soviet Russia only, the nuclear "club" is growing. You may modify the program accordingly.

You may wish to take a short-cut, at least for a minimum-effort trial. If so, try skipping lines 1000-1090 (Introduction).

If you do this, make line 10 read: GOTO 810. Of course, you may also omit the REMS. If you find the beeps annoying, delete lines 70-80 and GOSUB 80 in lines 200, 350, 450, 550, 890 and 1100.

Now, run the program and find out what the future holds—if anything. □

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The world dynamics model was originally written in *Dynamo* by Dr. Forrester at MIT. The entire computer model has now been written in *Atari Basic*, so that anyone may experiment with the capabilities of the model.

Dr. Forrester's model treats the world as a closed continuous system, and models each important parameter in the system. Variables which measure levels, sometimes known as state variables, in this model include population (P), natural resources (NR), capital investment (CI), pollution (POL) and the fraction of capital devoted to agriculture (CIAF).

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Mark Lewis Baldwin

through a set of relationships. It is the definition of these relationships which

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Let us examine a small portion of the

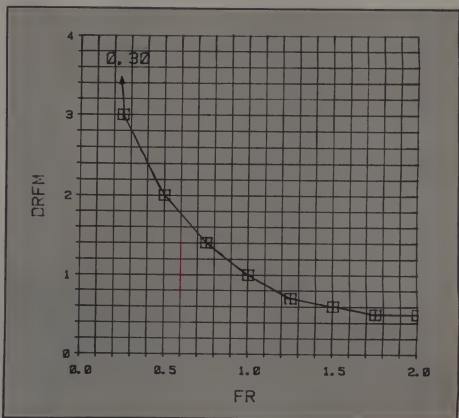


Figure 1. Death-rate-from-food multiplier vs. food ratio.

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CIRCLE 154 ON READER SERVICE CARD

model. The population of the earth is affected directly by two factors, the death rate and the birth rate. If we were modeling a smaller system such as a country, we would also have to include immigration and emigration.

The birth rate in the world is approximately 4 percent per year. In the model, this value is BRN for Birth Rate Normal. Likewise, the death rate (DRN) is at 2 percent. These rates are approximations based on the year 1970 and include the entire world, not just the United States.

If these rates stayed the same, we would be able by simple integration to predict the world population at any future time, but these rates vary for many reasons. If the available food (Food Ratio, FR) decreases, the death rate varies in some inverse proportion until no food at which point the death rate becomes 100 percent. On the other hand, if an infinite food supply is available, the death rate does not drop to zero but asymptotically approaches some value that is less than what currently exists today.

Figure 1 shows the relationship between food and death rate incorporated into the model. This table appears on line 8290 in the program. Other factors which influence the death rate include crowding (CR), pollution (POLR), and the material standard of living (MSL). All of the other rates in the model are controlled by the same types of considerations.

The model then integrates the values over time and we have our world simulation. The Basic version uses only a first order integration scheme with a step size of one year. Better integration schemes could be used but it seemed impractical considering the original approximations in the model.

What happens when we incorporate all of these factors? Figure 2 is a plot produced on an Atari showing some of the important variables and how they change with time. Variable values plotted include population, pollution, capital investment, food, natural resources, and the quality of life.

If the model is accurate, it shows that if the world continues on its current path, the population will peak in the year 2020. At the same time, the quality of life (Q)

Figure 2. The world on its current path.

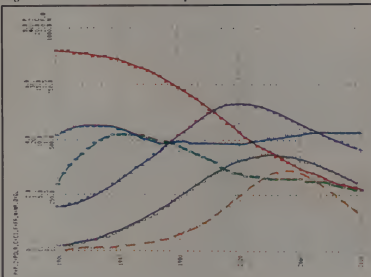


Figure 3. The world with a 25% reduction in birth rate.

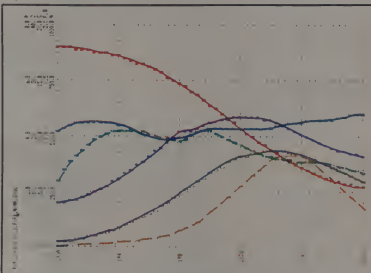
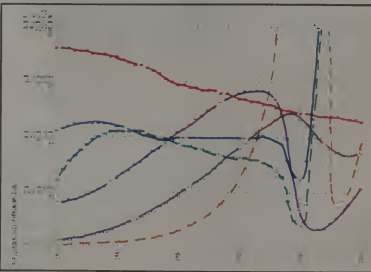


Figure 4. The world with a 75% reduction in the usage of natural resources.



Color	Symbol	Description
Red	N	Natural resources
Blue	F	Food ratio
Green	Q	Quality of life
Purple	P	Population
Brown	C	Capital Investment
Orange	2	Pollution Ratio

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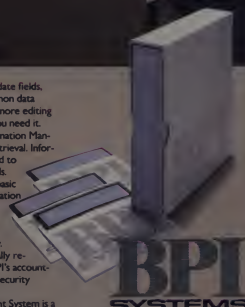
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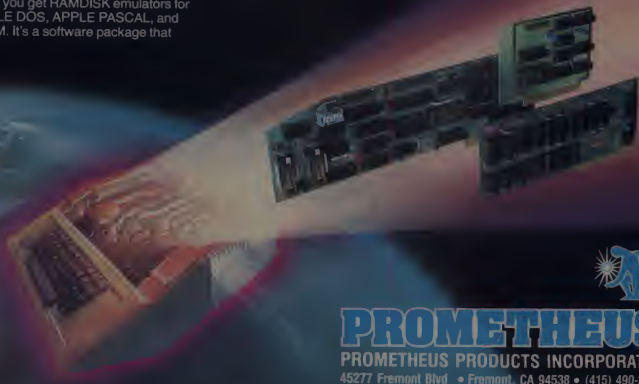
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Limits to Growth, continued...

will decrease significantly. One of the important detrimental factors will be a large scale increase in pollution and a drop in natural resources (NR).

Can we do something about this? One of the most common suggestions is to

control the birth rate. This is simple to test by inserting the following statement:
1495 IF TIME>1980 THEN BRN=.03

What we have done is decrease the birth rate by 25 percent to 3 percent starting in 1980. Figure 3 shows the results

of this experiment. The change in birth rate helped some temporarily, but in the long run seemed to have little effect.

What else can we try? Well, the government is always asking us to conserve our resources. Let's try cutting the consump-

Table 1. Micro-World Dynamics Variables

BR	Birth Rate (people/year)	LA	Land Area (square kilometers)
BRCM	Birth Rate from Crowding Multiplier (dimensionless)	MSL	Material Standard of Living (dimensionless)
BRFM	Birth Rate from Food Multiplier (dimensionless)	NR	Natural Resources (natural resource units)
BRMM	Birth Rate from Material Multiplier (dimensionless)	NREM	Natural Resource Extraction Multiplier (dimensionless)
BRN	Birth Rate Normal (fraction/year)	NRFR	Natural Resource Fraction Remaining (dimensionless)
BRPM	Birth Rate from Pollution Multiplier (dimensionless)	NRI	Natural Resource, Initial (natural resource initial)
CFIFR	Capital Fraction Indicated by Food Ratio (dimensionless)	NRMM	Natural Resource from Material Multiplier (dimensionless)
CI	Capital Investment (capital units)	NRUN	Natural Resource Usage Normal (natural resource units/person/year)
CIAF	Capital Investment in Agriculture Fraction (dimensionless)	NRUR	Natural Resource Usage Rate (natural resource units/person/year)
CIAFN	Capital Investment in Agriculture Fraction Normal (dimensionless)	P	Population (people)
CIAPT	Capital Investment in Agriculture Fraction adjustment Time (years)	PDN	Population Density Normal (people/square kilometer)
CID	Capital Investment Discard (capital units/year)	POL	Pollution (pollution units)
CIDN	Capital Investment Discard Normal (fraction/year)	POLA	Pollution Absorption (pollution units/year)
CIG	Capital Investment Generation (capital units/year)	POLAT	Pollution Absorption Time (years)
CIGN	Capital Investment Generation Normal (capital units/person/year)	POLCM	Pollution from Capital Multiplier (dimensionless)
CIM	Capital Investment Multiplier (dimensionless)	POLG	Pollution Generation (pollution units/year)
CIRQ	Capital Investment from Quality Ratio (dimensionless)	POLN	Pollution Normal (pollution units/person/year)
CIR	Capital Investment Ratio (capital units/person)	POLR	Pollution Ratio (dimensionless)
CIRA	Capital Investment Ratio in Agriculture (capital units/person)	POLS	Pollution Standard (pollution units)
CR	Crowding Ratio (dimensionless)	QL	Quality of Life (satisfaction units)
DR	Death Rate (people/year)	QLC	Quality of Life from Crowding (dimensionless)
DRCM	Death Rate from Crowding Multiplier (dimensionless)	QLF	Quality of Life from Food (dimensionless)
DRFM	Death Rate from Food Multiplier (dimensionless)	QLM	Quality of Life from Material (dimensionless)
DRMM	Death Rate from Material Multiplier (dimensionless)	QLP	Quality of Life from Pollution (dimensionless)
DRN	Death Rate Normal (fraction/year)	QLS	Quality of Life Standard (satisfaction units)
DRPM	Death Rate from Pollution Multiplier (dimensionless)	TIME	Calendar Time (years)
ECIR	Effective Capital Investment Ratio (capital units/person)	Other Program Variables	
ECIRN	Effective Capital Investment Ratio Normal (capital units/person)	B5	String containing blanks
FC	Food Coefficient (dimensionless)	DT	Integration step size (years)
FCM	Food from Crowding Multiplier (dimensionless)	DVAL	Output value from table lookup routine
FN	Food Normal (food units/person/year)	GRAPH	Address of screen graph subroutine
FPCI	Food Potential from Capital Investment (food units/person/year)	IJ	Temporary loop counters
FPM	Food from Pollution Multiplier (dimensionless)	INTVL	X interval in table lookup routine
FR	Food Ratio (dimensionless)	IVAL	Input value for table lookup routine
		MARK	Address of subroutine to mark screen plot
		P5	String containing print line for printer routine
		PRNT	Address of subroutine to print plot
		TAB	Table to be looked up
		TABLE	Array containing tables to lookup relationships or variables
		TABLX	Address of table lookup routine
		X	Horizontal position for plot routines
		XLOI	X low for table lookup routine
		Y	Vertical position for plot routines

Limits to Growth, continued...

tion of natural resources by 75 percent. This is easily done by adding the following line:

```
1495 IF TIME>1980 THEN NRUN=-.25
```

Look at Figure 4 for the results. A policy of reducing natural resource usage alone could be catastrophic to the world, by the year 2060, cutting our population by 80 percent. Here is an example of an obvious solution doing the opposite of what anyone would expect. Thought and analysis need to go into the decisions made by our world leaders.

That is where this model and more detailed variations of it are important. It allows us to examine and experiment with systems which are complex in nature without destroying what we are testing. That is the real value of any computer model.

The Basic program is shown in Listing 1. Table 1 lists all of the variables. For simplicity, the variable names are the same as those used in the original model.

Four of the subroutines in the program are specific to the Atari as they enable the computer to plot the results. Subroutine 10000 initializes the plotting routine for the screen while 12000 does the same for an Epson MX-80 printer. Routines 11000 and 13000 plot the data on the screen and printer respectively.

The rest of the program should be easily translatable into other Basics, so you need only write your own output routines.

A large number of simplifications and assumptions were required in the original model. Although there has been a great

deal of argument in academic circles about the accuracy of Forrester's model, it is a first attempt at solving and describing a complex system, and it does provide some insights into the problem.

Don't just run the program, experiment with it. Vary the parameters and see what you can do with the world in your computer.

References

- Forrester, Jay W., *World Dynamics* (Cambridge: Wright-Allen Press, 1971).
- Meadows, Donella H.; Meadows, Dennis L.; Randers, Jorgen; and Behrens, William W. III, *The Limits To Growth, A Report For The Club Of Rome Project On The Predicament Of Mankind* (New York: Universe Books, 1972). □

```
10 REM *****
11 REM * MICRO-WORLD DYNAMICS *
12 REM *
13 REM * BASED ON WORLD DYNAMICS
14 REM * BY J W FORRESTER (1972) *
15 REM * AND LIMITS TO GROWTH *
16 REM * BY D L MEADOWS (1972) *
17 REM *
18 REM * WRITTEN BY MARK BALDWIN *
19 REM * BEACON TECHNICAL SERVICES *
20 REM *****
21 PRINT " MICRO-WORLD DYNAMICS "
22 PRINT " BASED ON WORLD DYNAMICS BY "
23 PRINT " J W FORRESTER (1972) "
24 PRINT " AND LIMITS TO GROWTH BY "
25 PRINT " D L MEADOWS (1972) "
26 PRINT
27 PRINT " BY MARI LEWIS BALDWIN "
28 PRINT " PLEASE WAIT . . ."
29
30 DIM TABLE(21,12)
31
32 TABLE=9000
33 GRAPH=11000
34 MAT=81900
35 PRINT=13000
36
100 REM INITIALIZE WORLD
101 P=1650000000
102 REM POPULATION (PEOPLE)
103 DRN=0.04
104 REM BIRTH RATE NORMAL (FRACTION/YEAR)
105 TIME=1970
106 REM SIMULATION START TIME
107 NR=9541
108 REM NATURAL RESOURCES (NATURAL RESOURCE UNITS)
109 ECIR=1
110 REM EFFECTIVE CAPITAL INVESTMENT RATIO NORMAL (CAPITAL UNITS/PERSON)
111 DRN=0.028
112 REM DEATH RATE NORMAL(FRACTION/YEAR)
113 PDN=26.5
114 REM POPULATION DENSITY NORMAL (PEOPLE/SQUARE KILOMETER)
115 FC=1
116 REM FOOD COEFFICIENT (DIMENSIONLESS)
117 CIAPN=0.3
118 REM CAPITAL INVESTMENT IN AGRICULTURE FRACTION NORMAL (DIMENSIONLESS)
119 CI=410000000
120 REM CAPITAL INVESTMENT (CAPITAL UNITS)
121 CIGN=0.05
122 REM CAPITAL INVESTMENT GENERATION NORMAL (CAPITAL UNITS/PERSON/YEAR)
123 CIMD=0.025
124 REM CAPITAL INVESTMENT DISCARD NORMAL (FRACTION/YEAR)
```



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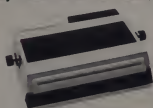
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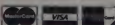
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Limits to Growth, continued...

```

113 POLS=3600000000
:REM POLLUTION STANDARD (POLLUTION UNITS)
114 POL=200000000
:REM POLLUTION (POLLUTION UNITS)
115 POLN=1
:REM POLLUTION NORMAL (POLLUTION UNITS/PERSON/YEAR)
116 CIAF=0.2
:REM CAPITAL INVESTMENT IN AGRICULTURE FRACTION (DIMENSIONLESS)
117 CIAFT=15
:REM CAPITAL INVESTMENT IN AGRICULTURE FRACTION ADJUSTMENT TIME (YEARS)
118 DLS=1
:REM QUALITY OF LIFE STANDARD (SATISFACTION UNITS)
119 DT=1
:REM TIME STEP SIZE (YEARS)
120 LA=135000000
:REM LAND AREA (SQUARE KILOMETERS)
121 FNM=1
:REM FOOD NORMAL (FOOD UNITS/PERSON/YEAR)
123 NRUN=1
130 GOSUB 8000
:REM INITIALIZE TABLES
140 GOSUB 10000
:REM INITIALIZE SCREEN PLOT
150 GOSUB 12000
:REM INITIALIZE PRINTER PLOT
1000 REM WORLD LOOP
1001 NRFR=NR/NRI
1010 CR=P/(LA*PDN)
1020 CIR=CI/P
1030 TAB=0
:IVAL=NRFR
:GOSUB TABLK
:NREM=DVAL
1040 ECIR=CIR*(1-CIAF)*NREM/(1-CIAFN)
1050 MSL=ECIR/ECIRN
1060 TAB=1
:IVAL=MSL
:GOSUB TABLK
:BRMM=DVAL
1070 TAB=2
:IVAL=MSL
:GOSUB TABLK
:DRMM=DVAL
1080 TAB=3
:IVAL=CR
:GOSUB TABLK
:DRCM=DVAL
1090 TAB=4
:IVAL=CR
:GOSUB TABLK
:BRCM=DVAL
1100 CIRA=CIR*CIAF/CIAFN
1110 TAB=5
:IVAL=CIRA
:GOSUB TABLK
:FPCI=DVAL
1120 TAB=6
:IVAL=CR
:GOSUB TABLK
:FCM=DVAL
1130 POLR=POL/POLS
1140 TAB=7
:IVAL=POLR
:GOSUB TABLK
:FPM=DVAL
1150 FR=FPCI*FCM*FPM*FC/FN
1160 TAB=8
:IVAL=MSL
:GOSUB TABLK
:CIM=DVAL
1170 TAB=9
:IVAL=CIR
:GOSUB TABLK
:POLCM=DVAL

```




```

1180 TAB=10
:IVAL=POLR
:GOSUB TABLK
:POLAT=DVAL
1190 TAB=11
:IVAL=FR
:GOSUB TABLK
:CFIFR=DVAL
1200 TAB=12
:IVAL=MSL
:GOSUB TABLK
:OLM=DVAL
1210 TAB=13
:IVAL=CR
:GOSUB TABLK
:OLC=DVAL
1220 TAB=14
:IVAL=FR
:GOSUB TABLK
:OLF=DVAL
1230 TAB=15
:IVAL=POLR
:GOSUB TABLK
:OLF=DVAL
1240 TAB=16
:IVAL=MSL
:GOSUB TABLK
:NRHM=DVAL
1250 TAB=17
:IVAL=OLM/OLF
:GOSUB TABLK
:CIDK=DVAL
1260 TAB=18
:IVAL=POLR
:GOSUB TABLK
:DRFM=DVAL
1270 TAB=19
:IVAL=FR
:GOSUB TABLK
:DRFM=DVAL
1280 TAB=20
:IVAL=FR
:GOSUB TABLK
:BRFM=DVAL
1290 TAB=21
:IVAL=POLR
:GOSUB TABLK
:BRFM=DVAL
1300 REM RATE COMPONENTS
1310 BR=P*BRN*BRFM*BRMM*BRM*BRM*BRM
1320 DR=P*DRN*DRHM*DRFM*DRM*DRM*DRM
1330 NRUR=P*NRUN*NRMM
1340 CIG=P*CIM*CIGN
1350 CID=CI*CIDN
1360 POLG=P*POLN*POLCM
1370 POLA=POL/POLAT
1400 REM LEVELS
1410 OL=DLS*OLM*OLC*OLF*OLF
1420 P=P+DT*(BR-DR)
1430 NR=NR-DT*NRUR
1440 CI=CI+DT*(CIG-CID)
1450 POL=POL+DT*(POLG-POLA)
1470 CIAF=CIAF+DT*(CFIFR*CIOR-CIAF)/CIAFT
1480 GOSUB GRAPH
:GOSUB PRNT
:REM GRAPHS DATA
1490 TIME=TIME+DT
1500 IF TIME<2102 THEN
1000
1510 GO TO 1510
8000 FOR I=0 TO 21
:FOR J=0 TO 12
8020 READ DATA
:TABLE(I,J)=DATA
:NEXT J
:NEXT I

```



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CIRCLE 140 ON READER SERVICE CARD

Limits to Growth, continued...

```

8030 RETURN
8100 DATA 0.1,0.25,0.0.15,0.5,0.85,1,1,1,1,1,1
8110 DATA 0.5,1.1.2.1,0.85,0.75,0.7,0.7,0.7,0.7,0.7
8120 DATA 0.4,5.0.5,3,1.8,1,0.8,0.7,0.6,0.53,0.5,0.5,0.5
8130 DATA 0.5,1.0.9,1.1.2,1.5,1.9,3,3,3,3,3
8140 DATA 0.5,1.1.05,1.0.9,0.7,0.6,0.55,0.55,0.55,0.55,0.55
8150 DATA 0.6,1.0.5,1.1.4,1.7,1.9,2.05,2,2,2,2,2,2
8160 DATA 0.5,1.2.4,1,0.6,0.4,0.3,0.2,0.2,0.2,0.2,0.2
8170 DATA 0.6,1.0,1,1.02,0.9,0.65,0.35,0.2,0.1,0.05,0.05,0.05
8180 DATA 0.5,1.0,1,1.8,2.4,2.8,3,3,3,3,3
8190 DATA 0.5,1.0.05,1,3,5,4,7,4,8,8,8,8
8200 DATA 0.6,1.0,0.6,2.5,5,8,11,5,15,5,20,20,20
8210 DATA 0.2,0.5,1.0,0.6,0.3,0.15,0.1,0.1,0.1,0.1,0.1
8220 DATA 0.5,1.0.2,1,1.7,2.3,2.7,2.9,2.9,2.9,2.9,2.9
8230 DATA 0.4,5.0.5,2,1.3,1,0.75,0.55,0.45,0.38,0.3,0.25,0.2
8240 DATA 0.4,1.0,1,1.8,2.4,2.7,2.7,2.7,2.7,2.7,2.7
8250 DATA 0.6,1.0,1.04,0.85,0.6,0.3,0.15,0.05,0.02,0.02,0.02,0.02
8260 DATA 0.9,1,0,1,1.8,2.4,2.9,3,3,3,3,3,3
8270 DATA 0.2,0.5,0.7,0.8,1,1.5,2,2,2,2,2,2
8280 DATA 0.6,1.0,0.92,1.3,2.3,2,4,8,6.8,9,2,9,2,9,2
8290 DATA 0.2,0.25,3,3,2,1.4,1,0.7,0.6,0.5,0.5,0.5
8300 DATA 0.4,1,0,1,1.6,1.9,2,2,2,2,2,2
8310 DATA 0.6,1.0,1.02,0.9,0.7,0.4,0.25,0.15,0.1,0.1,0.1,0.1
9000 REM TABLE LOOKUP SUBROUTINE
9010 IF IVAL<=TABLE(TAB,0) THEN
      DVAL=TABLE(TAB,3)
      :RETURN
9020 IF IVAL>=TABLE(TAB,1) THEN
      DVAL=TABLE(TAB,12)
      :RETURN
9030 INTVL=INT((IVAL-TABLE(TAB,0))/TABLE(TAB,2))
9040 XLOI=TABLE(TAB,2)*INTVL
9050 DVAL=TABLE(TAB,INTVL+3)+(TABLE(TAB,INTVL+4)-TABLE(TAB,INTVL+3))*(IVAL-XLOI)
      :/TABLE(TAB,2)
9060 RETURN
10000 REM SET UP PLOT
10010 GOSUB 32000
10020 SETCOLOR 0,1,10
      :SETCOLOR 1,5,10
      :SETCOLOR 2,10,10
10030 COLOR 4
      :PLOT 9,0
      :PLOT 10,0
      :DRAWTO 10,160
      :PLOT 9,40
      :PLOT 9,80
      :PLOT 9,120
10040 PLOT 10,160
      :DRAWTO 70,160
10050 FOR I=16 TO 71 STEP 5
      :PLOT I,160
      :PLOT I,164
      :NEXT I
10060 RETURN
11000 REM DRAW DATA
11005 X=10*(TIME-1900)/4
11010 COLOR 10
      :Y=159-160*(P)/1E+10
      :GOSUB MARK
11020 COLOR 8
      :Y=159-160*DL/2
      :GOSUB MARK
11030 COLOR 7
      :Y=159-160*NR/1E+12
      :GOSUB MARK
11040 COLOR 5
      :Y=159-160*POLR/40
      :GOSUB MARK
11050 COLOR 9
      :Y=159-160*CI/2E+10
      :GOSUB MARK
11060 COLOR 1
      :Y=159-160*FR/2
      :GOSUB MARK
11800 RETURN

```



Limits to Growth, continued...

```

11900 IF V<0 THEN
    Y=0
    :COLOR 0
11910 IF V>159 THEN
    V=159
11920 PLOT X,Y
    :RETURN
12000 REM PRINTER SET UP ROUTINE FOR MX-80
12010 DIM P$(150),B$(130)
    :FOR I=1 TO 150
        :B$(I,1)=" "
    :NEXT I
12020 LPRINT CHR$(15);CHR$(27);CHR$(85);CHR$(1);CHR$(27);CHR$(72);CHR$(27);"0"
12030 LPRINT "P=P,2=POLR,C=C1,F=FR,N=NR,Q=DL"
    :LPRINT
12040 LPRINT "          0.          2.B          4.B
        6.B          8.B P"
12050 LPRINT "          0.          10.          20.
        30.          40. 2"
12060 LPRINT "          0.          5.B          10.B
        15.B          20.B C"
12070 LPRINT "          0.          .5          1.0
        1.5          2.0 F,Q"
12080 LPRINT "          0.          250.B          500.B
        750.B          1000.B N"
12100 RETURN
13000 REM PRINTER PLOT ROUTINE FOR MX-80
13010 IF INT((TIME/4)*4)<TIME THEN
    RETURN
13020 P$=B$
    :IF INT((TIME-100)/40)*40=TIME-100 THEN
        13050
13030 FOR I=11 TO 91 STEP 20
    :P$(I,1)="."
    :NEXT I
    :GOTO 13100
13050 P$(6,10)=STR$(TIME)
    :FOR I=11 TO 91 STEP 2
        :P$(I,1)="."
    :NEXT I
13100 X=11+DL/0.025
    :IF X<92 THEN
        P$(X,X)="Q"
13110 X=11+NR/1.25E+10
    :IF X<92 THEN
        P$(X,X)="N"
13120 X=11+FR/0.025
    :IF X<92 THEN
        P$(X,X)="F"
13130 X=11+C1/250000000
    :IF X<92 THEN
        P$(X,X)="C"
13140 X=11+POLR/0.2
    :IF X<92 THEN
        P$(X,X)="2"
13150 X=11+P/100000000
    :IF X<92 THEN
        P$(X,X)="P"
13300 LPRINT P$
13310 RETURN
13000 REM SETS UP MULTI COLOR GRAPHICS MODE
13010 GRAPHICS 24
13020 DL=FEEK(560)+256*PEEK(561)
13030 POKE 559,0
13040 POKE DL+3,7B
    :POKE DL+99,7B
13050 FOR INSERT=DL+6 TO DL+9B
13060 POKE INSERT,14
13070 NEXT INSERT
13080 FOR INSERT=DL+102 TO DL+19B
13090 POKE INSERT,14
13100 NEXT INSERT
13110 POKE 87,10
13120 POKE 559,34
13130 RETURN

```



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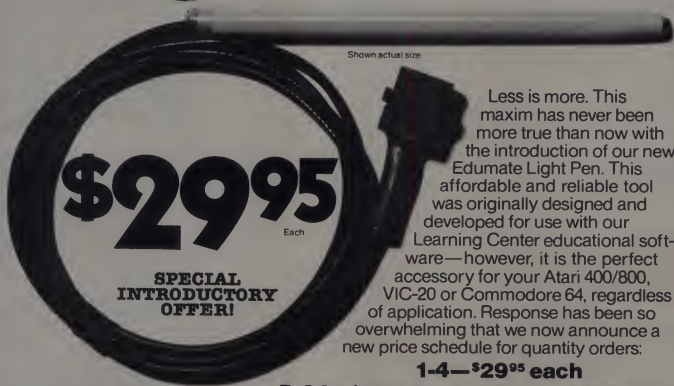
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A Comparison of Sorts, Revisited

Howard Kaplon

During a recent search for a better sorting routine, a colleague offered the article "A Comparison of Sorts" by John Grillo (Nov/Dec 1976—*Some people never discard their issues of Creative—EBS*). Previously, I had always used the bubble sort technique for exactly the reasons given in the Grillo article: it was a simple technique and one which was very familiar. According to the article, the Shell-Metzner sorting routine would end the search.

However, another colleague suggested that a technique called quicksort described in *The Art of Computer Programming*, Vol. III by Knuth be investigated. Having programmed this algorithm and modified it slightly, I wanted to see how it compared with the Shell-Metzner sort.

An empirical approach seemed the most direct way to compare the two sorting routines. The bubble sort was also included in the comparisons. At the end of this article (Listing 1) is the Basic program I used to make the comparisons. It is the Basic program given in "A Comparison of Sorts" that was modified for use on a Univac 1106 system and had the

Howard Kaplon, Towson State University, Towson, MD 21204.

Table I. Sort Execution Data.

		N						
Technique		10	20	50	100	200	500	1000
Bubble	T	17	70	379	1501	6241	38890	155642
	S	19	123	600	2329	9744	62181	252427
	C	45	190	1225	4950	19900	124750	499500
Shell-Metzner	T	15	42	125	302	948	2127	5280
	S	11	47	160	427	1050	2827	7415
	C	30	98	339	882	2162	6078	14890
Quicksort	T	12	29	98	233	505	1595	3526
	S	11	33	116	237	615	1851	4013
	C	22	69	286	790	1599	5443	12083

Table IA. Sort Execution Data.

		N		
Technique		2000	3000	4000
Shell-Metzner	T	13239	19503	33882
	S	17732	28725	49084
	C	34721	57173	87077
Quicksort	T	7541	11635	18227
	S	9175	14745	20310
	C	25195	38507	55549

Comparison of Sorts, continued...

quicksort technique appended to it.

Tables I and I-A summarize information on sorting arrays of 10, 20, 50, 100, 200, 500, and 1000 items by each of the three techniques. Additionally, arrays of 2000, 3000, and 4000 items were sorted by the Shell-Metzner and quicksort techniques. Each of the arrays consisted of a random sample generated from a normal distribution with a mean of 5000 and a standard deviation of 2000. The codes are: T = time of execution in milliseconds on a Univac 1106 time sharing system provided by the Maryland State Colleges Information Center, S = number of times that pairs of elements were switched, C = number of times that pairs of elements were compared, and N = number of items in the array.

As in the Grillo article, a regression model of the form $T = AN^B$ was used to predict the sorting time (T) from the array size (N). Table II gives the estimated regression equation for each of the three techniques. Using these equations and extrapolating, I calculated the predicted sorting times for large arrays as shown in Table III.

Differences between the values presented in Tables I, I-A and III of this article and the corresponding values that Grillo presented may be attributed to the different operating systems. However, the

figures themselves are not nearly as important as the comparison among the three techniques.

What has been accomplished? First of all, we see the logic of the quicksort algorithm is much clearer than that of the Shell-Metzner algorithm. Briefly, the quicksort routine chooses a pivot element (the first element in this case) of the array and divides the array into two subarrays

such that the left subarray contains all of the elements that are less than the pivot. The larger of the subarrays is put on a stack. The smaller subarray is further divided by its pivot into two subarrays. This process is repeated with each larger subarray being put on the stack until a smaller subarray has fewer than ten elements. This subarray is then bubble sorted, and the last subarray on the stack

Table II. Estimated Regression Equations.

Technique	Number of Data Points	$T = AN^B$
Bubble	7	$T = 0.176N^{1.978}$
Shell-Metzner	10	$T = 0.924N^{1.259}$
Quicksort	10	$T = 0.821N^{1.206}$

Table III. Extrapolated Predicted Sorting Times.

Array Size	Technique		
N	Bubble	Shell-Metzner	Quicksort
10,000	3.99 hours	1.67 minutes	0.91 minutes
100,000	15.81 days	30.37 minutes	14.66 minutes
1,000,000	4.13 years	9.19 hours	3.93 hours
10,000,000	392.55 years	6.95 days	2.63 days



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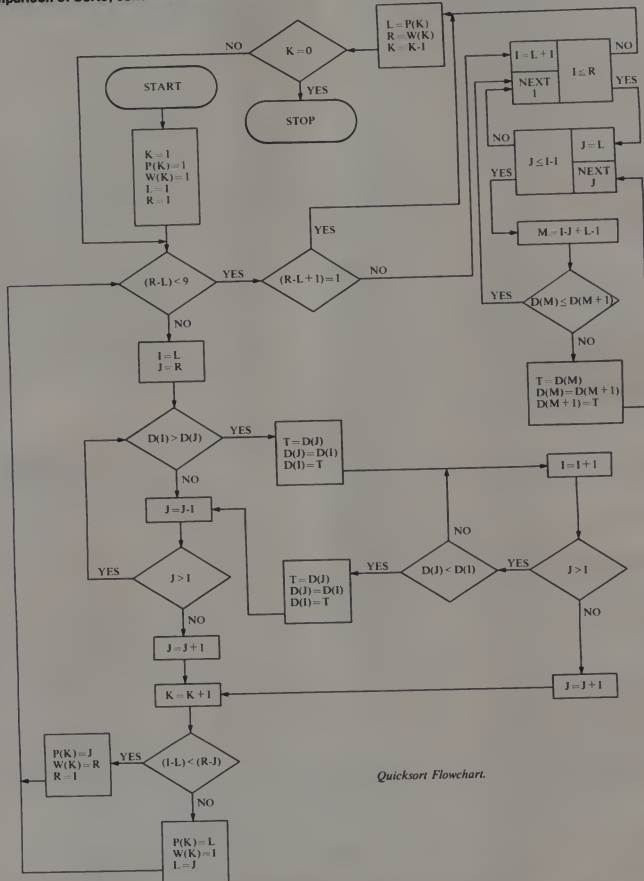
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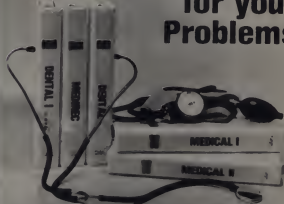
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Quicksort Flowchart.

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Comparison of Sorts, continued...

Table IV. Alternative Estimated Regression Equations.

Technique	Number of Data Points	Sorting Time Function
Bubble	7	$T = 0.156 N^2$
Shell-Metzner	7	$T = 0.753 N \ln(N)$
Shell-Metzner	8	$T = 0.847 N \ln(N)$
Shell-Metzner	9	$T = 0.824 N \ln(N)$
Shell-Metzner	10	$T = 0.934 N \ln(N)$
Quicksort	7	$T = 0.510 N \ln(N)$
Quicksort	8	$T = 0.499 N \ln(N)$
Quicksort	9	$T = 0.489 N \ln(N)$
Quicksort	10	$T = 0.523 N \ln(N)$

Table V. Average Alternative Estimated Regression Equations.

Technique	Sorting Time Function	Standard Deviation of the Coefficient K
Bubble	$T = 0.156 N^2$	
Shell-Metzner	$T = 0.840 N \ln(N)$	0.065
Quicksort	$T = 0.505 N \ln(N)$	0.013

Table VI. Alternative Extrapolated Predicted Sorting Times.

Array Size	Technique		
N	Bubble	Shell-Metzner	Quicksort
10,000	4.33 hours	1.29 minutes	0.78 minutes
100,000	10.06 days	16.12 minutes	9.69 minutes
1,000,000	4.96 years	3.22 hours	1.94 hours
10,000,000	496.03 years	1.57 days	0.94 days

when $N = 2000, 3000,$ and 4000 added one point at a time, three additional estimated regression equations were computed for each of the Shell-Metzner and quicksort techniques. These equations are given in Table IV. For the Shell-Metzner and quicksort techniques, the four estimated values of K were averaged. These average estimated regression equations, the standard deviations of K , and the equation for the bubble sorting time are given in Table V. The extrapolated sorting times for large arrays are shown in Table VI.

The conclusions that may be drawn from Table V are very similar to those already drawn from Table II, except that quicksort is now predicted to be a constant 1.663 times as fast as Shell-Metzner. However, I think that the values of extrapolated predicted sorting times in Table

VI are more accurate than those in Table III when executed on the Univac 1106.

In conclusion, while the understanding of the logic of the Shell-Metzner sort algorithm provides an interesting exercise, and while its sorting time is faster than that of the bubble sort, the delayed replacement sort and several other techniques, it is less efficient than quicksort. And so it seems that when internal sorting techniques are discussed, quicksort should be among those presented. Among the advantages of quicksort are: it allows for experimentation with different simple sorting routines for the subarrays of fewer than ten elements; it allows for variation in the number of elements at which the smaller subarray is to be bubble or otherwise simple sorted to optimize the execution time on each operating system; and it is easily programmed, clear, and quick.

Listing 1.

```

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Comparison of Sorts, continued...

```
00160 INPUT S$
00170 IF S$="YES" GO TO 270
00180 PRINT
00190 PRINT "SELECT SORTING ALGORITHM"
00200 PRINT
00210 PRINT "TYPE      TO USE"
00220 PRINT "  B      BUBBLE SORT"
00230 PRINT "  R      DELAYED REPLACEMENT"
00240 PRINT "  S      SHELL - METZNER"
00250 PRINT "  K      QUICKSORT"
00260 INPUT S$
00270 PRINT
00280 PRINT "TYPE THE FOLLOWING: SAMPLE SIZE, MEAN, STD. DEV."
00290 S2=S4=F=0
00300 X1=TIM
00310 INPUT Y,M,S
00320 IF Y<4000 GO TO 370
00330 PRINT "MAXIMUM SIZE = 4000"
00340 GO TO 280
00350 REM
00360 REM
00370 REM COMPUTE RANDOM NOS. USING CENTRAL LIMIT THEOREM TECHNIQUE
00380 FOR N=1 TO Y
00390 R=0
00400 FOR J=1 TO 12
00410 R=R+RND
00420 NEXT J
00430 R=M+S*(R-6)
00440 D(N)=INT(R)
00450 S2=S2+D(N)
00460 S4=S4+D(N)*D(N)
00470 NEXT N
00480 X2=TIM-X1
00490 PRINT
00500 PRINT
00510 PRINT
00520 PRINT "Y1' RANDOM NUMBERS GENERATED IN 'X2' SECONDS."
00530 PRINT
00540 PRINT
00550 N2=S2/Y
00560 V2=S4-M2#S2
00570 V2=V2/(Y-1)
00580 PRINT "MEAN = 'M2"
00590 PRINT "STD. DEV. = 'SQR(V2)"
00600 PRINT
00610 PRINT
00620 PRINT "WHAT FORM OF OUTPUT DO YOU WANT?"
00630 PRINT
00640 PRINT "TYPE      IF YOU WANT"
00650 PRINT "  G      HISTOGRAM ON TTY"
00660 PRINT "  T      NUMBERS ON TTY"
00670 PRINT "  F      NUMBERS ON FILE"
00680 PRINT "  TS     NUMBERS ON TTY, SORTED"
00690 PRINT "  FS     NUMBERS ON FILE, SORTED"
00700 INPUT O$
00710 C$=CPY$(O$+1,1)
00720 D$=CPY$(O$+LEN(O$),1)
00730 IF C$="F" GO TO 810
00740 PRINT
00750 PRINT "A TEMPORARY FILE OF THE FORM: YOUR PROJECT-ID#F$."
00760 PRINT "HAS BEEN ASSIGNED TO THIS RUN. TO PRINT THE CONTENTS"
00770 PRINT "OF THIS FILE, YOU MUST EXIT THE BASIC COMPILER AND"
00780 PRINT "USE THE RED F$, OR BDATA=L F$, COMMANDS."
00790 PRINT
00800 OPEN F$ FOR TEMPORARY OUTPUT AS FILE 1
00810 IF D$="G" GO TO 860
00820 IF F$=1 GO TO 840
00830 GOSUB 1470
00840 GOSUB 1260
00850 GO TO 1120
00860 IF D$="S" GO TO 890
00870 IF F$=1 GO TO 890
00880 GOSUB 1470
00890 IF C$="F" GO TO 990
00900 FOR A=1 TO Y STEP 10
00910 FOR B=A TO A+9
00920 IF B>Y GO TO 1120
00930 WRITE ON 1: D(B);
00940 NEXT B
00950 WRITE ON 1:
00960 NEXT A
00970 CLOSE 1
00980 GO TO 1140
00990 IF C$="T" GO TO 1040
01000 IF LEN(O$)>0 GO TO 1020
01010 STOP
01020 PRINT "IMPROPER OUTPUT CODE, TRY AGAIN!"
01030 GO TO 600
01040 PRINT
```

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Comparison of Sorts, continued...

```
01050 FOR A=1 TO Y STEP 10
01060 FOR B=A TO A+9
01070 IF B=Y GO TO 1120
01080 PRINT D(B);
01090 NEXT B
01100 PRINT
01110 NEXT A
01120 PRINT
01130 PRINT
01140 PRINT 'DIFFERENT OUTPUT?'
01150 INPUT Q$
01160 IF Q$='YLS' GO TO 630
01170 IF Q$='NO' GO TO 710
01180 PRINT
01190 PRINT 'DO YOU WANT ANOTHER SET OF NUMBERS?'
01200 INPUT T$
01210 IF T$='YES' GO TO 270
01220 STOP
01230 REM
01240 REM
01250 REM GRAPHING ROUTINE
01260 L=D(1)
01270 H=D(1)
01280 T=(H+L)/50
01290 PRINT
01300 PRINT 'GRAPH OF ; ; NUMBERS PRODUCED;'
01310 PRINT MAX(1,I) ; BY ;
01320 PRINT
01330 PRINT
01340 B=1
01350 FOR A=L TO (H+MAX(1,I)) STEP MAX(1,I)
01360 PRINT INT(A);
01370 IF D(B)-D(B-1) GO TO 1440
01380 IF D(B)-A GO TO 1420
01390 PRINT 'A';
01400 B=B+1
01410 GO TO 1370
01420 PRINT
01430 NEXT A
01440 PRINT
01450 PRINT
01460 RETURN
01470 REM SORTING ROUTINE
01480 PRINT
01490 F=1
01500 X1=TIM
01510 IF S$='R' GO TO 1280
01520 IF S$='B' GO TO 1580
01530 IF S$='K' GO TO 2220
01540 GO TO 1990
01550 REM
01560 REM
01570 REM BUBBLE SORT
01580 PRINT 'BUBBLE SORT ALGORITHM'
01590 N7=C7=0
01600 FOR A=1 TO Y 1
01610 FOR B=A+1 TO Y
01620 C7=C7+1
01630 IF D(A)-D(B) GO TO 1680
01640 N7=N7+1
01650 T=D(A)
01660 D(A)=D(B)
01670 D(B)=T
01680 NEXT B
01690 NEXT A
01700 X2=TIM-X1
01710 PRINT X2; 'SECONDS SORTING TIME'
01720 PRINT N7; 'SWITCHES EXECUTED'
01730 PRINT C7; 'COMPARISONS EXECUTED'
01740 PRINT
01750 RETURN
01760 REM
01770 REM
01780 REM DELAYED REPLACEMENT SORT
01790 PRINT 'DELAYED REPLACEMENT SORT ALGORITHM'
01800 N7=C7=0
01810 J7=K7=L7=0
01820 L7=L7+1
01830 IF L7=Y GO TO 1700
01840 J7=L7
01850 K7=J7+1
01860 C7=C7+1
01870 IF D(K7)>D(J7) GO TO 1890
01880 J7=K7
01890 K7=K7+1
01900 IF K7=Y GO TO 1860
01910 IF L7-J7 GO TO 1820
01920 N7=N7+1
```

May 1983 • Creative Computing

01930 T=D(J)
 01940 D(J)=D(L7)
 01950 D(L7)=T
 01960 GO TO 1020
 01970 REM
 01980 REM
 01990 REM SHELL = METZNER SORT
 02000 PRINT 'SHELL = METZNER SORT'
 02010 N7=C7=0
 02020 M6=Y
 02030 M6=INT(M6/2)
 02040 IF M6=0 GO TO 1700
 02050 M6=Y-M6
 02060 J6=1
 02070 I6=J6
 02080 L6=I6+M6
 02090 C7=C7+1
 02100 IF D(I6)<D(L6) GO TO 2170
 02110 N7=N7+1
 02120 T=D(I6)
 02130 D(I6)=D(L6)
 02140 D(L6)=T
 02150 I6=I6-M6
 02160 IF I6=1 GO TO 2080
 02170 J6=J6+1
 02180 IF J6>K6 GO TO 2030
 02190 GO TO 2070
 02200 REM
 02210 REM
 02220 REM QUICKSORT
 02230 PRINT 'QUICKSORT ALGORITHM'
 02240 N7=C7=0
 02250 K8=1
 02260 P(K8)=1
 02270 M(K8)=Y
 02280 L8=1
 02290 R8=Y
 02300 IF (R8-L8)<9 GO TO 2640
 02310 L8=L8
 02320 J8=R8
 02330 C7=C7+1
 02340 IF D(I8)>D(J8) GO TO 2440
 02350 J8=J8-1
 02360 IF J8=18 GO TO 2330
 02370 J8=J8+1
 02380 N8=K8+1
 02390 IF (I8-L8)<(R8-J8) GO TO 2600
 02400 P(K8)=L8
 02410 M(K8)=I8
 02420 I8=J8
 02430 GO TO 2300
 02440 N7=N7+1
 02450 T=D(J8)
 02460 D(J8)=D(I8)
 02470 D(I8)=T
 02480 GO TO 2510
 02490 C7=C7+1
 02500 IF D(J8)<D(I8) GO TO 2550
 02510 I8=I8+1
 02520 IF J8=18 GO TO 2490
 02530 J8=J8+1
 02540 GO TO 2380
 02550 N7=N7+1
 02560 T=D(J8)
 02570 D(J8)=D(I8)
 02580 D(I8)=T
 02590 GO TO 2350
 02600 P(K8)=J8
 02610 M(K8)=R8
 02620 R8=I8
 02630 GO TO 2300
 02640 IF (R8-L8)=1 GO TO 2760
 02650 FOR I8=(L8+1) TO R8
 02660 FOR J8=L8 TO (I8-1)
 02670 J9=I8-J8+L8-1
 02680 C7=C7+1
 02690 IF D(J9)<D(I9+1) GO TO 2750
 02700 N7=N7+1
 02710 T=D(J9)
 02720 D(J9)=D(I9+1)
 02730 D(I9+1)=T
 02740 NEXT J8
 02750 NEXT I8
 02760 L8=R8
 02770 R8=M(K8)
 02780 K8=K8-1
 02790 IF K8=0 GO TO 1700
 02800 GO TO 2300
 02810 END

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CIRCLE 279 ON READER SERVICE CARD

Medieval Combat



Medieval Combat is a strategy game for the Atari which requires 32K for cassette and 40K for disk.

The game is the medieval equivalent of "This town ain't big enough for both of us, pahdner!" You and your opponent are superpowers surrounded by lesser kingdoms. The enmity between your two countries is so great that neither can allow the other to survive.

The game universe consists of eight kingdoms. The castle and armies of the two opponents are in red and blue. Other kingdoms are in brown.

Initially, each opponent has 12 armies at his command; four each of archers, cavalry and infantry. The muster strength of each army is displayed in the first two lines of the text window (red is on the top line). These are updated after each battle. The combat strengths of the other (brown) kingdoms are assigned randomly. Since the peasants in these kingdoms are loyal, you cannot find out the strength of the brown armies before you attack.

Your fighting or effective strength depends on the type of battle fought and

the army type as shown in Figure 1. Infantry were not very effective in open-country warfare during this era. The armored knight still reigned supreme. On the other hand, knights were not too useful when laying siege to fixed fortifications. If you attack a neutral (brown) kingdom, you must win by besieging the castle. Battles between the red and blue armies take place in open country.

The outcome of the battle depends on the strength of the opposing forces. If the forces are closely matched, the battle will be indecisive, losses will be heavy,

Figure 1.

Army Type	Multiplier of Muster Strength per Battle Type	
	Siege of Castle	Open Country
Cavalry	0.4	0.9
Archers	0.8	0.7
Infantry	0.8	0.5

and both sides will be forced to retreat. If you can set your strategy so that your forces are greater than those of your enemy, then your losses will be reduced. If you can overwhelm your opponent, you will destroy his armies. In addition, you will also further reduce your losses by recruiting a proportion of your foe's demoralized and discouraged soldiers.

Here, as in real life, it is considered very bad form to lose your "home" kingdom. If this happens, a significant proportion of your subjects become disillusioned with your incompetence. They defect to your opponent providing him with sorely needed reinforcements. You also become nameless, being referred to solely by your color. This is a great humiliation for someone with your drive, ambition and ego.

If both kings invade a neutral kingdom, the initial battle is between the forces of the two kings. However, the native forces immediately attack the victor in the hope of catching his armies while still weak and in disarray from the first battle.

During your campaign, you may be beset by natural disasters (illness, floods, etc.). No one said that war was a piece of cake. Also, you must constantly be on the alert for rebel attacks. Once you conquer a kingdom, the losers form a rebel army which will quickly attack should you display any weakness.

Type RUN and the program asks for the name of each king. Then the screen goes blank for a few seconds while the computer defines a new character set. The kingdom map is then drawn and the war begins.

The computer flashes each army on and off, in turn, while asking for your move. Type the first letter of the kingdom you wish to move to. It is not necessary to hit RETURN. To keep an army in place, type any number or letter key other than those of the kingdoms (i.e. A,B,C,G,N,P,S,V). The space bar is also OK. Each kingdom is labelled on the TV display.

Your forces are too massive to allow movement over the mountains or through the forests. They can move only via specific passes through these obstacles. The computer tells you if your move is illegal.

Note that within each army type, each army is identified by a dot. These dots identify the army number as follows:

1	2
4	3

Since these dots are hard to see, the computer flashes the army when requesting battle commands.

It is necessary for the opponent to look away while the first player makes his moves. If you suspect that your opponent is cheating, you can try to outfox him by typing a key close to that of a kingdom's key. In this way, you can also exercise the diplomatic craft of deviousness along with your battle skills.

After all moves are entered, the computer moves the armies and the battle begins.

You can conquer your known world in two ways. If you can control a total of four kingdoms, your influence will be so great that your opponents will give up the fight. Alternately you can destroy your opponent's armies until their strength is so low that they will surrender and pledge their allegiance to your banner. Should you be so even

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Medieval Combat, continued...

matched that both armies are reduced to near zero, the game will end due to the exhaustion of your soldiers.

The Program

The program structure is shown in Figure 2.

The program makes use of two character sets. The standard one is stored in ROM beginning at memory location 57344. To form the second character set, the first half of the ROM-based set (512 bytes) is moved into RAM (lines 32000-32020). The location chosen was just beneath the Graphics 1 display list.

Then the punctuation characters are redefined into the army and landscape

characters (lines 32030-32040, 32100-32123). To make use of the two sets, a display list interrupt is set at the last line of the Gr.1 display. Finally, a short machine language program is used to switch between the two character sets (lines 32050-32060, 32125).

Note that the machine language program, used to move the ROM-based set into RAM, is stored as graphics characters within a string (CHAR \$ in line 32020). Since the printer will not print graphics characters, type the string as shown in Figure 3.

I hope you enjoy this game as much as I enjoyed programming it. May all your campaigns be successful and may you rule your realm long and wisely. □

Figure 2.

Lines	Purpose
10-240	Initialization and initial display
275-1292	Subroutines
1740-2980	Main game loop
3000-3617	Subroutines
9000-9220	Data statements
32000-32125	Subroutine and data for redefining the character set and setting up a display list interrupt.

Figure 3.

Character Position in String	Type	Seen on Screen
1	Lower-case H	h
2	Inverse)	Inverse)
3	Control comma	Graphics heart
4	Inverse control E	Inverse graphics character
5	Inverse M	Inverse M
6	Inverse)	Inverse)
7	Inverse control period	Inverse graphics diamond
8	Inverse control E	Inverse graphics character
9	Inverse N	Inverse N
10	Inverse l	Inverse l
11	Inverse M	Inverse M
12	Inverse control Q	Inverse graphics character
13	Inverse K	Inverse K
14	Inverse H	Inverse H
15	Inverse P	Inverse P
16	Inverse lower-case Y	Inverse y
17	Inverse lower-case F	Inverse f
18	Inverse L	Inverse L
19	Inverse lower-case F	Inverse f
20	Inverse N	Inverse N
21	Inverse %	Inverse %
22	Inverse N	Inverse N
23	Inverse I	Inverse I
24	Inverse lower-case B	Inverse b
25	Inverse P	Inverse P
26	Inverse lower-case M	Inverse m
27	Control period	Graphics diamond

10 DIM K019,71,XS(3,7),RA(5,11),BA(5,11),NA(7),RBA(7),TE(1,11)
 20 DIM ENS(48),MVB5(12),MVB5(12),M15(1),K05(8),NMB5(9),HLOS(8),
 PLS(11,3518),NUMBER5(24)
 25 DIM ARMY5(24),BLK5(39),NAMES(25),NAME5(25),LOGO5(35),WMS(9),LS(9)
 30 BLK5**
 50791479993479994569999
 15 NUMBER5="FIRST SECONTHIRO FOURTH",ARMY5="CAVALRY ARCHERS INFANTRY",MVB5="999
 999999999"

40 GRAPHICS 1:LOGO5** MEDIEVAL COMBAT *FOR L=1 TO 10:POSITION
 1,B:7 P6,LOGO5(L,L+17),COLOR 130
 40 PLO 0.7,DRAWTO 19,7,ORAWTO 19,9,ORAWTO 8,9,ORAWTO 8,0
 43 SOUND B,L=14,10,14:SOUND 1,L=14-1,10,12:SETCOLOR 3,INT(RNO(8)=16),4:GOSUB 6B5
 5:SETCOLOR 3,INT(RNO(8)=16),6
 44 GOSUB 6B5:NEXT L:SOUND 0,0,0,0:SOUND 1,0,0,0:POKE 711,70:E=280:F=290,G=680
 50 NAMES**": "My lord: You will command the red":? "aries. Choose your royal
 title":? INPUT NAMES
 55 IF NAME5**" THEN NAMES="Red Sire"
 60 NAMES**":? "My liege! You will command the blue":? "aries. Choose
 your royal title":? INPUT NAMES
 65 IF NAME5**" THEN NAMES="Blue Sire"

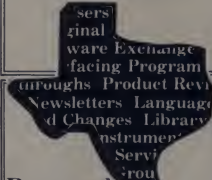
240 GOSUB 32000:POKE 559,34:POKE 700,30:POKE 82,1
 240 GOSUB 3000:GOSUB 3100:GOSUB 3150:GOSUB 3200:GOSUB 3500:GOTO 1740
 275 JS="12403576":RETURN
 276 JS="78612453":RETURN
 277 JS="43526871":RETURN
 280 POKE 650,2:POKE 657,1:RETURN
 280 POKE 650,3:POKE 657,1:RETURN

300 ADOO=SMR=0:SMR=0:SMR=0:IF RES=1.2 THEN 325
 108 IF B THEN M=0.85:GOSUB 1000:GOSUB B24:IF TESB:TESB AND TESB>0 THEN M=0.94:GO
 SUB 1060
 310 IF R THEN M=0.85:GOSUB 1050:GOSUB B00:IF TESB:TESB AND TESB>0 THEN M=0.94:GO
 SUB 1050
 315 IF N THEN NA(J)=0.85+NA(J)
 320 GOTO 565

325 IF RES=1.5 THEN 300
 310 IF B+1 THEN M=0.9:GOSUB 1000:IF R=1 THEN M=0.7:GOSUB 1050:GOSUB B00:GOTO 56
 5
 335 IF B+10 THEN N=1 THEN NBA(J)=0.7+NA(J):NA(J)=0:GOTO 565
 340 IF K+10 THEN M=0.9:GOSUB 1050:IF B+1 THEN M=0.7:GOSUB 1000:GOSUB B20:GOTO 56
 5

345 IF K+10 THEN IF N=1 THEN NBA(J)=0.7+NA(J):NA(J)=0:GOTO 565
 350 IF N+10 THEN NA(J)=0.9+NA(J):IF B+1 THEN M=0.7:GOSUB 1000:GOSUB B20:GOTO 565
 355 IF M+10 THEN IF N=1 THEN M=0.7:GOSUB 1050:GOSUB B00:GOTO 565
 360 IF K+10 THEN 390
 370 V=0:GOSUB 1120
 375 IF B+10 THEN 445
 385 GOSUB 1130:GOTO 445
 390 IF B+10 THEN 420
 400 V=1:GOSUB 1120
 405 IF R+10 THEN 445
 415 GOSUB 1140:GOTO 445
 420 IF R+10 THEN 440
 430 GOSUB 1140:GOTO 445
 440 GOSUB 1130
 445 IF RES=2 THEN 495
 450 IF B+10 THEN M=0.9:GOSUB 1000:IF R=1 THEN ADOO=(SMR=0.2)/SMW,V=1:GOSUB 1070:
 M=0.5:GOSUB 1050
 455 IF B+10 THEN IF R=1 THEN GOSUB B00:GOTO 565
 460 IF B+10 THEN IF N=1 THEN ADOO=(NA(J)=0.5)/SMW,V=1:GOSUB 1070:RBA(J)=0.5+NA(J)
 NA(J)=0:GOTO 565
 465 IF R+10 THEN M=0.9:GOSUB 1050:IF B+1 THEN ADOO=(SMR=0.2)/SMW,V=0:GOSUB 1070
 471 IF R+10 THEN IF B=1 THEN M=0.5:GOSUB 1000:GOSUB B20:GOTO 565
 475 IF R+10 THEN IF N=1 THEN ADOO=(NA(J)=0.5)/SMW,V=0:GOSUB 1070:RBA(J)=0.5+NA(J)
 NA(J)=0:GOTO 565
 480 IF N+10 THEN NA(J)=0.9+NA(J):IF B+1 THEN NA(J)=NA(J)+SMR=0.2
 481 IF N+10 THEN IF B=1 THEN M=0.5:GOSUB 1000:GOSUB B20:GOTO 565
 485 IF N+10 THEN IF R=1 THEN NA(J)=NA(J)+SMR=0.2:M=0.5:GOSUB 1050:GOSUB B00:GOTO 56
 565
 495 IF B+10 THEN M=0.9:GOSUB 1000:IF R=1 THEN ADOO=(SMR=0.4)/SMW,V=1:GOSUB 1070:
 M=0.1:GOSUB 1050:GOTO 565
 505 IF B+10 THEN IF N=1 THEN ADOO=(NA(J)=0.5)/SMW,V=1:GOSUB 1070:NA(J)=0:GOTO 565
 510 IF R+10 THEN M=0.9:GOSUB 1050:IF B+1 THEN ADOO=(SMR=0.4)/SMW,V=0:GOSUB 1070:
 M=0.1:GOSUB 1050:GOTO 565
 520 IF R+10 THEN IF N=1 THEN ADOO=(NA(J)=0.5)/SMW,V=0:GOSUB 1070:RBA(J)=0.5+NA(J)
 NA(J)=0:GOTO 565
 525 IF N+10 THEN NA(J)=0.9+NA(J):IF B+1 THEN NA(J)=NA(J)+SMR=0.4:M=0.1:GOSUB 1
 060:GOTO 565
 530 IF N+10 THEN IF R=1 THEN NA(J)=NA(J)+SMR=0.4:M=0.1:GOSUB 1050
 565 FOR V=0 TO 1:FOR W=0 TO 1:TE(V,W)=(INT((TE(V,W)+0.05)*10))/10
 570 X=TE(V,W):IF X=0 THEN 580
 575 IF X=0.1 THEN TE(V,W)=0
 576 GOTO 585
 580 TE(V,W)=1000
 585 NEXT W:NEXT V:RETURN
 610 IF Z=67 THEN MIS="0":RETURN
 611 IF Z=60 THEN MIS="1":RETURN
 612 IF Z=71 THEN MIS="2":RETURN
 613 IF Z=82 THEN MIS="3":RETURN
 614 IF Z=65 THEN MIS="4":RETURN
 615 IF Z=88 THEN MIS="5":RETURN
 616 IF Z=76 THEN MIS="6":RETURN
 617 IF Z=80 THEN MIS="7":RETURN

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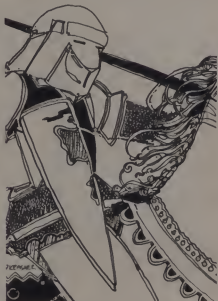


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CIRCLE 278 ON READER SERVICE CARD

Medieval Combat, continued...

```
610 MIS:=M: RETURN
620 IF W<4 THEN GOSUB F:L=W*6: ? NUMBER:(L+1,L*6): " "; ARMS:(1,B): "?": RETURN
621 IF W<3 AND W<8 THEN GOSUB F:L=(W-4)*6: ? NUMBERS:(L+1,L*6): " "; ARMS:(9,16): "?": RETURN
622 IF W<7 AND W<12 THEN GOSUB F:L=(W-8)*6: ? NUMBERS:(L+1,L*6): " "; ARMS:(17,24): "?": RETURN
623 IF VAL(MIS)*X THEN GOSUB E: ? "You're already there!": GOSUB 1285: GOSUB G: RETURN
630 GOSUB I: ? "Can't move there! Please try again.": GOSUB 1285: GOSUB G: RETURN
640 FOR V=0 TO 1: FOR W=0 TO 1: TE(V,W)=1000: NEXT W: NEXT V
650 FOR W=0 TO 1: IF RA(4,W)=1 THEN TE(0,W)=RA(1,W)
660 IF BA(4,W)=1 THEN TE(1,W)=BA(1,W)
670 NEXT W: RETURN
680 POKE 77,0: FOR I=1 TO 600: NEXT I
690 GOSUB E: ? BLKS: GOSUB F: ? BLKS: RETURN
700 POKE 77,8: FOR I=0 TO 48: NEXT I: RETURN
710 TESB:=TESB+RES: R=0: B=0: N=0
720 IF N<1 THEN 730
730 FOR W=0 TO 1
740 IF TE(0,W)=0 THEN 713
750 NEXT W: GOTO 730
760 IF BTL THEN 720
770 IF W<4 THEN M=0: 4: GOSUB 1100: GOTO 717
780 IF W<8 THEN M=0: 8: GOSUB 1100: GOTO 717
790 M=0: 8: GOSUB 1100
800 NEXT W: GOTO 730
810 IF M<4 THEN M=0: 9: GOSUB 1100: GOTO 725
820 IF W<8 THEN M=0: 7: GOSUB 1100: GOTO 725
830 M=0: 5: GOSUB 1100
840 NEXT W
850 IF BL<1 THEN 755
860 FOR M=0 TO 11
870 IF TE(1,M)=0 THEN 738
880 NEXT M: GOTO 725
890 IF BTL THEN 745
900 IF W<4 THEN M=0: 4: GOSUB 1110: GOTO 742
910 IF W<8 THEN M=0: 8: GOSUB 1110: GOTO 742
920 M=0: 8: GOSUB 1110
930 NEXT W: GOTO 755
940 IF W<4 THEN M=0: 9: GOSUB 1110: GOTO 750
950 IF W<8 THEN M=0: 7: GOSUB 1110: GOTO 750
960 M=0: 5: GOSUB 1110
970 NEXT W
980 IF R<0 AND BL THEN 775
990 IF R<0 AND NT THEN 770
1000 IF BL=0 THEN RETURN
1010 RES:=TESB/NA(J): IF RES<1/1.2 AND RES<1.2 THEN B=1: BL=0: N=1: RETURN
1020 IF TESB/NA(J) THEN B=10: N=1: NT=0: RETURN
1030 RES:=TESB/NA(J): TESB=0: BL=0: N=1: RETURN
1040 RES:=TESB/NA(J): IF RES<1/1.2 AND RES<1.2 THEN R=1: R=0: B=1: RETURN
1050 IF TESB/NA(J) THEN R=10: N=1: NT=0: RETURN
1060 RES:=TESB/ILSR: R=1: R=0: B=1: RETURN
1070 C=1: IF C<0: J=1 THEN RETURN
1080 FOR W=0 TO 1: IF TE(0,W)=0 THEN 815
1090 GOSUB 1190: V=RA(5,W): X1=K(5,0,V): X2=K(1,V): Y1=K(2,V): Y2=K(3,V): GOSUB 3400:
1100 RA(4,W)=RA(5,W): GOSUB 3300
1110 NEXT W: RETURN
1120 C=2: IF C<0: J=2 THEN RETURN
1130 FOR W=0 TO 1: IF TE(1,W)=0 THEN 835
1140 GOSUB 1190: V=BA(5,W): X1=K(5,0,V): X2=K(1,V): Y1=K(2,V): Y2=K(3,V): GOSUB 3400:
1150 BA(4,W)=BA(5,W): GOSUB 3300
1160 NEXT W: RETURN
1170 FOR W=0 TO 11
1180 IF TE(1,W)=0 THEN RA(1,W)=TE(0,W): IF RA(1,W)=0 THEN GOSUB 1190: FOR X=2 TO 3:
1190 X=X: RA(X,W)=0: RA(X+2,W)=9: NEXT X
1200 IF TE(1,W)=0 THEN BA(1,W)=TE(1,W): IF BA(1,W)=0 THEN GOSUB 1190: FOR X=2 TO 3:
1210 X=X: BA(X,W)=0: BA(X+2,W)=9: NEXT X
1220 NEXT W: GOSUB 1500: RETURN
1230 GOSUB 3610: J=L: LT: KOS: HLDs: RETURN
1240 IF N=0 THEN 900
1250 IF N=10 THEN GOSUB 3610: J=LW: LT: MNS: HLOs: GOTO 900
1260 GOSUB 3610: J=LL: LT: LSS: HLOS
1270 IF R=10 THEN MNS=NMRs: LW=LR
1280 IF R=1 THEN LSS=NMRs: LL=LR
1290 IF R=10 THEN MNS=NMRs: LW=LB
1300 IF R=1 THEN LSS=NMRs: LL=LB
1310 GOSUB F: ? "Sires! Battle results!": GOSUB G
1320 IF RES<1.2 THEN GOSUB L: ? "Heavy losses on both sides!": GOSUB F: ? "Both sides are retreating!"
1330 IF RES<1.2 THEN GOSUB G: GOTO 940
1340 IF KLS>2 THEN 935
1350 IF N THEN 925
1360 GOSUB E: WNS(1,LW): "s has defeated "LSS(1,LL): "": GOSUB F: LSS(1,LL): "s are retreating!":
1370 GOTO 940
1380 IF N=10 THEN GOSUB E: ? WNS(1,LW): "s has withstood the siege!":
1390 IF N=10 THEN GOSUB F: ? LSS(1,LL): "s armies are retreating!": GOTO 940
1400 IF N=1 THEN GOSUB E: ? WNS(1,LW): "s has conquered "LSS(1,LL): "":
1410 IF N=1 THEN GOSUB F: ? "Survivors have joined the rebels!": GOTO 940
```



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935 GOSUB E: "Forces of ";LS$(1,LL);" destroyed!";GOSUB F: WMS(1,LU);" is vic
torious!";
940 GOSUB G: RETURN
950 FOR W=0 TO 11: IF RA(4,W)=3 THEN RA(1,W)=M+RA(1,W);RA(1,W)=(INT((RA(1,W)+0.05
+10)/10)
970 IF BA(4,W)=J THEN BA(1,W)=M+BA(1,W);BA(1,W)=(INT(((BA(1,W)+0.05)+10)/10)
9800 NEXT W:GOSUB 3500: RETURN
1000 RBA(J)=0.5+RBA(J):GOSUB F: "Rebels retreat after a bloody battle!";GOSUB
1205:GOSUB G: RETURN
1010 RBA(J)=0.6:GOSUB F: "Rebels destroyed! A glorious victory!";GOSUB 1205:GOSUB
B: RETURN
1020 RBA(J)=0.8+RBA(J):GOSUB E: "Rebels inflict heavy losses!";GOSUB F: "then
fade away!";
1021 IF W=0 THEN GOSUB 1205:GOSUB G: RETURN
1030 RBA(J)=0.9+RBA(J):GOSUB E: "Rebels destroy opposition!";GOSUB F: "A mil-
itary disaster!";
1031 GOSUB 1205:GOSUB G: RETURN
1050 FOR W=0 TO 11: TE(0,W)=M+TE(0,W);NEXT W: RETURN
1060 FOR W=0 TO 11: TE(1,W)=M+TE(1,W);NEXT W: RETURN
1070 FOR W=0 TO 11: TE(2,W)=M+TE(2,W);NEXT W: RETURN
1080 FOR W=0 TO 11: IF TE(V,W)=0 THEN TE(V,W)=M+TE(V,W);TE(V,W)=(INT((TE(V,W)+0.0
5)+10)/10)
1091 NEXT W: RETURN
1100 IFSW=ESR+M+TE(0,W);RETURN
1110 TSW=TSW+M+TE(1,W);RETURN
1120 FOR W=0 TO 11: IF TE(V,W)=0 THEN SHW=SW+1
1123 NEXT W: RETURN
1130 FOR W=0 TO 11: IF TE(1,W)=0 THEN SHLB=SHLB+TE(1,W)
1131 NEXT W: RETURN
1140 FOR W=0 TO 11: IF TE(0,W)=0 THEN SHLR=SHLR+TE(0,W)
1141 NEXT W: RETURN
1150 XI=X(0,J):X2=X(1,J):Y1=Y(2,J):Y2=Y(3,J):RETURN
1160 GOSUB E: "Epidemic of cholera has broken out in!";GOSUB F: "kingdom of ";
KOS(1,LL);":GOSUB G
1161 M=0.85:GOSUB 950: RETURN
1165 GOSUB L: KOS(1,LL);" reports dysentery epidemic!";GOSUB F: "Many deaths r-
eported!";GOSUB G
1166 M=0.8:GOSUB 950: RETURN
1170 GOSUB L: "Mild influenza reported in ";KOS(1,LL);":GOSUB F: "Losses are
enormous!";GOSUB G
1171 M=0.9:GOSUB 950: RETURN
1175 GOSUB E: "Severe flooding in ";KOS(1,LL);":GOSUB F: "Heavy losses repor-
ted!";GOSUB G
1176 M=0.8:GOSUB 950: RETURN
1180 GOSUB F: "Reinforcements reported in ";KOS(1,LL);":GOSUB G: M=1.2:GOSUB 9
50: RETURN
1190 COLOR 32:PLOT RA(2,W),RA(3,W);RETURN
1195 COLOR 32:PLOT BA(2,W),BA(3,W);RETURN
1200 IF IKB=J THEN GOSUB E: "NAMERS:GOSUB G
1201 IF IKB=J THEN GOSUB E: "NAMERS:GOSUB G
1202 GOSUB E: "Sire! Due to your incompetence!";GOSUB F: "your home kingdom h-
as been lost!";GOSUB G
1205 GOSUB E: "Your subjects are defecting to!";GOSUB F: "Join the opposing fo-
rces!";GOSUB G
1210 FOR W=0 TO 11: IF IKB=J THEN IF RA(4,W)=J THEN RA(1,W)=(INT(((1.3+RA(1,W)+0.0
5)+10)/10)
1215 IF IKB=J THEN IF BA(4,W)=J THEN BA(1,W)=(INT(((1.3+BA(1,W)+0.05)+10)/10)
1220 NEXT W: IF IKB=J THEN IKB=9:WMS="Blue Sire";LB=9
1225 IF IAR=J THEN IAR=9:WMS="Red Sire";LR=8
1230 RETURN
1250 FOR X=1 TO 30: SOUND 0,FR,10: SOUND 1,FR+10,10: SOUND 2,FR+20,10: FOR
Y=0 TO 2: SOUND Y,0,0: NEXT Y
1251 NEXT X: RETURN
1255 FOR X=0 TO 250 STEP 2: SOUND X,0,10,10,14: SOUND 1,240-X,10,14: SOUND 2,INT(RN
0(0))+250,10,0: NEXT X
1256 FOR X=0 TO 2: SOUND X,0,0,0: NEXT X: RETURN
1260 FOR W=0 TO 7: IF K(0,W)=2 THEN J=W:PC=2:C=1:GOSUB 3350
1261 IF K(0,W)=3 THEN J=W:PC=3:C=1:GOSUB 3350
1262 NEXT W:GOSUB 3110
1263 FOR W=0 TO 11: IF BA(1,W)=0 THEN NEXT W: RETURN
1264 COLOR RA(0,W):PLOT BA(2,W),BA(3,W);NEXT W: RETURN
1265 FOR W=0 TO 7: IF K(0,W)=1 THEN J=W:PC=1:C=2:GOSUB 3350
1266 IF K(0,W)=3 THEN J=W:PC=3:C=2:GOSUB 3350
1267 NEXT W:GOSUB 3110
1268 FOR W=0 TO 11: IF RA(1,W)=0 THEN NEXT W: RETURN
1269 COLOR RA(0,W):PLOT RA(2,W),RA(3,W);NEXT W: RETURN
1275 FOR I=0 TO 100: NEXT I: FOR I=0 TO 1: FOR Y=1 TO 15: SERCOLOR 4,Y
14: NEXT Y: NEXT I: NEXT I
1276 SFCOLOR 4,W,GOSUB E
1277 "Sire: You have been proclaimed!";GOSUB F: "EMPEROR OF THE UNIVERSE!";G
OSUB 1205:GOSUB G: RETURN
1280 FOR Y=16 TO 10 STEP -1: FOR Y=FR TO 250 STEP 10: SOUND 0,Y,10,X: NEXT Y: NEXT X:
RETURN
1285 A=INT(RND(0)+100)+100: FOR T=0 TO 60: SOUND 0,A,10,14: SOUND 1,A+1,10,14: NEXT
T: SOUND 0,W,0,0
1286 SOUND 1,0,0,0: RETURN
1291 IF RA(2,W)=0 THEN GOSUB 1195
1291 IF BA(2,W)=0 THEN GOSUB 1195
1292 NEXT W: RETURN
1294 GOSUB E: "Sirs: I am ready to accept!";GOSUB F: "your battle commands!";
GOSUB G
1295 MVS=MVS+MVS:MVS=MVS:GOSUB F: "NAMERS!";GOSUB 1205: OPEN #3,4,0
"*.":GOSUB G

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17M FOR W=0 TO 11:IF RA(1,W)=0 THEN NEXT W:GOTO 1850
17N GOSUB 82R:POKE 764,255
17M GOSUB 84R:W=PILOT RA(2,W),RA(3,W):GOSUB 68S:IF PEEK(764)<255 THEN GET #3,
2:GOSUB 61W:GOTO 1820
17M GOSUB 114W:GOSUB 68S:GOTO 1790
18W X=BA(4,W):FOR Y=0 TO 5:Y=X*6+Y:IF VAL(ENS(L,Y))=VAL(MIS) THEN POP :GOTO 1
46R
18M NEXT Y:GOSUB 62S:W=M-1:NEXT W:GOTO 1850
18M MVS(M+1,W+1)=MIS:NEXT W
18M GOSUB 841:GOSUB F1: NAME$=, COMMAND ME! :GOSUB 120S:GOSUB G
18M FOR W=0 TO 11:IF RA(1,W)=0 THEN NEXT W:GOTO 1925
18M GOSUB 62R:POKE 764,255
18M FOR W=0 TO 11:FOR Y=0 TO 5:BA(2,W),BA(3,W):GOSUB 68S:IF PEEK(764)<255 THEN GET #3,
2:GOSUB 61W:GOTO 1900
18M GOSUB 114S:GOSUB 68S:GOTO 1870
18W X=BA(4,W):FOR Y=0 TO 5:L=X*6+Y:IF VAL(ENS(L,Y))=VAL(MIS) THEN POP :GOTO 1
47R
191M NEXT Y:GOSUB 62S:W=M-1:NEXT W:GOTO 1925
192R MVS(M+1,W+1)=MIS:NEXT W
192M GOSUB 841:GOSUB F1:POKE 5376R,24:FOR T=0 TO 6 STEP 2:POKE 5376T+1,T,160:NEXT T:POK
E 5376R,24R:POKE 5376R,252
192R MVS 53767,28R:POKE 5376R,49
193M GOSUB 841:GOSUB F1:GOSUB F1: ? "Peasants report troop movements!":GOSUB G
194M FOR W=0 TO 11:J=VAL(MVS(M+1,W+1))
194S IF J<0 THEN GOSUB 119R:GOSUB 115R:C=1:GOSUB 340R:RA(S,W)=RA(4,W):RA(4,W)*J
GOSUB 330R
195M NEXT W
194M FOR W=0 TO 11:J=VAL(MVS(M+1,W+1))
194S IF J<0 THEN GOSUB 119S:GOSUB 115R:C=2:GOSUB 340R:BA(S,W)=BA(4,W):BA(4,W)*J:
GOSUB 330R
197M NEXT W:FOR T=0 TO 3:GOTO T,0,0,0:NEXT T
198M J=INT(WND(M)=3):GOSUB 275Y
198M FOR J=1 TO W-J:VAL(J&2,2,1):BL=0:RD=0:NT=0:BL=0
198M FOR W=0 TO 11:IF RA(4,W)*J THEN RD=1:POP :GOTO 2030
198M NEXT W
200R FOR W=0 TO 11:IF RA(4,W)*J THEN BL=1:POP :GOTO 2050
200M NEXT W
200R IF RD AND BL THEN RT=1:GOTO 2090
201M IF RD AND BL THEN 2200
202M IF RT,RT<3 THEN 273R
203M NEXT RT=1
204M GOSUB 65W:GOSUB 87R:GOSUB F1: ? "Battle underway in ",KOS(1,L),":!":FR=75:GOS
UB 120R:GOSUB G
210R GOSUB 70W:GOSUB 80R:GOSUB 30R:GOSUB 850
212R IF RT=0 THEN 230R
213M IF K(D,0,J)<3 THEN 230R
213S IF RD=0 AND BL=0 THEN NEXT 2:GOTO 2370
214M RT=1:RT=1:GOSUB 65R:GOSUB F1: ? KOS(1,L),":s forces attack the victors!":FR=
15R:GOSUB 120R:GOSUB G
215M GOSUB 70W:GOSUB 80R:GOSUB 30R:GOSUB 850
216M IF RT=1 THEN NEXT 2:GOTO 2370
217M IF RT=1 THEN C=1:PC=3:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
218M IF RT=1 THEN C=2:PC=3:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
219M IF RT=1,1 THEN NEXT 2:GOTO 2370
220M GOSUB 87R:GOSUB E1: ? "Rebels forces take over ",KOS(1,L),":s":GOSUB F1: ? "unde
fended" :GOTO 2370
221M IF RT=1 GOSUB 125W:GOSUB U:IF IKR=0 OR IKR=3 THEN GOSUB 120R
221M NAI(J)=RA(1,J)-RA(1,J)+C=3:PC=K(D,0,J):GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 23
70
221R GOSUB 87R:IF RT=1 THEN 2770
222M IF K(D,0,J)<3 THEN NEXT 2:GOTO 2370
223M GOSUB F1: NMS(1,1R): ? "takes over":GOSUB F1: ? "undefended ",KOS(1,L):FR=150
GOSUB 87R:GOSUB G
224M IF IKR=3 THEN GOSUB 120R:GOSUB 350R
225M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
226M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
227M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
228M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
229M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
230M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
231M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
232M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
233M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
234M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
235M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
236M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
237M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
238M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
239M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
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244M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
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248M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
249M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
250M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
251M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
252M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
253M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
254M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
255M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
256M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
257M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
258M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
259M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
260M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
261M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
262M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
263M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
264M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
265M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
266M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
267M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
268M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
269M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
270M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
271M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
272M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
273M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
274M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
275M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
276M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
277M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
278M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
279M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
280M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
281M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
282M IF RT=1 GOSUB 125W:GOSUB U:GOSUB 335R:GOSUB 310R:NEXT 2:GOTO 2370
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Similar game for Timex/Sinclair 16k - hunting treasure instead of monsters \$14.95.



ADVENTURE WRITING/DEATHSHIP by Rodger Olsen - This is a data sheet showing how we do it. It is about 14 pages of detailed instructions how to write your own adventures. It contains the entire text of Deathship. Data sheet - \$3.95. NOTE: Owners of T199, TRS-80, TRS-80 Color, and Vic 20 computers can also get Deathship on tape for an additional \$5.00.

Dealers - We have the best deal going for you. Good discounts, exchange programs, and factory support. Send for Dealer Information.

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ADVENTURES - Adventures are a unique form of computer game. They let you spend 30 to 70 hours exploring and conquering a world you have never seen before. There is little or no luck in Adventuring. The rewards are for creative thinking, courage, and wise gambling - not fast reflexes.

In Adventuring, the computer speaks and listens to plain English. No prior knowledge of computers, BASIC, or games is required so everyone enjoys them - even people who do not like computers.

Except for Quest, the unique among Adventure games, Adventures are not tragic. Adventures are more like a novel than a comic book or arcade game. It is like reading a particular exciting book where you are the main character.

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TREK ADVENTURE by Bob Retella - This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one - The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to take care that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players - I wrote this one with a concordance in hand. It is very accurate - and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

DERELICT by Rodger Olsen and Bob Anderson - For Wealth and Glory, you have to ransom a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players - This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.

Dungeons of Death - Just for the 16k TRS-80 COLOR, this is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. At the normal price for an Adventure (\$14.95 tape, \$19.95 disk), this is a giveaway.

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CIRCLE 101 ON READER SERVICE CARD

PYRAMID by Rodger Olsen - This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players - This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenious problems. This one has captivated people so much that I get calls daily from all over the world. New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

MARS by Rodger Olsen - Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players - This is highly recommended as a first adventure. It is in no way simple - playing time normally runs from 30 to 50 hours - but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.



QUEST by Bob Retella and Rodger Olsen - THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alaska. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

32k TRS-80 COLOR Version \$24.95. Adds a second level with dungeons and more Questing.

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All adventures are \$14.95 on tape. Disk versions are available on VIC/COMMODORE and TRS-80 Color for \$2.00 additional. \$2.00 shipping charge on each order.

VISA



A Joystick For The Color Computer

One of the strong points of the TRS-80 Color Computer is its game playing ability. For many games, joysticks are essential. They come in two basic varieties: the proportional control type contains a pair of potentiometers, one for vertical and the other for horizontal control. This type of joystick normally works with an analog-to-digital converter and yields values from 1 to 63 (for the 6-bit converter on the Color Computer) with 31 at the center. The switch type of joystick contains four momentary contact switches and gives values of up, down, left, right and center, but no in-between states. These joysticks normally have a spring return to center.

The joysticks sold by Radio Shack for the Color Computer are of the proportional control type, and do not automatically return to center. They are well suited to controlling objects on the

Ian Hodgson

ing or changing direction when center is reached. For such games the response is much better when a switch-type joystick is used. The most common of the switch-type joysticks are those sold by Atari and Commodore. Here you will learn how to connect these to your Color Computer.

Theory

The Atari joystick contains five small "oilcan" type switches for left, right, up, down and fire. (Note: if your joystick contains coil spring switches, you have

an ancient model and I suggest you buy one of the newer ones.) All five have one side connected to a common ground return; the other sides are used to connect one of five input lines to ground. The original wiring is shown in Figure 1.

The Radio Shack joystick interface requires quite a different arrangement, which allows you to vary a voltage from about 0.25v to 4.75v on each of two input lines. This means that you must isolate the common connection from several of the switches. This is done by cutting two of the traces on the joystick printed circuit, and setting the voltages to the correct values with four resistors (the voltage is already supplied by the Color Computer). The final circuit wiring is shown in Figure 2.

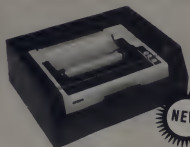
***You will be amazed
by the control you
have over your
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screen where the position of the object is controlled by the position of the joystick. Many arcade type games do not behave this way, however. Instead, the player moves or changes direction whenever the joystick is off center and stops mov-

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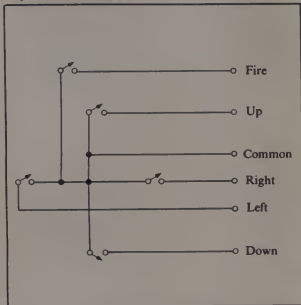


Figure 1. The original wiring of the Atari or Commodore joystick.

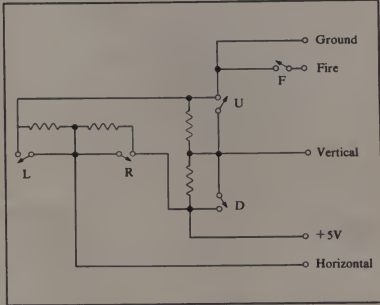


Figure 2. The joystick circuit must be modified as shown to work with the Color Computer. Four resistors and two circuit cuts are required to do this.

Construction

To do the job, you will need: an Atari or Commodore joystick (they appear to be identical), a 5-pin, wide spaced (240 degree) DIN plug to match the joystick connector on the TRS-80; four 51K ohm, 1/4 watt resistors; some fine gauge wire (I used wire wrap wire); and a soldering iron, as well as ordinary electronic tools.

To begin, remove the bottom from the Atari joystick. It is held in place by four Philips head screws. Hold the joystick upside down while separating the halves of the case, and be careful not to lose the small spring in the fire button. Inside, you will see a small printed circuit board as shown in Figure 3a. (Since this article was originally written I have bought a second joystick and it is constructed dif-

ferently in a much smaller case. The operation is identical, though, and its circuit board is shown in Figure 3b.) This board is covered with a transparent plastic tape and has five small circular switches held in place by the tape. *Do not* lift the tape and disturb them, as they must be accurately positioned. You must make some modifications to this board.

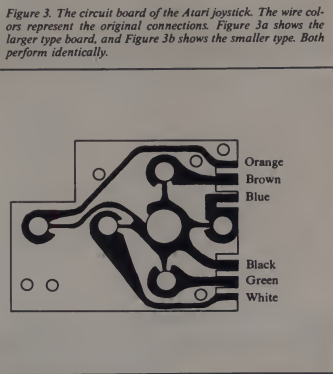
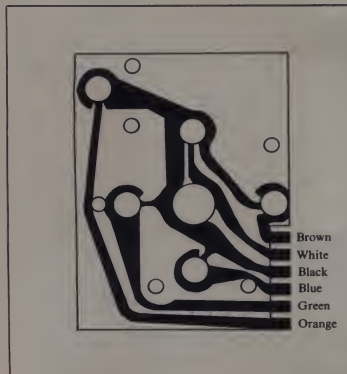


Figure 3. The circuit board of the Atari joystick. The wire colors represent the original connections. Figure 3a shows the larger type board, and Figure 3b shows the smaller type. Both perform identically.

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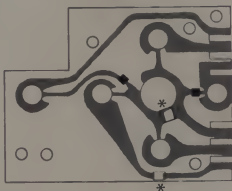
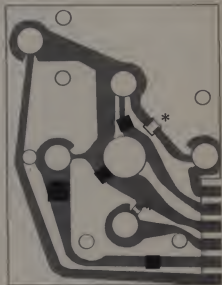


Figure 4. The dark block represents areas where the insulating tape should be cut off the board as described in the text. Two places marked with open boxes and *'s should also have a cut made in the copper foil.

Six colored wires are attached to the board, as shown in Figure 3. They may be removed so that the board is easily accessible. Using a small X-acto knife, carefully cut small rectangles out of the tape in the six spots shown in Figure 4a for the older type or Figure 4b for the newer one. The point of the knife may be used to lift the bits of tape off the board.

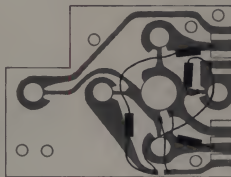
At the two openings marked with an *, carefully cut through the copper traces on the board. To do this, firmly scribe two lines about 1mm apart, cutting completely through the copper trace. Then, with the point of the knife, pry out the small sliver of copper that has been freed. On this phenolic board material the copper should lift off quite

easily. If it does not, you have probably not cut all the way through the trace. Check with a magnifying glass to make sure that there is no connection left at these points.

Install the four 51K ohm resistors (47K should work just as well and may be easier to find) in the positions shown in Figure 5a or 5b. Trim and shape their



Horiz. Orange pin 1
Vert. Green pin 2
Gnd. Black pin 3
+5v White pin 5
Horiz. Blue pin 1
Fire Brown pin 4



Fire Brown pin 4
Horiz. Orange pin 1
Vert. Green pin 2

+5v White pin 5
Horiz. Blue pin 1
Gnd. Black pin 3

Figure 5. Four resistors and two wire jumps must be soldered to the circuit board. Place them as shown, and they should not interfere with any of the hardware. The new wire connections are shown with function, wire color, and DIN plug pin number.

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Joystick, continued...

leads before soldering, and use a small, hot iron and low temperature (63% tin) solder if you can get it. Temporarily replace the covers to make sure that the resistors don't interfere with the support posts; move the resistors if they do. There is nothing like a fast session with *Space Invaders* to break improperly mounted resistors. Install the two wire jumpers also shown in Figure 5. The new circuit diagram is shown in Figure 2.

Now you may replace the board in the holder and reconnect the wires using the color coding shown in Figure 5. Hold the assembly upside down and replace the bottom of the case making sure that no wires are trapped or interfere with the motion of the stick. Disassemble the DIN plug and note that the pins are numbered. If you can't read the numbers, refer to Figure 6. Cut off the DB-9 connector on the end of the Atari cable (if you leave a few inches of wire on it, you may be able to re-use it for something else later). Strip about 1/4" of insulation off the cable, and about 1/8" off the colored wires. Then solder the wires to the pins as follows:

- Pin 1 - orange and blue (twisted together)
- Pin 2 - green
- Pin 3 - black
- Pin 4 - brown
- Pin 5 - white

Now you will probably discover that you have forgotten to slide the plug hood over the cable. If so, you will have to undo those nice solder connections and start over. Otherwise, assemble the DIN connector, and the job should be finished.

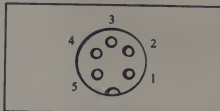
Testing and Operating

Connect the joystick to the right joystick connector, and type in the following program to test it:

```
10 CLS
20 A = JOYSTK(0)
30 B = JOYSTK(1)
40 F = PEEK(65280)
50 PRINTQ(A,B,F
60 GOTO 20
```

When you run this program, your screen should clear and show values of 31, 31 and either 127 or 255. Press the fire button. The 127 should change to a 126 (or the 255 to a 254). Push the stick left. This should change the first 31 to a 0. Push the stick right. This should change the first 31 to a 63. Similarly, you should change the second 31 to a 0 and down should change it to a 63.

Figure 6. The DIN 5-pin plug, viewed from the pin end. On most plugs the pin numbers are clearly marked. Slide the hood over the cable before soldering to the pins.



Congratulations! It works. Now, how do you use it?

Unlike the Radio Shack joysticks, which allow any value from 0 to 63 in both the vertical and horizontal directions, this conversion allows only values of 0, 31, and 63 in each direction. Most games that I have tried work perfectly with this arrangement. If you are writing your own programs, you will have to arrange a timing loop so that the position or speed of objects depends on how long the joystick returns a 0 or 63 rather than on its exact position.

You will be amazed by the control you now have over your favorite arcade games. The spring return to center instantly quadrupled my score on *Gobbler* (a Pac-Man type game). The entire job can be done in less than an hour for only about \$12.

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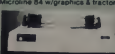


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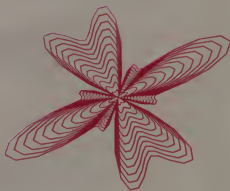
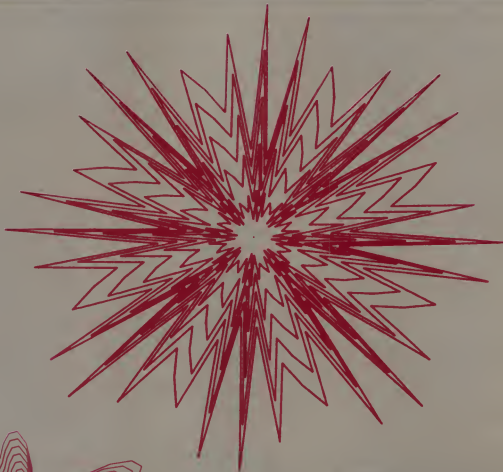
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Computer Art For The Tektronix 4052

This month I will discuss my Sine Product computer program. This is somewhat similar in structure to the other polar coordinate programs I presented in recent issues of *Creative Computing*; it involves successive angular sweeps with the radius incremented between sweeps. However,

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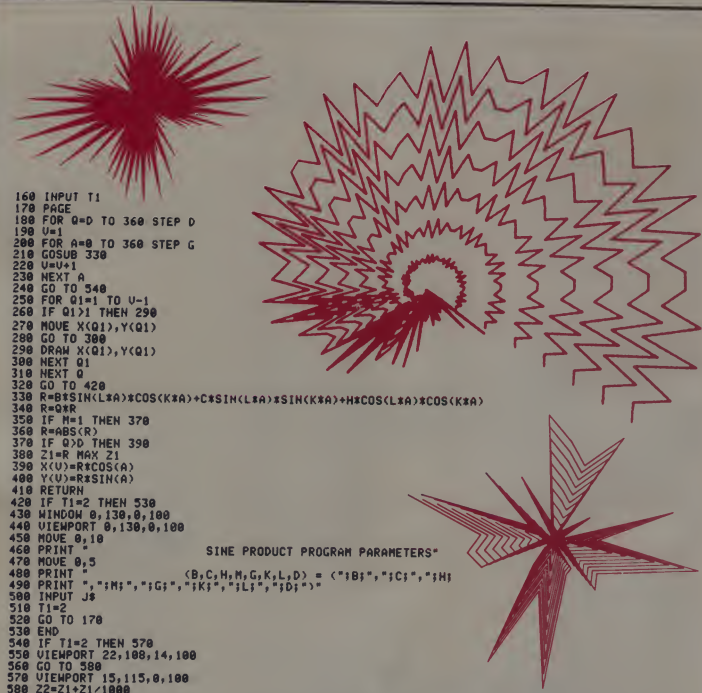
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a different polar function is used in Sine Product.

The radius is computed as the weighted sum of products of two sinusoids, or as the absolute value of that weighted sum (depending on the value you enter for the parameter M).

```
90 REM SINE PRODUCT
91 PAGE
92 PRINT "ENTER B"
93 INPUT B
94 PRINT "ENTER C"
95 INPUT C
96 PRINT "ENTER H"
97 INPUT H
98 PRINT "ENTER M; M MUST BE 1 OR 2."
99 INPUT M
100 PRINT "ENTER G"
101 INPUT G
102 PRINT "ENTER K"
103 INPUT K
104 Z1=0
105 PRINT "ENTER L"
106 INPUT L
107 PRINT "ENTER D"
108 INPUT D
109 U=INT(360/G)*10
110 DIM X(U),Y(U)
111 SET DEGREES
112 PRINT "ENTER T1. T1 MUST BE 1 OR 2."
```

Technically, this program was more difficult to write because it required automatic scaling. The radius values computed can be very large or very small, depending on the input parameter values selected, and it is desirable to have the pattern just fill the screen in all cases. This scaling was accomplished through the use of storage arrays and an algorithm that finds the maximum value of the radius.



```

160 INPUT T1
170 PAGE
180 FOR Q=0 TO 360 STEP D
190 U=1
200 FOR A=0 TO 360 STEP G
210 GOSUB 330
220 U=U+1
230 NEXT A
240 GO TO 540
250 FOR Q1=1 TO U-1
260 IF Q1>1 THEN 290
270 MOVE X(Q1),Y(Q1)
280 GO TO 300
290 DRAW X(Q1),Y(Q1)
300 NEXT Q1
310 NEXT Q
320 GO TO 420
330 R=B*SIN(L*A)*COS(K*A)+C*SIN(L*A)*SIN(K*A)+H*COS(L*A)*COS(K*A)
340 R=Q*R
350 IF M=1 THEN 370
360 R=ABS(R)
370 IF Q>0 THEN 390
380 Z1=R MAX Z1
390 X(U)=R*COS(A)
400 Y(U)=R*SIN(A)
410 RETURN
420 IF T1=2 THEN 530
430 WINDOW 0,130,0,100
440 VIEWPORT 0,130,0,100
450 MOVE 0,10
460 PRINT "
470 MOVE 0,5
480 PRINT "
490 PRINT " (B,C,H,M,G,K,L,D) = (" ;B;"," ;C;"," ;H;
500 INPUT J0
510 T1=2
520 GO TO 170
530 END
540 IF T1=2 THEN 570
550 VIEWPORT 22,100,14,100
560 GO TO 580
570 VIEWPORT 15,115,0,100
580 Z2=Z1+21/1000
590 Z2=Z2*(360/D)
600 WINDOW -22,22,-22,22
610 GO TO 250

```

SINE PRODUCT PROGRAM PARAMETERS"

(B,C,H,M,G,K,L,D) = (" ;B;"," ;C;"," ;H;

";M;"," ;G;"," ;K;"," ;L;"," ;D;")"

The parameters B, C, and H, which are requested in user prompts, are the weighting coefficients for the products of sinusoids. K and L are angular frequency coefficients in the arguments of the sinusoids. D is the radius increment added between successive angular sweeps. G is the angular increment within a sweep. Enter M=2 if you want the radius to be an absolute value; enter M=1 otherwise.

As with the programs previously described, setting T1=1 yields a design

plot with the input parameter values listed at the bottom. Then you clear the screen and hit RETURN and a "clean" plot (without the parameter list) appears. If you don't want the parameter list at all, set T1=2.

Table 1 lists ranges of input parameters that I have found to give good results. Some values outside these intervals may also work well. Note that B, C, H, G, K, L, and D can be decimal fractions (i.e., not only integers) and some of these can even be negative. You should explore the possibilities inherent in this program by trying various combinations of parameter values. □

Table 1. Suggested Parameter Values.

Parameter	Range of Values	
	From	To
B	-∞	+∞
C	-∞	+∞
H	-∞	+∞
M*	1	2
G**	5	15
K	6	60
L	6	60
D	30	50
T1*	1	2

*M and T1 must each be either 1 or 2.
 **G must be +2.4 or greater.

Products...new products...new

COMPUTERS

IBM ANNOUNCES PC XT, PRICE REDUCTIONS

IBM today extended its Personal Computer line with the IBM Personal Computer XT, which provides individuals and businesses with more than nine times the storage capacity previously available.

The base system, which is priced at \$4995, features 131,072 characters of user memory, a dual-sided disk drive with a 368,640 character capacity and a fixed disk drive with a capacity of more than 10 million characters. The IBM Personal Computer XT also includes an asynchronous communications adapter to enable the system to communicate with other IBM Personal Computers, larger IBM systems and outside information sources. In addition, there are eight expansion slots, three of which are used for the already installed communications adapter and the floppy and fixed disk drives.

With an optional expansion unit installed, and maximum user memory, the XT can store nearly 22 million characters of information, or the equivalent of 11,000 double-spaced, typewritten pages.

Also announced was the IBM Color

Display, which features a 12-1/2" screen capable of displaying 256 characters in 16 colors against one of eight background colors.

Along with the introduction of the XT, IBM announced price reductions for IBM Personal Computer products.

A configuration including System Unit with 64K of user memory, keyboard, 160K disk drive and color graphics monitor adapter will be \$2108 at IBM Product Centers. Addition of an IBM graphics printer, printer adapter and printer cable would bring the price to \$2908. Formerly, this entire configuration would have cost \$3305.

A larger configuration, consisting of a 64K system unit and keyboard, with two 160K disk drives, monochrome display, display/printer adapter and an asynchronous communications adapter, will be \$2953. Adding a graphics printer and printer cable would bring the price to \$3603.

IBM also introduced a new version of its Disk Operating System, DOS 2.0, which supports the expanded capabilities for both IBM Personal Computers and includes a new version of the Basic Interpreter. The operating system also permits selected IBM application programs to operate on both IBM Personal Computers, as long as the necessary memory, disk storage and other system resources are available.

PeachText, a new word processing

package for IBM Personal Computers by Peachtree Software, Incorporated, provides a series of Help menus for quick problem solving. The program allows the user to insert new copy in existing text. Simple commands from a single menu enable users to write, correct, change, edit, store, display and print documents.

New versions of IBM Personal Computer business software packages also were announced. Users who already have Version 1.0 of the Peachtree Accounting System may upgrade each program to Version 1.1 through Authorized IBM Personal Computer Dealers. The cost of upgrading each program is \$120 at IBM Product Centers.

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TERMINALS & I/O

BAUSCH & LOMB PORTABLE PLOTTER



A new small plotter is available from Houston Instrument. The DMP-40 is a portable single-pen plotter featuring pen speeds of up to 4.2 ips, and a format size of up to 11" x 17".

Internal firmware enables the DMP-40 to automatically generate circles, arcs, ellipses and general curves on command. Five different character sets are resident in ROM, which may be presented normally, or as italics, and at 255 possible sizes and 360 different degrees of rotation. Eleven different line types are available, ranging from solid lines, to variations on dotted and dashed lines. The DMP-40 will also clip, window, viewport and scale to size. RS-232-C interfacing is built in, as is the ability to autobaud, at no extra cost. Price is \$995.

Bausch & Lomb, 8500 Cameron Road, Austin, TX 78753, (512) 835-0900.

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New Products, continued...

DAISY WHEEL PRINTER

Digital Associates has introduced the DP Series 35 and 55 cps daisywheel printers.

Features include in-use noise level of less than 62 dBA; a selection of over 100 font styles in both plastic and metal printwheels; column/status display (DP-55); 90 degree printwheel rotation to permit easy changing; universal power supply; removable platen; and expandable programmable memory. Compatibility with many computer systems is available. Optional features include cut sheet feeder; tractor feed paper; bottom feed paper slot, and word processing package.

Digital Associates Corp., 1039 E. Main St., Stamford, CT 06902. (800) 243-9054.

CIRCLE 407 ON READER SERVICE CARD

IBM GRAPHICS PRINTER

IBM has announced the IBM Graphics Printer, a new version of the Personal Computer Matrix Printer.

The 80 characters per second, bi-directional printer includes the following features for text and graphics applications.

All points addressable graphics capability with up to 240 dots per inch hori-

zontally. 216 dots vertically; two character sets, one of which is similar to the video display character set, while the other adds international characters enabling users to print French, Spanish, Italian and German; and superscript and subscript capability and an underline module. \$595.

IBM Corp., P.O. Box 1328, Boca Raton, FL 33432.

CIRCLE 406 ON READER SERVICE CARD

THERMAL PRINTER

ACI has introduced the MP 2000, a 20-column thermal printer. Features include an integral Bell 103 standard ASCII 300 baud FSK modem for communications over any dial-up phone line and unattended automatic answering on the first or



fourth ring which allows incoming messages to be printed at 30 characters per second, 24 hours a day. The FCC registered printer plugs into any standard RJ11 telephone jack and does not require special installation.

Advanced Communication, Inc., 462 Oakmead Pky., Sunnyvale, CA 94086. (408) 773-8585.

CIRCLE 409 ON READER SERVICE CARD

APPLE PRINTERS

A dot matrix and a letter quality printer are now available from Apple Computer, Inc.

The Apple Dot Matrix Printer, which uses a parallel interface, has a printhead life of over 100 million characters. It offers high-resolution graphics output (7 x 9 dot matrix, 144 x 160 dots per square inch) and a bi-directional print speed of 120 characters per second. It permits multiple-pitch and proportional spacing, and will mix fonts during a single pass. The Dot Matrix Printer utilizes pin-addressable graphics, and handles cut sheets or tractor-fed paper (roll or fan-fold). \$695.

The Apple Letter Quality Printer, which uses a serial interface, prints bi-directionally at 40 cps on individual sheets or continuous forms. Its switch-selectable settings include vertical and horizontal

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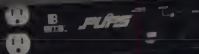
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May 1983 • Creative Computing

taps, 6 or 8 lines-per-inch vertical pitch, 10, 12, or 15 characters-per-inch horizontal pitch; and Auto-Line-Feed toggle. A full complement of print wheels, including six foreign language character sets, will be available. \$2195.

Apple Computer, Inc. 10260 Bandy Dr., Cupertino, CA 95014. (408) 996-1010.

CIRCLE 410 ON READER SERVICE CARD

COMPOSITE VIDEO COLOR MONITOR



USI International has announced a 14" composite video color monitor.

The monitor eliminates the two-step process of converting the computer's video signal to a form that a television can receive and the subsequent conversion within the television set back to a pure video signal. \$399.

USI Computer Products, 71 Park Lane, Brisbane, CA 94005. (415) 468-4900.

CIRCLE 411 ON READER SERVICE CARD

TYPEWRITERS BECOME PRINTERS

Vertical Data Systems Inc. has announced a line of Converters which turn Olivetti and IBM electronic typewriters into computer printers and/or terminals. Printing speeds range from 175 to 230 words per minute.

Converters are available for either Centronix type parallel or RS-232 serial input. The serial version can send as well as receive data and is available for IBM models 50, 60, and or 75. Both versions are available for Olivetti ET121 or ET221.

The Converter fits inside the typewriter, does not affect normal use and requires no modifications. Serial interfaces have selectable baud rates, hardware or XON, XOFF handshake protocols and a built in self test mode.

Vertical Data Systems Inc., 1215 Meyerside Dr., Unit 2, Mississauga, Ontario, Canada L5T 1H3. (416) 671-1752.

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New Products, continued...

PERIPHERALS

PRINTER BUFFER FOR IBM PC

von Leivendyke Enterprises has announced ConvertBuffer, model CBP-64, a 64K byte printer buffer designed to work with the IBM PC and the IBM/Epson dot matrix printer. ConvertBuffer accepts data at 1000 characters per second; stores up to 27 average pages of data in its built-in memory buffer; and then sends it to the IBM/Epson's slower speed of 80 characters per second.

Additionally, ConvertBuffer can format pages to skip over perforations, number the pages, insert a standard header (such as the date) at the top of each page, and print multiple copies.

ConvertBuffer comes with its own power supply, and since it connects to the standard parallel printer adapter, it does not use a card slot inside the PC. \$299.

von Leivendyke Enterprises, Silvermine Ave., Norwalk, CT 06850. (203) 846-4973.

CIRCLE 413 ON READER SERVICE CARD

TYPEWRITER TURNED INTO PRINTER

Electric Typing Fingers (ETF-80) is a peripheral which turns an IBM Selectric or equivalent typewriter into a printer.

The ETF-80 offers the following features: compatibility with IBM Selectric or similar typewriters, no need for additional software required, interface cables



available for Radio Shack TRS-80, Personal Micro Computers PMC-80/81 and Apple II, IBM Personal Computer adapter available and computer access to all standard typewriter functions. \$595.

Personal Micro Computers, Inc., 475 Ellis Street, Mt. View, CA 94043. (415) 962-0220.

CIRCLE 414 ON READER SERVICE CARD

COMPUTER CAMERA

Micron Technology, Inc. has announced the MicronEye, which adds a visual function to a home computer or an

inexpensive eye for industrial robotics. Other applications include image storage, signature analysis, games, and scanning for security of home or property.

The major component in the camera is the Micron IS32 OpticRAM, which is a light sensitive 64K dynamic RAM in a clear package. The MicronEye connects to the Apple II, IBM PC, TRS-80 Color Computer, Commodore 64 or Timex Sinclair. Included with the camera are the 16mm C-mount lens, tripod, 6' telephone cord (camera to computer), serial interface card, floppy disk with basic software routines, and an instruction manual. \$475.

Micron Technology, Inc., 2805 East Columbia Rd., Boise, ID 83706. (208) 383-4000.

CIRCLE 415 ON READER SERVICE CARD

MOUSE FOR MICRO COMPUTERS

Micromouse, designed and priced for microcomputers, has been introduced by the 3G Company. The mouse acts as a pointing device. Roughly the size of a bar of soap and with two pushbutton switches



on top, when it is moved on a table top, a small cursor is moved on the computer screen. The pushbutton switches are used to initiate a computer action at the identified screen location. The mouse has word processing and graphics applications. \$180.

3G Company, Inc., Rt. 3, Box 28A, Gaston, OR 97119. (503) 357-9889.

CIRCLE 416 ON READER SERVICE CARD

LIGHT METER FOR APPLE

A plug-in light meter with accompanying software is being offered by Centronic, Inc. Called "Light Meter II," this hand-size device may be used in a variety of applications including laboratory photometric measurements; home, office or physical plant lighting control; photographic light measurements; solar energy management; and other environmental controls.

The Centronic Light Meter II plugs into any Apple microcomputer and measures light levels up to 6 feet away. The software, which comes on a DOS 3.3 disk, may operate either as a stand-alone light



measurement program or as a subroutine package incorporated into existing application programs. The software can display light levels in footcandles, lumens, or photos. \$69.95. Muirhead, Inc., 1101 Bristol Road, Mountainside, NJ 07092. (201) 233-7200.

CIRCLE 417 ON READER SERVICE CARD

TEXT-TO-SPEECH SYNTHESIZER

Micromint, Inc. has introduced the Microvox, a second generation text-to-speech synthesizer.

It can announce data transmitted at high baud rates over telephone lines or serve as an unlimited vocabulary audio interface for telephone transaction applications. Features include 64 digitally programmable levels of inflection, a 6K text-to-phoneme algorithm, 750 character buffer, RS-232C parallel connector, music and sound effects capability, and adjustable baud rate.

Attached to a terminal keyboard, Microvox can function as a typewriter for the blind or as a communicator for the vocally impaired. Every ASCII character is recognized (including punctuation) as it is typed and can be echoed automatically. \$295.

The Micromint, Inc., 917 Midway, Woodmere, NY 11598. (516) 374-6793.

CIRCLE 418 ON READER SERVICE CARD

PRINT SPOOLING FOR IBM PC

Persyst Inc. has announced Wait-Less Printing, a software print spooler for the IBM Personal Computer.

Wait-Less supports both parallel and serial printers and user-selectable buffer sizes from 2K to 62 Bytes. Buffer size may be automatically assigned through the execution of AUTOEXEC.BAT when the system is initially loaded. \$49.95.

Personal Systems Technology, 22957 La Cadena, Laguna Hills, CA 92653. (714) 859-8871.

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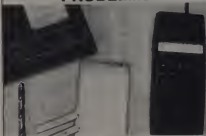
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Interface, Inc., 20932 Cantara St.,
Canoga Park, CA 91304. (213) 341-7914.
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WINCHESTER DRIVE FOR APPLE II

XitenSystems has announced Gallium 10, The Ten Meg Plus Winchester for Apple II computers. The Winchester disk subsystem offers an unformatted capacity of 14.4 megabytes and formatted capacity of 11.3 megabytes. Each controller is capable of driving up to four Winchester disk drives for a total formatted capacity of 45 megabytes.



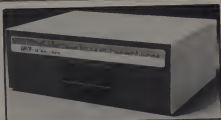
The Gallium 10 is compatible with DOS 3.3, Pascal and CP/M.

XitenSystems, 16815 Hawthorne Blvd.,
Lawndale, CA 90260. (213) 370-3966 or
(800) 421-1947.

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HARD DISK FOR TRS-80

Owners of the Radio Shack TRS-80 Models II and III, and other personal and small business computers can expand storage capacities and cut data accessing



times by as much as 80% with Automated Resource Management's ARMdisk/525 Winchester disk subsystem.

It offers 30 megabytes of formatted hard disk storage and allows up to 4 hosts of equal design to share the same unit. The ARMdisk/525 is supported by TRS-DOS compatible operating systems (HSDS for TRS-80 Model II and LDOS for TRS-80 III). Price is \$3395 for the 7-1/2 megabyte system, \$3995 for the 15 megabyte system, and \$6695 for the 30 megabyte system.

Automated Resource Management,
3613 West MacArthur Blvd., Santa Ana,
CA 92704. (714) 850-9792.

CIRCLE 422 ON READER SERVICE CARD

HARD DISK FOR APPLE III



Davong Systems has introduced three hard disk expansion systems for the Apple III, the DSI-A306 with 5Mb formatted (6Mb unformatted), the DSI-A312 with 10Mb formatted (12Mb unformatted), and the DSI-A319 with 15Mb formatted (19Mb unformatted).

All Davong hard disk systems include support for up to four hard disks and back-up for files larger than a floppy disk.

They are compatible with all standard Apple III software. Prices begin at \$1995. Davong Systems, Inc. 1061 Terra Bella Ave., Mountain View, CA 94043. (415) 965-7130.

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GRAPHICS

80-GRAFIX BOARD

The 80-Grafix board gives any configuration of a TRS-80 Model III computer an effective resolution of 512 x 192 (256 x

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New Products, continued...

(92 in the 32 character mode) through the use of 128 programmable characters. These characters are each made up of a 8 x 12 matrix of individually controlled dots. Once programmed, in Basic or machine language, the characters can be easily and rapidly displayed with a PRINT or POKE statement. Software which uses the normal graphics is not affected since the high resolution graphics are disabled whenever the reset button is pressed. In the high resolution mode, which is enabled by a Basic or Assembly language OUT statement, the new graphics characters are given the values 128 to 255.



The board is supported with over 20 programs/files. In addition to many example programs, included are the utility programs Create, Gethr, and Hires83. Hires83, for example, allows you to edit an entire character set one character at a time on an enlarged grid using the arrow keys to draw characters.

The 80-Grafix programmable character generator gives you the ability to make accurate representations of objects that can be easily and quickly moved around, the ability to experiment with graphics, and 100% compatibility with previously written software. Installation requires clipping on six micro-clips, cutting two traces, and removing three integrated circuits from sockets. \$169.95.

Micro-Labs Inc., 902 Pinecrest,
Richardson, TX 75080. (214) 235-0915.

CIRCLE 424 ON READER SERVICE CARD

MISCELLANEOUS

RS-232C CABLES AND ADAPTORS FOR TRS-80

Radio Shack offers TRS-80 computer users eight RS-232 cables and adaptors used to connect computers together to transfer information, or to connect peripherals.

RS-232C cables are offered in four

lengths: 10 feet (26-1490) for \$29.95; 25 feet (26-1491) for \$39.95; 50 feet (26-1492) for \$54.95; and 100 feet (26-1493) for \$89.95. An 8-inch flat cable extender (26-1497) for \$17.95 allows the use of longer cables with the TRS-80 Model III desktop microcomputer, which requires flat RS-232C cable.

Two RS-232C cables (male-terminated at both ends) can be connected using a new female-to-female RS-232C adapter (26-1495) for \$29.95. The null modem (26-1496) for \$29.95 lets two RS-232C-equipped computers communicate without additional equipment. A 5-foot, 4-pin to RS-232 cable (26-1494) for \$19.95 connects the TRS-80 Color Computer to Network III.

Tandy Corporation/Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102. (817) 390-3300.

EZ PORT-II FOR APPLE



Versa Computing, Inc. announces EZ Port-II, a twin switched zero insertion force (ZIF) socketed extension and cable designed to extend the Apple computer game I/O Port. EZ Port-II is a two socket version of EZ Port-I which extends the I/O games port outside of the computer. \$34.95.

Versa Computing, Inc., 3541 Old Conejo Rd., Suite 104, Newbury Park, CA 91320. (805) 498-1956.

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SOFTWARE

TRS-80 PROGRAM LIBRARY

Over the past two years, Gordon Speer has written over 250 Basic programs for the 16K TRS-80 Model I and III, most of which have been published in *H & E Computerics Magazine*. For those who do not wish to type them in, Gordon is now offering these programs individually on tape or disk for the nominal cost of \$2 each for 1 to 10 and \$1 each for programs over 10.

Gordon also has eight business programs such as inventory, dealer list, health insurance and mail lists at prices ranging from \$40 to \$495. Send a self-addressed stamped envelope for a complete list.

Gordon Speer, 3304 Woodlawn Road, Sterling, IL 61081.

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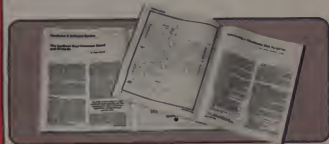
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NEW SUBSCRIBERS ONLY

Multiple Socket Extensions

This month we will show you how to build multiple socket extensions for Apple computers. These devices provide several convenient functions for the computer user: they bring the game port out of the case to a position beside the keyboard; they permit switching game controllers without interrupting the program currently running; and, with appropriate software, they let you use two standard joysticks at once.

Socket extensions are available commercially, of course, but no single unit has all the features we will describe. Besides, you can construct a home built unit for about half the cost of a commercial one. A multiple socket extension is an excellent first project for learning to work on computer hardware, since the device is simple and easy to construct. The materials are easy to obtain, and only a small multimeter is required for testing the finished unit. What more could you want?

Figures 1 through 5 give you the details of units that were built for the Apple II. We will discuss what might be done to construct multiple socket extensions for other computers later in the article.

Types of Multiple Sockets

There are two types of multiple socket extensions. Those which permit the choice of one of two or more controls will be referred to as *selection units*. Those which permit two standard paddle sets or joysticks to be used at the same time will be called *two-person units*.

We will also describe special features for each type of unit, including click action power switches, isolation diodes

Tom and Kelda Riley

that prevent controls from affecting each other's readings, and zip (zero insertion pressure) sockets. These special features will let you customize the unit to your exact needs.

A Word of Caution

Good practice for working on electronic equipment requires that the power to the unit be turned off before any plug is installed or removed. The power switches on these multiple sockets are intended to allow you to select among controls already plugged into the sockets. Plugging in a paddle when the power switch is off but the computer is turned on violates good practice, although it is preferable to plugging the paddle into a live socket. Remember: turn off the main power supply to your computer before plugging in or unplugging any device from any of these socket extensions.

Tools Required

The construction of a socket extension is primarily a precise and somewhat tedious soldering job. Soldering is the key-stone of all hardware skills and one that can only be learned through practice. It is definitely a skill worth mastering.

For this project you need a small pencil soldering iron of about 25 watts and a stand to hold it, a sponge to clean the tip of the iron, desoldering braid to remove solder bridges, and fine resin-core solder. Other tools you should have on hand include a pair of small diagonal cutters, long-nose pliers (for bending fine wires), an X-acto or other small-bladed knife,

and wire strippers. The plier-type wire strippers with an adjustment bolt work well but must be adjusted and tested on each new wire size.

The Stacked Plug Unit

The plugs on Apple paddles and joysticks are easily damaged and may have to be replaced. It is helpful to replace the plug with a stacked plug and socket, thus providing an extra socket of the two-person type. For this replacement you will need a 16-pin wire-wrap socket and a 16-pin dip header. The construction details are given in Figure 1. The socket rides on top of the header, providing not only a new socket but also a handle for the plug.

First trim off the socket pins to an even $\frac{1}{2}$ " and bend them out slightly. (You might cut the #2 pin $\frac{1}{8}$ " longer.) Then straighten the pin ends as shown in the end view of Figure 1; this allows the wire-wrap pins to slip over the spades of the header. Double check to be sure that the pin 1 end of the header, marked with a cut off corner, is matched to the pin 1 end of the socket, marked with a notch or cut off corner.

Plug the header into another unattached socket so that its pins will not misalign when heated. Solder pins 1, 8, 9, and 16. Then solder pins 3, 5, 12, 13, 14, and 15. Cut off pins 4, 7, and 11 about $\frac{1}{4}$ " down from the socket. Using long-nose pliers, bend pin 6 over to fit into spade 7 and bend pin 10 over to reach spade 11.

Now for the tricky part: pin 2 must be bent around behind pin 3 to reach spade 4, but without touching pin 3. If this gives you trouble, try cutting off the #2 pin $\frac{1}{4}$ " from the socket and soldering a $\frac{1}{4}$ " piece of insulated #22 solid wire between the pin 2 stub and spade 4.

Tom and Kelda Riley, 1002 Lewis Ave., Rockville, MD 20851.

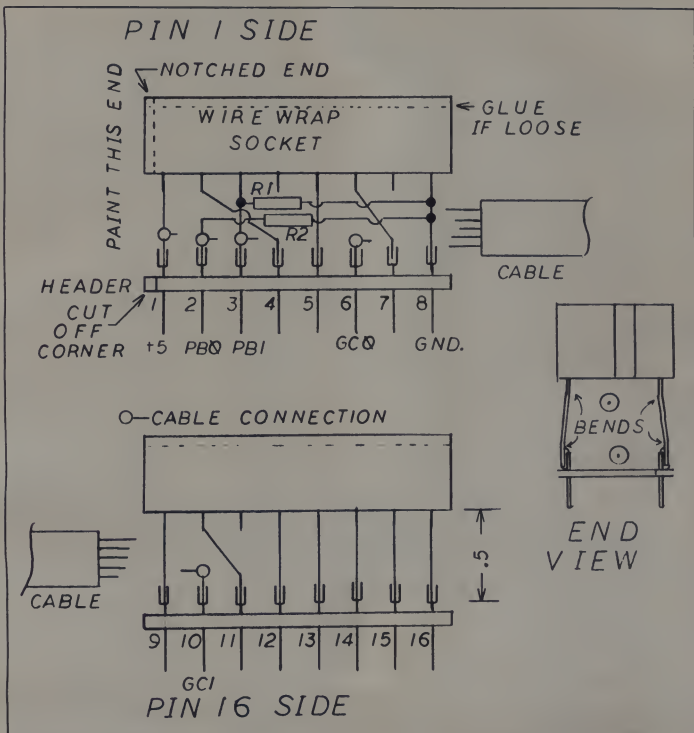


Figure 1. Apple stacked plug.

If the old paddle plug that you are replacing with the stacked unit needs pull-down resistors for its pushbuttons, these can be installed between the socket pins. We used two $\frac{1}{4}$ watt, 1K ohm, 5% resistors. They share pin 8 for ground; one resistor goes to spade 2 and the other to pin 3. Trim the wires carefully, bend them neatly around the pins, and solder.

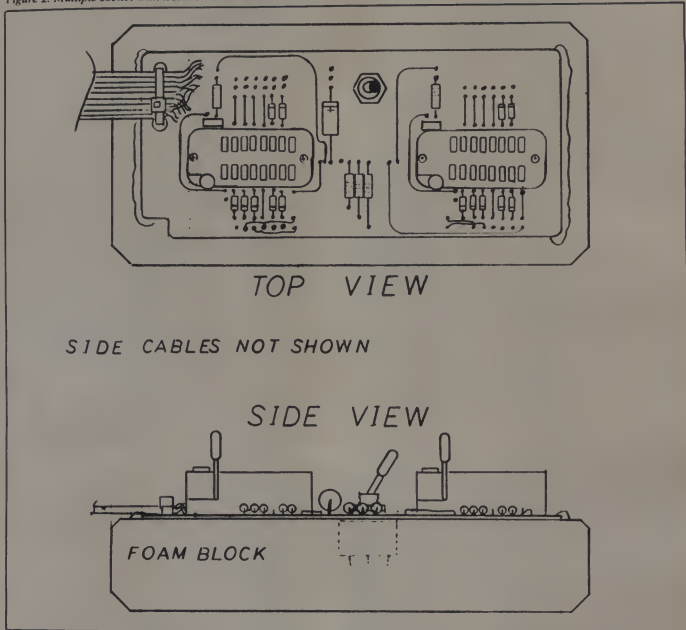
The cable should be stripped of its outer cover for $\frac{3}{4}$ " and the wire trimmed. Since the cable normally enters from the pin 8 end, the +5 wire will be longest and the ground wire shortest. Strip the wire back $\frac{3}{16}$ ", twist the strands, bend them into a small hook, and tin the wire. Your wire stripper must be set so that none of the fine wires are cut. Try several adjustments on a

scrap of the same wire until you have it set correctly. One at a time, press each wire into the correct fork or close the hook around the pin shaft, and solder it.

The pin 1 end should be marked with light-colored fingernail polish, model enamel, or white typing correction fluid covered with clear fingernail polish. Sometimes the plastic top of the socket comes loose and must be glued back on

Controller Corner, continued...

Figure 2. Multiple socket with isolation diodes.



with Super Glue or clear fingernail polish.

Testing the Stacked Plug Unit

If you have a multimeter you should check your wiring for continuity and to insure against shorts. Pin 1 to pin 8 must measure in excess of 50 ohms, and the measurement is usually much greater.

If you have difficulty inserting a plug into the new socket the first time you try it, stick a medium sewing needle into each of the holes in the socket to realign the internal parts with the holes. If you plug the control with this stacked socket into the Apple and then plug a standard set of paddles or a joystick into the new socket, pot 0 of the second joystick acts

as pot 2, and its pot 1 acts as pot 3. Similarly, its pushbutton 0 acts as pushbutton 2, but its pushbutton 1 remains pushbutton 1 and is shared with the original joystick. (Apple II has only three pushbuttons.) Incidentally, if you have made the shift key modification for upper/lower case, it will hold pushbutton 2 closed unless the shift key is pressed. This will interfere with the use of the pushbutton on the second joystick plugged into the stacked plug.

You now have all the hardware you need to play two-person competitive games with full joystick control. There is not much software available that makes use of this feature, but you can dream, or write your own.

The Selection Switch Unit

Now let's look at the construction of a multiple socket that can be placed beside the Apple to let you choose between two controls with the flick of a switch. Figure 2 is a sketch of this unit showing the component layout. The terminations of the main cable wires and two side cables are not shown because they would hide the components. These cables will be discussed later.

This multiple socket extension has all the most popular features, including sockets, a click switch, and isolation diodes. If you don't need all of these features and want to leave one or more of them off, the cost of the parts will be reduced.

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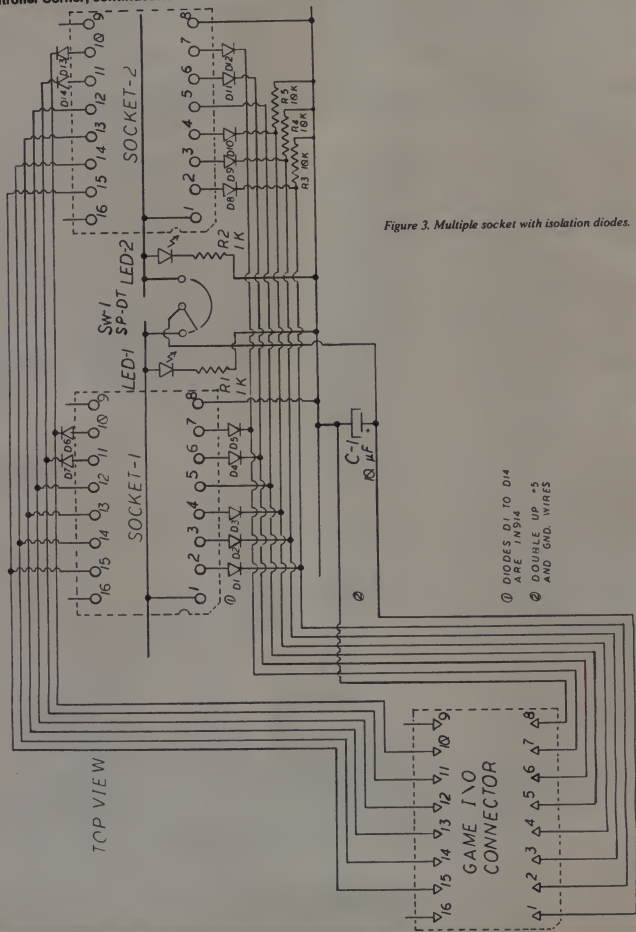


Figure 3. Multiple socket with isolation diodes.

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Controller Corner, continued...

The zip plugs used for this unit cost about \$6.20 each (see Parts List), compared to \$1.00 for a good standard socket. The zip plugs are larger and have a small lever on the side that locks and unlocks the socket. If you have only one set of paddles and a joystick and want to switch back and forth between them, you probably won't want to pay extra for zip plugs, so buy standard, gold-plated sockets.

We prefer a switch that clicks and makes positive contact to the simple slide switches commonly used on commercial extension sockets. A click switch, however, extends below the circuit board, requiring the foam block shown in Figure 1 for a base.

Figure 3 is the schematic for the selection socket. It is basically very simple: 13 pins of the plug are connected to their counterparts on each socket. The +5 supply (pin 1) is filtered with a capacitor and switched between the two sockets. The only complication is the isolation diodes.

Each socket has seven 1N914 or equivalent general purpose silicon diodes. On the pushbutton lines, they prevent the pull-down resistors or the plugged-in paddles from being in parallel. This would waste +5 current and, if more than four paddles were plugged in at one time, might overload the +5 supply. The use of these diodes necessitates the three 10K pull-down resistors (R3, R4, and R5) on this board.

The four diodes on the game control inputs prevent the pots in the unused controls from affecting the readings of the one in use. These diodes are a must if correction caps are used on any paddle. They may have a slight effect on the paddle readings. Some devices such as the sketch pad (the subject of an upcoming article) and the quad thermometer, will have to have their calibrations checked for when used in sockets with diodes.



Parts List

Number Required	Description of Part	Suggested Supplier	Total Cost
1	276-154A Experimental Bread Board	Radio Shack	\$ 3.70
2	216-3340 ZIP DIP II Socket, 16-pin	Jameco	12.40
1	16-pin W.W. Socket, gold plated	Jameco	1.40
1	16-pin H.P. (Header Plug)	Jameco	.70
2 ft.	Ribbon cable, 20-conductor	Radio Shack	.40
14	1N914 (or 1N4148) diodes	Jameco	1.00
1	Capacitor, 10 uf, 15 volt	Radio Shack	.40
3	Resistor, 10K ohm, 1/4 watt, 5%	Radio Shack	.40
2	Resistor, 1K ohm, 1/4 watt, 5%	Radio Shack	.40
2	Light Emitting Diodes	Radio Shack	1.50
Misc.	Silicone sealant, solder, etc.		1.10
		Total	\$26.00

Suppliers:
Jameco Electronics
1355 Shoreway Rd.
Belmont, CA 94002

Circuit Board for the Selection Switch

Figure 4 shows the bottom of half of a Radio Shack printed circuit board (Catalog No. 276-154A Experimental), with modifications to suit this device. The board was cut in half by scoring both sides with an X-acto knife and breaking it over the edge of a table. Each half will make a two-socket unit. Drill a hole in the board to suit the switch you choose and a hole for a wire tie to secure the main cable.

The existing copper lanes must then be cut in 24 places, as shown by the dashed lines in Figure 4. This is done by making two cuts, 1/32" apart, with an X-acto knife and removing the copper sliver between the cuts. Some skill and practice as well as a sharp knife blade are required for this step.

Smooth the edges of the board and the drilled holes with a fine file. Clean the copper lanes by rubbing them vigorously with a pink eraser. This last step, a standard electronics practice, is vital.

The sockets are installed first. Figure 4 shows the pin locations from the bottom: both #1 pins go toward the cable end. The socket pins and all wires should be bent over flat for 1/16" before soldering, since this circuit board does not have the metal-lined holes (often called "plated-through") that a more expensive board would.

The 1N914 diodes can now be installed on pins 2, 3, 4, 6, 7, 10, and 11 of each socket. The end with the black band is the cathode, or positive, terminal and must point away from the socket. Bend the wires over flat, solder them, and cut off the excess. In the 18 places shown in Figure 4, the wires must be bent across an open space to make a bridge from one small copper pad to another. Use the wires cut off of the diodes to make straight wire jumpers the same

length as the diodes for pins 5, 12, 13, 14, and 15 on both sockets. This step will make it easier to install the cables.

One of the long copper traces that runs through the socket is used for the ground bus. The negative lead of the capacitor and one end of each pull-down resistor (R3, R4, R5) go to the ground bus. In addition, a wire from pin 8 of each socket must be run to this bus as shown in Figure 2.

The single-pole double-throw switch requires three insulated wires on the underside of the board. The first wire runs from the plus wire of the cap to the center common of the switch, and the other two wires run from pin 1 of each socket to the opposite switch terminal.

The LEDs (light emitting diodes) used for the prototype are small and rectangular, one red, one green. They are slightly more expensive than round LEDs, but that is the only difference. Purchase round ones of any color, if you prefer them. Install the LEDs beside the socket and even with its top. From the positive terminal, run a wire around to pin 1 of each socket. Then install the current-limiting resistors R1 and R2 on a wire run to the ground bus for each. The LED for socket 1 is in an area where there are no copper pads, so loop one wire around the other one before you solder them.

On the pin 1 side (see Figure 4), three bus lanes are used for the pull-down resistors of the pushbuttons. Short insulated jumper wires are needed to run between pins 3 and 4 and these buses on each end, as shown in Figure 2. Both #2 pins are jumped to a bus below the board. As detailed in Figure 5, two of these jumper wires go into holes through which cable wires must also be inserted, so you must wait until the second wire is ready before you solder them both.

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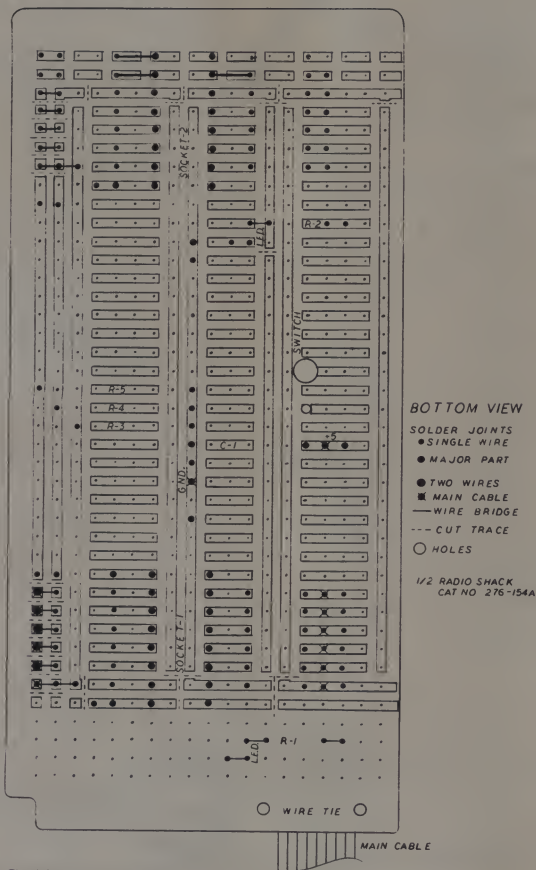


Figure 4. Circuit board for multiple socket with diodes.

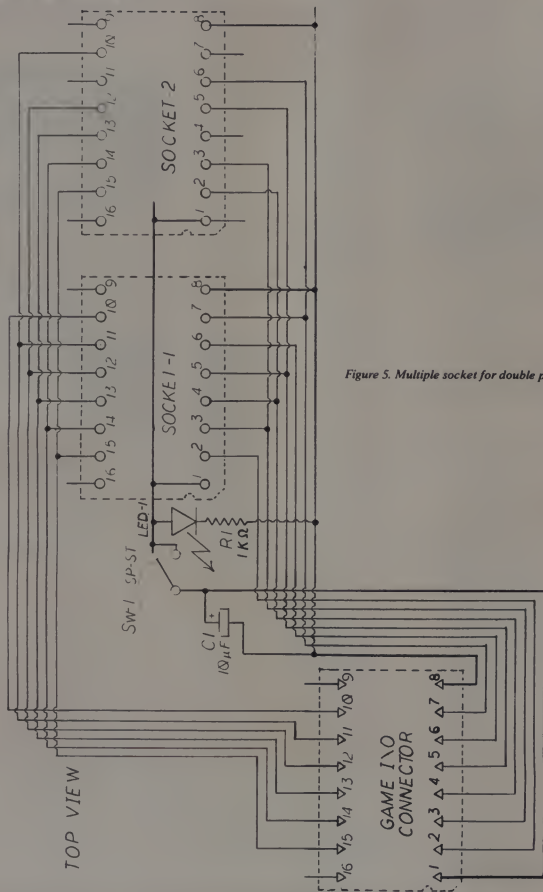


Figure 5. Multiple socket for double paddle games.

There is a total of five such double-wire holes, and it is somewhat tricky to install and solder the wires. When using a general-purpose circuit board, you will run into a few difficulties like this as a matter of course.

Cables for the Selection Switch

The two side cables noted previously must now be made up and installed. (They were omitted from Figure 2 for the sake of clarity; their locations are shown on Figure 5.) The one on the pin 1 side has three conductors, for pins 5, 6, and 7. The one on the pin 16 side has six conductors, for pins 10, 11, 12, 13, 14, and 15. You can use two pieces of ribbon cable or individual wires for these cables.

The main cable requires 14 conductors. You can use a DIP jumper cable; these come with DIP plugs on each end. Cut off one plug and fan out the wires. Be certain to check the jumper for continuity end-to-end and for each wire since DIP jumpers sometimes have open pins.

We prefer to use 16-wire ribbon cable (cut from 20-wire ribbon) and double up the wires on pins 1 and 8. This improves the electrical characteristics of the unit and lets you add the stacked plug socket described earlier. The pull-down resistors R3, R4, and R5 need not be put inside the plug since they are on the board, but careful soldering is required to place 16 wires in so small a space.

Separate 2" of ribbon on the board end of the cable into individual wires and trim them to the required length. The longest wire is the double ground that runs to the central bus. The +5 wires that run to the plus end of the cap are only a bit shorter. The rest of the wires connect along each side of socket 1. Each wire is trimmed, stripped, twisted, tinned, inserted into its hole, and soldered.

People with small hands have a definite advantage in doing this type of electronic work. You will find that a stand or clamp to hold the board is also a great help.

The cables should be laid down neatly and secured with a wire wrap. A 1" thick block of white plastic foam, stiff but flexible, from a shipping box makes an excellent base for the unit. Cut out a hole for the switch and secure the board in place with a small amount of silicone sealant. If you are concerned about the exposed wires you could cover the top with a sheet of plastic with three holes cut into it.

Testing the Selection Switch

To test the selection unit, measure the resistance from pin 1 to pin 8 of each socket. The reading should be infinite at all switch positions. Inspect the solder

side of the circuit board, looking for bridges between copper lanes and cold solder joints that have an excess of dark resin. To double check your work, ask a friend to check conductance wire-by-wire, with the multimeter on a low ohms setting, and color in the second photocopy of the schematic.

When you are satisfied that the circuit tests out correctly, plug in the selection socket and turn on the Apple. (We assume that you first turned off your computer if it was already on.) If the computer does not start up in a completely normal fashion, turn it off at once and recheck your work. If the computer starts up correctly, try the switch and watch the LEDs. Next, turn off the computer and plug a trusted paddle into your new socket extension. Start up the computer again and run a paddle check program (for an example of such a program, refer to "Rebuilding Game Paddles and Joysticks" in the February issue.)

If there are any bugs in the unit, they will quickly become apparent. Turn off the computer and carefully check the solder joints associated with any feature that didn't work properly. Most problems are visible on close inspection. Also, remember to test the stacked plug that is now inside the computer case.

Construction of Other Types of Extensions

Figure 5 is the circuit schematic for a two-person game multiple socket board. This unit has an on/off switch for both sockets and does not need isolation diodes. Pins 2 and 4, 6 and 7, and 10 and 11 are cross wired. Like the stacked plug, this circuit gives you the two-person game feature, but makes it available outside the Apple case.

Alternatively, you could make up a four-socket board that included both schematics (Figures 4 and 5), with a three-position rotary switch in the center. The rotary switch would direct power to socket 1, 2, or 3, while the fourth socket on the board would be attached to socket 3 as shown in Figure 5. Seven isolation diodes would be required for socket 3 (none for socket 4), but the connection to socket 4 would be located between the diodes and the sockets. But why stop at four sockets? There is no particular limit except the size of the circuit board.

Owners of computers other than the Apple will also find it beneficial to bring the game ports out of the case and add a choice switch. The type of plug is different for each computer, and of course the pin numbers will change. In many systems, all the plugs and sockets would be on short cables, with the switch, diodes, and resistors on a circuit board in

the center. It will take some work to find the correct pin out information and locate a supplier for the connectors. Some systems may use pull-up resistors, connected to the +5 supply rather than the ground, instead of the Apple pull-down resistors. Other systems may not need resistors at all.

There is one other type of multiple control worth mentioning. The multiplexing control, for which the computer chooses the active control, is not used for games. When the control input is a measurement (for example, of temperature or light level) and you must log the measurements from more than four sensors automatically, you would use a multiplexing control. In this way you could monitor a solar hot water system or a science project. This type of multiple socket is quite similar to the units we have just described. We will try to cover the multiplexing control at a later date.

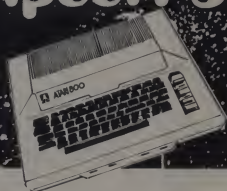
In Conclusion

The multiple socket extension is one of the most popular additions to the Apple and other personal computers. The home built version not only costs less than a commercial unit but has more features and is an excellent beginning project in computer hardware.

Next time we will discuss the construction of a sketch pad and digitizer. With this unit you can draw on a piece of paper and on the hi-res screen at the same time. You can also use it to enter information from charts and graphs directly off paper into the computer memory.



outpost: atari



Is it possible that there is a touch of spring in the air? Could it be that those are buds on the trees? Can the sun be turning warm and rich with promise? Is it time for a young man's fancy to turn to thoughts of—yes—the viability of Atari marketing?

Maybe you are the kind of devout Atari follower who is offended by any critical comment aimed at the makers of your impressive array of hardware. I'll bet the last place you would want to encounter these is in the Outpost. If so, please skip ahead to our next topic.

Scuttlebytes

"What's good for General Motors," they used to say, "is good for the USA." Well that may or may not have ever been true, but it seems now that a good part of the USA is worried about Atari. From the *Wall Street Journal* to *Rolling Stone* magazine and ABC news, word has it that Atari is "demoralized," due in large part to the plummeting of Warner Communications stock in early 1983. It has lost 1.3 billion (yes folks, that's *billion*) dollars in share value since the end of last year, and when pressed for a reason, Warner points a shaky finger at Atari. It is only fair: when Warner was making more profits from Atari than all of its other subsidiaries combined, that was Atari's doing, too. They can now at least take the heat.

The thing that has Wall Street really skitterish is the fear that Atari will suck other video game interests down the drain with it if it goes the way of the Titanic. Companies such as Mattel are already hurting through no fault of their own. The key word is "saturation." Has the video games market reached "saturation"? If so, it is time to sell out and head for the lifeboats. Unsinkable Atari may have struck an iceberg, and America's economic waters are frigid. Backers and brokers first!

John Anderson

While remaining one of its most loyal fans, I have been a follower and sometimes vocal critic of Atari for some years now, observing its occasionally erratic market behavior. It is amazing to me, first of all, that Atari has survived its own remarkable rate of expansion. It is a credit to the company that it has held together through periods of growth so rapid that a more rigid organization might have shattered. And Atari did more than that—it continued developing quality products.

But the company has made some wrong turns lately. One of the least productive and most destructive affairs to befall Atari recently is the vituperative feuding between its Home Computer Division and Consumer Electronics (home video game) Division. This rift has compromised the effectiveness of each, and the proof is in the latest products.

At a time when categories of home computers and home entertainment machines are meshing, Atari has introduced the 5200 Supersystem, which is

a somewhat redesigned Atari 400, undercutting and completely incompatible with it or any other Atari computer. This was a serious marketing error, especially coming from a company that prides itself on marketing savvy.

The reason? Well the only one that I can posit is fear on the part of the powerful Consumer Electronics Division that it would be made obsolete or absorbed by the Home Computer Division, if the 400/800 became the games "heir apparent" to the ubiquitous VCS model 2600. Witness the introduction of a keyboard peripheral for the VCS that will be upwardly incompatible with any other Atari product. It just doesn't make sense.

Although the Supersystem is selling, it is up against some very stiff competition, and its poorly designed controllers detract seriously from game playability (they are even slower than those on the Bally Astrocade). I would much rather play the 400/800/1200 versions of its game cartridges to avoid the sluggish 5200 joysticks, which make Pac-Man play like he's stuck in quicksand. Whatever was on the design team's mind (I suspect the design of a single controller to act as paddle and joystick, and opening up the possibility of an analog trackball), they went wrong here.

Then there is the model 1200 XL computer, the Home Computer Division's "next generation." If it had been announced at \$499 instead of \$899, it would have been a welcome addition to the Atari computer line. As it stands, it is strike two for Atari. The 1200 has met with nearly universal insouciance in the microcomputer community, and for good reason. It has an extra 16K in a designer case, without a right cartridge slot, expansion slots, or a third and fourth controller jack. It has no standard parallel or RS-232 ports. Only substantive price cuts will help its image in any tangible way.



The infamous 5200 controller, with the slowest action in the West, East, or in between. It is also next to impossible to get one back together once it's apart.

Outpost: Atari, continued...

And what of the Atari 600? Well, it seems we may never see such a product, because word has it the Atari 600 has been postponed indefinitely. The reason? Nowhere to fit it into the product line. With the 800 now discounted to as low as \$450, the 600 can't fit between the 400 and the 800 in pricing.

Even more damaging to the Atari Home Computer Division is the downright hostility that it has displayed to third-party support. It seems that marketing resents, and seeks to eliminate or absorb, those who develop third-party hardware. Interfacing is kept intentionally nonstandard, expansion slots are phased out, and potential interfacing controller jacks are removed. One of the more enlightened sales points of the original 800 was its modularity—it would never be obsolete, said Atari, because the operating system was on a plug-in board, as was RAM memory, and all could be replaced in a matter of seconds.

Well the new 800s are not modular. In fact, the memory slot area on the new 800 machines is no longer accessible! This means a new 64K OS for the 800 is not on the docket from Atari, and operating systems from other sources will be discouraged.

These moves constitute a very serious underestimation by Atari concerning the attitude of the home computer consumer. While the home user is in most cases not a computer "hacker," he should not be patronized, either. He might want modularity, 80 column capability, or bank-selectable RAM. He may see uses for the machine that nobody has yet dreamed, and should have every opportunity to realize those applications.

This is the kind of open-ended flexibility that made the Apple the most popular microcomputer of its day. It is the kind of attitude that Commodore is taking to get the model 64 off to a strong start. It is an attitude that Atari has continually misunderstood, discouraged, and somehow confused with piracy—"it's *our* machine," I imagine them saying, "we'll design the peripherals." They should really rethink that outlook, and quickly.

For if Atari misses with its next swing, reports of its death may not be so exaggerated. This is a fickle business, and the early lead of the VCS, as well as the inspiration that bred the magnificent 400 and 800, has now been spent. Atari must play it smart now. It can do so only by responding to the needs and desires of an increasingly discriminating and well-versed buyer.

Well enough of that. It is well known that the Atari is my favorite micro-

computer, and it is time to underscore the positive side of that opinion.

Light Pen Revisited

Though it was years ago, I can still vividly remember my frustration. I was new to the Atari, and starved for programming applications to help me get the most from, and learn the most about, my machine. And there I was, having typed in a program from a magazine four hours on end, to discover not only that it didn't run, but that it *couldn't* run as it was printed. Sometimes I would be able to institute my own fix, and other times I couldn't. Sometimes the magazine would acknowledge the problem in a subsequent issue, and print a fix. Sometimes the flaw would never be addressed.

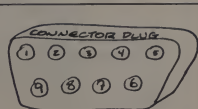
As a lasting result of these trials, I try very hard to make sure that everything that makes it into this column is correct when it gets here. It is hard for me to prove that assertion right this minute, however, because of a reversed figure, dropped program line, and lack of attention to the unique features of the Atari 400 in the March home-brew light pen column. This has caused a lot of consternation. All I can do is tender my sincere apologies, and set out the corrections.

The first person to bring these problems to my attention was my friend Greg Leslie, sysop of the GREKELCOM Atari BBS in Oklahoma City (give them a call 24 hours a day at (405) 722-5056). The patches for the 800 are as simple as a pair of switched wires and a missing program line, but that's quite enough to cause aggravating foul-ups for many readers. The touch ring on a pen constructed as originally indicated will not work, returning a PADDLE (0) value of 228 no matter what.

The touch switch is actually part of a circuit that feeds a small voltage from the wire loop, through the user, and into the body of the pen. The voltage feeds into pin 9 on port I of the computer, causing the PADDLE (0) value to dip below 228. With the pen body grounded, no voltage can flow. The following swap is needed:

Inside the pen, disconnect the loop wire from the wire that leads to pin 9. Then solder the loop wire to the end of the resistor that is *not* connected to the phototransistor. There should be another wire soldered there which goes to pin 7 on the DE-9 plug.

The wire that is friction-fit against the metal pen body needs to be disconnected from the emitter of the phototransistor and soldered to the wire that leads to pin 9 (the disconnected lead described above).



NOTE: THIS IS THE PLUG.
THE JACK WIRES UP IN
MIRROR IMAGE.

- 6 - (PENHOT) - DIRECTLY TO COLLECTOR
- 7 - (+5v) - TO RESISTOR AND TOUCH RING
- 8 - (GROUND) - TO EMITTER
- 9 - (PADDLE 0 HOT) - TO PEN BODY

Figure 1. This supersedes Figure 8 in the March Outpost.

Now, if all is well, the wire loop will be connected to +5v (pin 7), the pen body will be connected to the paddle input (pin 9), and the switch should work as advertised. A revised Figure 8 appears here as Figure 1.

As I first mentioned, it may be necessary to dampen your finger for best results. Pen sensitivity may also be improved by increasing the brightness control on your TV or monitor.

That's not all. Line 130 is missing from Figure 12, and should be exactly the same as line 130 in Figure 11: 130 Y=PEEK(565).

In addition, there are some hardware differences between the Atari 400 and 800 models which cause the light pen to be read from port 4 on the 400. If you have a 400, plug the pen into port 4 and substitute PADDLE(6) for all references to PADDLE(0) in the demo programs. From there everything should be peachy.

Jeepers. I'm sorry about that. I hope it didn't cause too many readers to throw their light pens in the trash. It really can be done, and with impressive results. Greg told me he was quite happy with his pen once he had worked out the gremlins, and that it compared favorably to some commercial models.

And I promise I'll check possible patches for the 400 on all hardware projects to come! I've had a lesson on those differences here, as well as the need for triple-checking of figures and listings.

Programming Utilities

Have you ever wished you had a program editor for developing Atari Basic or assembler code? The Atari Program-Text Editor, available from APX, has

At last, the first home video joystick that puts the firing button where it should have been in the first place.

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CIRCLE 167 ON READER SERVICE CARD

Outpost: Atari, continued...

long been the only sophisticated tool available in this category. Now a new and powerful entry, *ERedit* brings over 25 separate editing commands to the disposal of the Atari programmer.

Among its standard features are commands to search for strings, search and replace strings, move, copy, insert, and delete portions of the files; full cursor control; file comparison; formatting of disks; locking and unlocking, as well as renaming of files, and renumbering.

In addition, the editor provides in-depth help functions for each of its commands, and best of all, English error messages when the master disk is accessible in drive 1.

The program supports multiple drive systems as well as printers.

Once you use an editor such as *ERedit* to aid program development, you'll never want to work "raw" again. The tedious and sometimes dangerous editing processes (beware the infamous keyboard lock-up syndrome) are made fussless and trouble free.

ERedit is a new product, and its retail price was not fixed at press time. It requires a 24K system with at least one disk drive. For more information contact EHR3 Inc., 174 Summit Ave., Summit, NJ 07901. (201) 277-6785.

Another product that can be of massive help during programming is *Basic Commander*, from MMG Micro Software. It contains a mini-DOS, allowing the user to list, save, enter, load, run, delete, lock, unlock, and format disks, without needing to invoke the main DOS program. "But many mini-DOS programs are on the market with similar

features," you may say. Well, *Basic Commander* also features automatic line numbering, block delete, and transparency during use. "All well and good," state the skeptics, "but *ERedit* and *Monkey Wrench* do those things just fine." Yeah, but do they allow three user-programmable function keys for simultaneous macro definition? This program does, and it is a very convenient potential.

For example, you might assign the keystrokes CONTROL-I to the string "LOAD D1:", CONTROL-S to the string "SAVE D1:", and CONTROL-R to the string "RUN D1:". Cursor placement can then be determined within the macro so that the user need only type the file name and RETURN to execute the desired command. Or the string can just as easily be embedded within a bit of code. Who says the IBM can do things that the Atari can't?

This is another of the category of features that a programmer learns to lean on during program development, and would from that moment on miss dearly were they not available.

Basic Commander lists for \$34.95. For more information, contact MMG Micro Software, P.O. Box 131, Marlboro, NJ 07746.

DOS Access from Forth

Valpar International has added yet another package to its growing ValForth series, which is without a doubt the foremost Forth implementation available for the Atari computer. This new package is *ValDOS*, which allows access to conventional DOS files from the Forth

environment. Think of it: no more incompatibility between Forth screens and DOS files.

The *ValDOS* package is documented in the same professional manner as previous ValForth packages, and retails for \$45. This includes a file editor that allows Forth code to be saved in DOS format.

For more information, contact Valpar International, 3801 E. 34th St., Tucson, AZ 85713. (602) 790-7141.

Reference Books Revisited

In the December 1982 Outpost, we took a look at reference books for the Atari computer owner. These ranged from books for the child or beginner to advanced technical notes for machine language programmers. Let's add to that list the following new titles:

Atari Programming With 55 Programs, by Linda M. Schreiber. 244 pp. TAB Books, Blue Ridge Summit, PA 17214. This crisply organized introduction to programming uses generic information alongside an Atari-specific manual to approach the fundamentals of Basic. Programs are neat and really do work. There are nicely presented techniques to dispel the fears of flowcharting so common in beginners (and not-so-beginners) and the best description of error-trapping I've seen in an Atari work. The book offers quick immersion into assembler and then sets you back out again before shock can set in. It would be even nicer if it came with a disk.

Inside Atari Basic, by Bill Carris. 181 pp. Reston Publishing, Reston, VA 22090. Word has it that this book will replace *Atari Basic* in the carton accompanying Atari computers, and it is an improvement over that beginner's text (though not of the caliber of *Your Atari Computer*). Carris touches on basic points with humor and common sense. The book is quite short, and therefore necessarily rather shallow most of the time, but of great help to the beginner. It is not for the intermediate or advanced programmer.

And heaven save me from the inveterate programming punster. Ever take note of how often "programming-made-painless" texts inflict sadistic puns at every turn? Best (worst) one in this book: "Hip Hip Array." As my buddy Arlan says, somebody please gag that man with a spoon.

Understanding Atari Graphics, by Michael Boom. 49 pp. Alfred Publishing, Sherman Oaks, CA 91403. Though really not much more than a tall pamphlet, this work contains a great deal of valuable reference material pertaining to Atari graphics, including a keypress to ATASCII character chart, which can be



"I suppose someday they'll be replaced by a single chocolate chip."

found in no other reference I have seen, and a color chart showing the hues available with SETCOLOR commands. It also contains interesting material pertaining to the GTIA chip. I just wish there were more than 49 pages available to the author, so he might have taken up a meaty subject or two, like player-missile graphics or display list manipulation.

The Visicalc Book, Atari Edition, by Donald H. Beil. 298 pp. Reston Publishing, Reston, VA 22090. The best *Visicalc* reference around is now in an edition to complement *Atari Visicalc*. This primer on accessing the real power of the program, and the creation of templates to best serve user's needs, is available in hard and softcover editions.

There are at least a couple of other new publications on the Atari now appearing, and I hope to get a look at them soon. I will report my book findings again shortly.

Supertext Revisited

I created a network. When I posed a challenge to readers of the February column to send in a self-modifying version of the title card generator I had written, I little expected to be buried in a blizzard of entries (we've had enough blizzards out this way for one year, thank you). I wish I could reply to everybody personally, but that just isn't possible. If you receive mystery software in the mail, it is probably from me. And my thanks to you for participating, and for the many words of encouragement you sent. As many of you have suggested, I hope to pose another challenge in an upcoming column.

As promised, in a month or so you will see an entire self-modifying supertext program, encompassing the best of the many techniques we have seen for accomplishing it. In the meantime, I'd like to single out a few contestants for programs that showed, for one reason or another, what I thought was exceptional originality, elegance, or cleverness.

The names of these people appear as Figure 2. The order of the names does not represent any sort of ranking, but merely the order in which they were received. I salute these folks, whose programming savvy in many cases far exceeds mine, and wish them the best in their further efforts on the Atari, as well as in all of their endeavors.

Mail Bag Revisited

While we're revisiting so many things, I shall take an opportunity to answer a few of the many questions that have come my way. Yes, there will be a Logo for the Atari, and we should see it some

time soon. It will be on a 16K ROM cartridge. Yes, there will be a 16K Microsoft Basic ROM cartridge as well, but no, Microsoft is not built into the 1200 XL. Nice thought, though. Nor do I know much about the rumored new graphics modes of that machine, as we still have not received one at the lab.

In answer to a common query, I unfortunately know of no way to toggle off the internal speaker through software. I attached a toggle switch to the underside of my original 800, and pulled the speakers entirely from two other units I use regularly. A description of the speaker switch project will appear in next month's *Outpost*. The 1200, by the way, has no internal speaker at all, and routes its beeps, glurps, and gurgles to the TV or monitor speaker. Apparently I was not the only Atari user being driven slowly looney by keyclicks and razzes.

Until next time, do try to keep your Computing Creative...

Contest Entries Of Special Merit

Kaewing Kenner, Great Falls, VA
Mark Warner, Milwaukee, WI
Fred Tedsen, Sonoma, CA
Page Starr, Philadelphia, PA
Dave Adair, Cuyahoga Falls, Ohio
Sol Guber, Saint Louis, MO
Alan Belke, Belvidere, IL
Eric Vaterlaus, Beaverton, OR
Harold Watson, Dayton, OH
Rod Smoliak, New Hope, MN
Scott Zimmerman, Salt Lake City, UT
David Thigpen, Killen, AL
Adam Kao, Walnut Creek, CA
Jim Lauman, Oregon City, OR
Larry West, Burlington, Ontario
Jeffrey Olkin, North Miami Beach, FL
James Brezden, Northglenn, CO
Debby Keen, Racoon, KY
Richard Cole, Mobile, AL
Brian Fitzpatrick and
Gary Herzenstiel, Lansing, MI
David Brandman, Manchester, MO
Richard Kulas, Winona, MN
John Davis, Lubbock, TX
Alfred Arnold, Mountain Home, ID
Jorge Villaseca, Mexico City, Mexico
Brian Biggs, Falls Church, VA
Eldon Black, Colorado City, AZ
Timothy Connor, Saint Petersburg, FL
Philip Kreiker, Loveland, CO
Alfred Louie, Flushing, NY
Allen Warren, Tyler, TX
Alan Stockbridge, Grand Ledge, MI
Gordon Oppenheimer, Milford, CT
Gordon Burnham, Orlando, FL
Dick Peterson, Lansing, MI
Mark Odendahl, Bloomington, MN
Paul Richard, Maurepas, LA

Figure 2. The honor roll.

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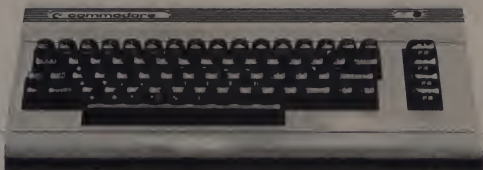
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CIRCLE 224 ON READER SERVICE CARD

rt...commodore's port...co

**Joel Swank**

Our guest columnist this month is Joel Swank, who will present a tutorial concerning screen manipulation with the Vic-20. If you have questions for Mr. Swank, please contact him directly at 12550 SW Colony #3, Beaverton, OR 97005. —JJA

Expanding the Vic 20 Screen

Most Vic owners know that the Vic displays information on a screen that has 23 lines of 22 characters each. Routines in the Vic KERNAL (control program) take care of formatting output to match this screen size. But the Vic is not limited to this screen configuration. In fact, the 6560 Vic II (Video Interface Chip) TV controller IC (Integrated Circuit) can display a wide variety of other screen formats. After the 6502 microprocessor IC that controls all operations in the VIC, the 6560 is the most important. It generates the color display and sound that are the most impressive features of the Vic.

The Vic uses a technique called memory-mapped video for displaying information on a TV. This technique is

SCREEN CODES						SET 1 SET 2 POKE		SET 1 SET 2 POKE		SET 1 SET 2 POKE		SET 1 SET 2 POKE		
SET 1	SET 2	POKE		SET 1	SET 2	POKE		SET 1	SET 2	POKE		SET 1	SET 2	POKE
G	0			U	u	21	-							
A	a	1	V	v	22	+								
B	b	2	W	w	23	.								
C	c	3	X	x	24									
D	d	4	Y	y	25									
E	e	5	Z	z	26									
F	f	6	[		27	#								
G	g	7	\		28	1								
H	h	8	]		29	2								
I	i	9	^		30	3								
J	j	10	=		31	4								
K	k	11			32	5								
L	l	12			33	6								
M	m	13			34	7								
N	n	14	#		35	8								
O	o	15	\$		36	9								
P	p	16	%		37	58								
Q	q	17	&		38	59								
R	r	18			39	<								
S	s	19	()		40	=								
T	t	20	()		41	>								

Table 1. A list of the screen code for each Vic character. Two possible characters can be displayed for each code, depending on which of the Vic's two standard character sets is being used. Vic character sets can be switched by pressing the shift and Commodore keys at the same time.

APPENDIX I: SCREEN MEMORY MAPS

Use this appendix to find the memory location of any position on the screen. Just find the position in the grid and add the numbers on the row and column together. For example, if you want to poke the graphic "ball" character onto the center of the screen, add the numbers at the edge of row 11 and column 11 (7900 + 10) for a total of 7910. If you poke the code for a ball (81, see Appendix H) into location 7910 by typing POKE 7910,81, a white ball appears on the screen. To change the color of the ball (or other character), find the corresponding position on the color codes memory map, add the row and column numbers together (38620 + 10, or 38630) for the color code and type a second poke statement. For example, if you poke a color code into this location, POKE 38630,3 the ball will change color to cyan. Note that when POKEing, the character color numbers are one less than the numbers on the color keys—as shown below.

Abbreviated List of Color Codes:

Code	Color
0	Black
1	White
2	Red
3	Cyan
4	Purple
5	Green
6	Blue
7	Yellow

Table 2. The color codes for the Vic character colors.

Location		
Hex	Decimal	Function
9000	36864	Horizontal centering and interlace scan
9001	36865	Vertical centering
9002	36866	Characters per line and screen buffer address
9003	36867	Lines per screen and character size
9004	36868	TV raster beam line
9005	36869	Character pattern address and screen buffer address
9006	36870	Horizontal position of light pen
9007	36871	Vertical position of light pen
9008	36872	Digitized value of paddle X
9009	36873	Digitized value of paddle Y
900A	36874	Sound port low frequency
900B	36875	Sound port medium frequency
900C	36876	Sound port high frequency
900D	36877	Sound port noise
900E	36878	Volume of sound and auxiliary color
900F	36879	Screen and border color

Table 3. The location and use of the 16 registers used to communicate with the 6560 Video Interface Chip.

determines the color of the characters on the screen. This is called the color buffer. Each byte of the color buffer determines the color of one character. So, each character on the screen must have one byte that determines its pattern of dots and one byte that determines its color.

Table 1 is a list of the screen codes for each Vic character from page 141 of the Vic user's manual. Table 2 is a list of the Vic color codes from page 144 of the Vic user's manual.

To place a character directly onto the

screen, first look up the screen code of the character in Table 1 and the location of the desired spot on the screen in the top half of Figure 1. Then POKE the screen code into the desired location. For example, to place an asterisk at the third character of the tenth row, type POKE 7880,42.

If you do this on an empty screen you will not see the character. This is because the color code in the color buffer is still set to white, the screen color. Now find the location in the color buffer of the desired spot on the screen from the

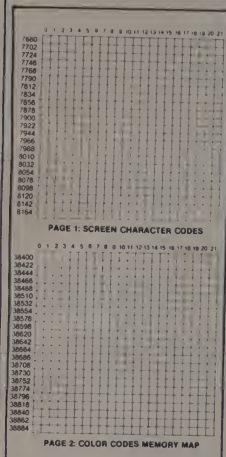


Figure 1. Maps of the Vic screen buffer and color buffer. Codes from Table 1 are POKE'd into the page 1 of this figure to place characters on the screen. Color codes from Table 2 are POKE'd into locations on page 2 of this figure to set the color of each character.

common among low cost computers. With memory-mapped video, a section of the computer memory or RAM (Random Access Memory) serves a dual purpose. It appears to the microprocessor as normal memory, but is also used by the video interface to determine what is displayed on the screen. Each byte of memory determines what pattern of dots is displayed in each area, or character, of the screen.

The video controller reads this section of memory every thirtieth of a second and displays it on the TV. So, whenever the microprocessor alters a byte of this memory, the change is immediately visible on the screen. This special section of memory is called the screen buffer. Each byte in the screen buffer contains the number, called the screen code, of the character that is to be displayed in one part of the screen.

If the display is to have color there must also be a section of memory that

Commodore's Port, continued...

second half of Figure 1, and the code for the desired color from Table 2, and POKE the color code into the color buffer: POKE 38600,2. Since 2 is the code for red, a red asterisk should now appear on row 10, character 3.

This technique can be used to place any character of any color anywhere on the screen.

Mapping The Display

The details of how the computer memory is used to map the display vary from one video controller to another. Many controllers have a fixed format and a fixed character set. The Vic 6560 controller has registers that allow the computer to change the way the 6560 displays memory. This adds a great deal of flexibility not found in simpler video controllers.

Table 3 gives a summary of the registers in the 6560. These registers control the size and format of the Vic screen, the color of the screen and border, and the location in memory of the screen buffer and color buffer. They also control other functions of the 6560 not normally found in a video controller, such as sound, game paddle inputs, and light pen. A complete description of all registers in the 6560 is given in the Vic programmer's reference guide, starting on page 212.

I will now explain and give some examples of using five of these registers to change the size and location of the Vic screen. Vic addresses will be given in decimal and hexadecimal for convenience. Hexadecimal numbers will be denoted with a leading dollar sign (\$).

The first two registers in the 6560 are the horizontal and vertical centering registers, located at 36864 (\$9000) and 36865 (\$9001). These are used to center the Vic screen within the border. Location 36864 is the horizontal control register. Increasing the value in this register moves the screen to the right, while decreasing the value moves the screen to the left.

The high order bit of this register is used for another function (interlace scan), so it should always be off. This means that the valid range for horizontal centering is 1 to 127.

Location 36865 controls the vertical position of the Vic screen within the border. Increasing the value in this register causes the screen to move down, and decreasing the value causes the screen to move up. The valid range of this register is 0 to 255. You can experiment with these registers by POKEing different values into them and watching the change in screen location. Pressing the STOP/RUN and RESTORE keys will restore them to the default values.

The next two registers in the 6560

```
100 REM STOPWATCH PROGRAM
200 REM
300 REM F1 = START
400 REM F3 = STOP
500 REM F5 = CLEAR
600 REM F7 = END PROGRAM
700 REM
800 REM WILL NOT WORK WITH PROGRAMMERS AID
900 REM THIS PROGRAM MOVES THE SCREEN RESET AFTER USING
1000 POKE 646,30 SVS58646,POKE 52,30 POKE 56,30 CLR
1100 C=PEEK(646) POKE 646,2 GOSUB 1900 POKE 646,C
1200 GOSUB 4600 GOSUB 2600
1300 GET A$ IF A$="" THEN 1700
1400 A=ASC(A$)-132
1500 IF A<1 OR A>4 THEN 1700
1600 WH A GOSUB 3400,4600,4600,7100
1700 IF C<0 THEN GOSUB 2600
1800 GOT 1300
1900 REM SCREEN INIT SUBROUTINE
2000 POKE 36867,48
2100 FOR I=37008 TO 37888+16 POKE I,1 NEXT
2200 FOR I=8186 TO 8186+6 POKE I,32 NEXT
2300 FOR I=38906 TO 38906+6 POKE I,PEEK(646) NEXT
2400 RETURN
2500 REM CLOCK UPDATE SUBROUTINE
2600 T1=T1+1
2700 POKE 8187,ASC(MID$(T1,3,1))
2800 POKE 8188,ASC(MID$(T1,4,1))
2900 POKE 8189,59
3000 POKE 8190,ASC(MID$(T1,5,1))
3100 POKE 8191,ASC(MID$(T1,6,1))
3200 RETURN
3300 REM START STOPWATCH
3400 IF V=1 THEN RETURN
3500 T1=T1
3600 V=1
3700 PRINT"START"
3800 RETURN
3900 REM STOP STOPWATCH
4000 IF V=0 THEN RETURN
4100 T1=T1
4200 V=0
4300 PRINT"STOP"
4400 RETURN
4500 REM CLEAR STOPWATCH
4600 T1="000000"
4700 T1=T1
4800 PRINT"CLEAR"
4900 GOSUB 2700
5000 RETURN
5100 PRINT"END"
5200 END
READY
```

Listing 1. Stopwatch program. A stopwatch is displayed on the expanded Vic screen.

control the line length and the number of lines on the screen. Location 36866 (\$9002) controls the number of characters per line. Only the low order seven bits of this register are used for line length. Bit 7 is part of the screen buffer address and should not be changed.

This should allow from one to 127 characters per line, but the 6560 will accept no more than 29 characters per line. Location 36867 (\$9003) controls the number of lines on the screen. This value is kept in bits 1-6. Bits 0 and 7 are used for other functions. Six bits allow from one to 63 lines on the screen.

The Vic screen can be from one to 63 lines or from one to 29 characters. Just how much of the screen is actually visible at one time depends on the TV being used. Some TVs can barely display all of the standard Vic screen. Others display the screen with a wide border. My Sony can display a maximum of about 30 lines of 24 characters.

Some TVs have vertical and horizontal size adjustments on the back that can be used to increase the amount of

picture displayed. If these controls are external they can easily be adjusted. If they are internal, you can only change them by operating the TV with the back off, a dangerous proposition. Operating the TV with the back off should be left to experienced TV service personnel. The high voltages found in a TV can destroy the delicate circuits in the Vic. I have seen ICs actually explode when subjected to such voltages.

An expanded screen is not compatible with the Vic KERNAL. The KERNAL works properly only with the standard 22 x 23 screen. This means that PRINT statements and the cursor movement keys will not work properly. Things must be displayed by POKEing screen codes into the screen buffer, and color codes into the color buffer. Also, if you expand or move the screen, the maps in Figure 1 are no longer valid, and must be redrawn to match the new screen configuration.

The screen buffer normally resides at location 7680 (\$1E00) through location 8185 (\$1FF9). Vic memory ends at loca-

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tion 8192 (\$1FFF), leaving only six bytes for expansion. To expand the screen more than six bytes, the screen buffer must be relocated. But it is possible to expand the screen and use only these six bytes.

Listing 1 is a short Basic program that makes use of these six bytes to display stopwatch. It enlarges the screen by one line to 24 lines, but does not change the line length. Leaving the line length the same allows the KERNAL to be used to display information on the top 23 lines of the screen.

Since memory ends at location 8191, only the first six bytes of the new line are usable. The other 16 bytes are displayed from the Vic ROMs and cannot be changed. These 16 characters are blanked by storing the screen color (white) in their color buffer locations starting at location 37888 (\$9400).

The first six characters of the last line are used to display a four-digit stopwatch. The Vic's jiffy clock is used to keep time. The function keys also print their functions on the screen each time that they are pressed.

As the program runs and keys are pressed, the screen behaves normally. Lines scroll up just as they should, except that the line with the stopwatch is never used. KERNAL does not know about this line, and PRINT statements can never access it.

The only way to display anything on the last line is to POKE screen codes directly into the screen buffer. This means that the normal ASCII characters must be converted into screen codes. For numeric digits this is easy, since their ASCII code is the same as their screen code and can be converted by the Basic ASC function. Table 1 can be used to convert other characters from ASCII to screen codes.

Expanding the screen further requires that the screen buffer be moved. Moving the screen buffer means telling the 6560 the new screen buffer address and also notifying the KERNAL and Basic of the move. Listing 2 is a Basic program that moves the screen buffer to location 7168 (\$1C00).

Basic is informed about the new location by POKEing 28 into locations 52 and 66 and executing a Basic CLR command. This tells Basic not to use any memory above memory page 28 (\$1C). The KERNAL is notified by POKEing 28 into location 646, and calling the KERNAL subroutine at 58648 (\$E518) to initialize KERNAL pointers. This subroutine also stores the new screen buffer location in the 6560 registers.

[illegible]

Listing 2. Time of day clock program. The Vic screen is expanded by three lines and relocated so that a digital clock can be displayed.

The new number of lines must be inserted into the 6560 register at 3686 (\$9003) and must be stored in bits 1 through 6 of this register, not using bits 0 and 7. To do this, the number of lines must be doubled. So to tell the 6560 26 lines, 52 must be POKed into this register.

In this program the screen is expanded by three lines to 26 lines, and a full time of day clock is displayed in the three extra lines. Before this program is RUN the Vic jiffy clock must be set by entering the current time into the variable T15. Twenty-four hour clock time must be entered. For example to set the current time to 6:33 p.m., T15="183300" would be entered. A full six digits must always be entered.

The program updates the clock display as it waits for input. When a key is pressed, its ASCII equivalent is displayed on the normal Vic screen. Once again the extra lines at the bottom are not affected by printing on the normal Vic screen.

Depending on the TV being used, all of the three extra lines may or may not be visible. The screen can be centered by pressing the cursor up/down key. When it is pressed, the program scrolls the en-

tire screen up or down by incrementing or decrementing the vertical centering register in the 6560.

These three extra lines on the screen could be used for a wide variety of other things. A program could put status information there or a trace of where the program is executing. Any desired information can be displayed totally independently of what is happening on the standard screen.

It is also possible to expand the width of the screen by increasing the value in the line length register at location 36866 (\$9002), but doing this makes Basic PRINT statements totally unusable. All data to be displayed anywhere on the screen must be POKED into the screen buffer. Expanding the screen this way is most useful for graphic displays such as video games.

The Vic has great flexibility in its screen format. There are many more possibilities than the simple examples given here. You can use this flexibility to add a personal touch to your applications and tailor the display to the specific needs of each application. Using the techniques presented here, you can make your programs easier and more pleasant to use.

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CIRCLE 214 ON READER SERVICE CARD



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Here we go with another technical column, this time for you fans of Basic. Wait a minute, don't go away yet! Even if the word *technical* scares you, I think you might find the results of my work this month of some interest, and for a variety of reasons.

First and foremost, I have kept my promise to demonstrate how to interface Basic with routines in BIOS. Second, I have chosen to interface to the routine that handles scrolling of windows, since this is the only major feature of the video display system that is not directly available to the Basic programmer. Third, I have uncovered some interesting facts as a result of my work. Finally, the window handling routine is a handy one in general.

And don't be scared off by the assembly language routine printed herein: I'll show you how to use the routine without having to own or use the assembler. What's that? Still scared? Okay, forget it. I'll see you next month.

But if you're still here, let's get to work.

The Problem

Basic, of course, is the only programming language that is immediately available to the IBM PC owner. It comes "free" with the operating system. Basic is well known, and pretty easy to learn,

W H Fastie, Suite 211, The World Trade Center, Baltimore, MD 21202. Correspondence can only be acknowledged when a stamped, self-addressed envelope has been provided. Source Address: TCP 394.

Will Fastie

so it is in widespread use. As a professional programming tool, it leaves much to be desired, but its combination of price and distribution are compelling.

Basic is often not well suited to the task at hand, especially if performance is an issue. This can partly be solved with the Basic Compiler, a truly valuable asset to the Basic program developer. However, there are some things which even the Basic Compiler cannot deal with, and an entirely different set of things which the language can handle, but for which assembly language provides considerably more performance. We will discuss a feature that falls in the first category, something for which assembly language is required. The feature is the control of independent "windows" on the display screen.

As you probably know, the PC is delivered with a considerable amount of software in Read Only Memory (ROM). Part of this is the resident Basic interpreter, but the other part is called BIOS, for Basic Input/Output System. The so-called "primitive" routines for handling most of the devices which can be attached to the PC are part of BIOS, including a very large section devoted to the video display devices, both color and monochrome. One of the features supported by the video I/O section is scrolling. Two routines are provided,

one for scrolling up and one for scrolling down.

Scrolling is the act of moving all the lines of text on the screen up (or down) by a line (or more). The top (or bottom) lines disappear from view, as if they had passed behind the edge of the screen. The space created at the bottom (or top) of the screen is usually blanked by the scrolling operation so that the program can insert new information for display. It is easy to see the effect simply by pressing the ENTER key repeatedly at the DOS prompt: sooner or later you get to the bottom of the screen and the display at the top begins to rise and go away.

The PC version of scrolling is very sophisticated, both because it can go either up or down and because it can be applied to a rectangular window anywhere on the screen. Since the BIOS program provides only the scrolling function and not the *management* of windows, the application program is free to operate as many windows as are needed. And that is a vital point: your program does the real work, while BIOS provides a little bit of very fast help.

The Demonstration

Listing 1 is the program I wrote in Basic to demonstrate how windows and scrolling work. It uses two routines, SCROLLUP and SCROLLDN, which I will describe in a minute. It allows you to give scrolling commands and watch the effect of the command on the display.

Listing 1.

```

1000 ' Program to demonstrate interface routine to BIOS video scroll function
1010 '
1020 ' Author: Will Fastie
1030 ' Source: DEMO.BAS
1040 ' Created: 15 Jan 83
1050 ' Edited: 07 Feb 83 1100
1060 '
1070 ' This program defines three windows on the screen. Two are filled with
1080 ' text and occupy the first 22 lines on the screen, half to each.
1090 ' The third occupies 3 lines at the bottom, and is the command and status
1100 ' area. The commands that can be given are:
1110 '
1120 ' M selects Top or Bottom window
1130 ' S scrolls the selected window Up or Down
1140 ' C clears the selected window
1150 ' F fills the selected window with new text
1160 ' A sets the scroll line attribute. Default is white on black.
1170 ' R reset: clear screen, reset attributes, start over
1180 ' X exits the program.
1190 ' -----
1200 ' Initialize memory and load the machine code interface routine.
1210 CLEAR 32000 ' <----- Depends on your memory size !!
1220 BLOAD "scroll.abs" ' <----- Depends on your memory size !!
1230 DEF SEG = &HFFC
1240 SCROLLUP = 0
1250 SCROLLDN = &HE
1260 ' ----- Setup the screen and initialize the control parameters
1270 DIM ULRX(3), ULCX(3), LRRX(3), LRCX(3), ATTRX(3)
1280 ULRX(1) = 0: ULCX(1) = 0: LRRX(1) = 9: LRCX(1) = 79
1290 ULRX(2) = 11: ULCX(2) = 0: LRRX(2) = 20: LRCX(2) = 79
1300 ULRX(3) = 22: ULCX(3) = 0: LRRX(3) = 23: LRCX(3) = 79
1310 GOSUB 1790 ' reset screen
1320 ' ----- Command Processing Section
1330 PROMPT$ = "Enter command: "; GOSUB 1670
1340 X = INSTR("MSCFAXR",C%)
1350 IF X = 0 THEN BEEP: GOTO 1330
1360 ON X GOSUB 1380, 1430, 1500, 1540, 1620, 1650, 1790
1370 GOTO 1330
1380 ' ----- Select Window
1390 PROMPT$ = "Which window, T or B? "; GOSUB 1670
1400 IF C% <> "T" AND C% <> "B" THEN BEEP: GOTO 1390
1410 IF C% = "T" THEN W = 1 ELSE W = 2
1420 RETURN
1430 ' ----- Scroll Current Window
1440 PROMPT$ = "Which way, U or D? "; GOSUB 1670
1450 IF C% <> "U" AND C% <> "D" THEN BEEP: GOTO 1440
1460 GOSUB 1740: INPUT "Enter number of lines to scroll: ",NRLINESX
1470 IF NRLINESX < 0 THEN BEEP: GOTO 1460
1480 IF C% = "U"
1490 THEN CALL SCROLLUP (NRLINESX, ULRX(W), ULCX(W), LRRX(W), LRCX(W), ATTRX(W))
1500 ELSE CALL SCROLLDN (NRLINESX, ULRX(W), ULCX(W), LRRX(W), LRCX(W), ATTRX(W))
1510 RETURN
1500 ' ----- Clear Current Window
1510 NRLINESX = 0
1520 CALL SCROLLUP (NRLINESX, ULRX(W), ULCX(W), LRRX(W), LRCX(W), ATTRX(W))
1530 RETURN
1540 ' ----- Fill Current Window with Text
1550 NRLINESX = 1
1560 FOR I = 1 TO 10
1570 CALL SCROLLUP (NRLINESX, ULRX(W), ULCX(W), LRRX(W), LRCX(W), ATTRX(W))
1580 LOCATE LRRX(W)+1, ULCX(W)+1
1590 PRINT USING "This is line ## of 10 lines of text in window #";I;W
1600 NEXT I
1610 RETURN
1620 ' ----- Set Attribute for scrolled line
1630 GOSUB 1740: INPUT "Enter new attribute: ",ATTRX(W)
1640 RETURN
1650 ' ----- Exit Program
1660 END
1670 ' ----- Input command character and upperify
1680 GOSUB 1740: PRINT PROMPT$;
1690 C% = INKEY$: IF C% = "" THEN 1690
1700 C% = LEFT$(C%,1)
1710 IF C% > "a" AND C% <= "z" THEN C% = CHR$(ASC(C%) - (ASC("a")-ASC("A")))
1720 PRINT C%;
1730 RETURN
1740 ' ----- Routine to clear command area
1750 NRLINESX = 0
1760 CALL SCROLLUP (NRLINESX, ULRX(3), ULCX(3), LRRX(3), LRCX(3), ATTRX(3))
1770 LOCATE 23, 1
1780 RETURN
1790 ' ----- reset both windows
1800 KEY OFF: CLS
1810 LOCATE 11, 1: PRINT STRING$(80,CHR$(205))
1820 LOCATE 22, 1: PRINT STRING$(80,CHR$(205))
1830 FOR W = 1 TO 2: ATTRX(W) = 7: GOSUB 1540: NEXT W
1840 ATTRX(3) = 7: GOSUB 1740
1850 W = 1 ' default is top window
1860 RETURN

```


The program is clear, and instructions for its use are included in the comments. The commands are single letters, which are interpreted immediately without need of an ENTER key depression. When parameters are required, the program prompts for them; if letters, they are taken immediately, and if numbers, an ENTER is required.

When invoked, the program clears the screen, divides it into three windows, and fills the two upper windows with text. The bottom window is the command area in which the program prompts are displayed. The routines SCROLLUP and SCROLLDN are used in the program whenever the windows are to be scrolled, cleared, or filled. The reset command (R) can be used to restore the program to its initial state in case things go awry (they can).

The section of the program in lines 1200 to 1250 is the really tricky part in which the assembly language routine is loaded into memory. The first step (1210) is to specify how much memory Basic will use for its workspace. This is needed to reserve memory space outside the Basic workspace area for the assembly language program. If you are using Basic (as opposed to BasicA), the number 32000 should leave plenty of space. BasicA is bigger, so it might be necessary to specify a smaller number when it is used. In any case, the workspace size is a number which should be adjusted for your exact configuration. The second step is to load the program using BLOAD. The file created by the BSAVE command contains specific memory addresses, so line 1220 works without any additional parameters.

Lines 1230 through 1250 establish the values Basic will need to call the assembly language routines. What you have to do is specify the precise memory address for each routine loaded. Addresses for

A Note on Diskettes

I have previously written about my great success with Radio Shack diskettes, even when used in double sided drives. I recently bought two boxes (this is diskette sale time, an annual affair it seems) and I ran into some problems.

I was immediately struck by the change in packaging, not so much for the form/factor as for the bold words on the front of the box: Single-Sided Diskettes. Even though all the Radio Shack computers use only single sided drives, they had never made a big deal about the diskettes before. I was a little hesitant, because I thought the media had changed in some way and was really only usable on one side. I tried the new box of diskettes within days.

Of the six disks I tried, only two formatted without error. Of the other four, two never made it past the formatter program and the other two both had bad tracks allocated. This problem occurred with both single and double sided formatting.

I called my local store manager, who was very nice about the whole thing and offered to take everything back. It turns out that she had some boxes of the previous batch of disks, so I was able to trade back for the ones I have been using all along. I have no complaints about the way the problem was handled at the store.

I suspected some major manufacturing change because an examination of one of the new diskettes next

to the older one revealed a half dozen physical differences. I called Fort Worth and talked with Bob MacQuigg, Tandy's buyer for diskettes. I related my story to him, along with my suspicions, and gave him a description of the differences.

His response was surprise, and he told me straight out that there had been no change in vendor or formulation of the product. He said there had been no reports of field problems, but more to the point that no internal problems had been reported. All the Radio Shack software is placed on these same diskettes, and Bob felt that any problem with the media would have been caught inside.

Bob made one very interesting point. He said that Tandy had "overbuilt" when it came to diskettes because of the many different brands of disk drives used by Radio Shack computers. In order to avoid problems caused by minor variations in the drives, Tandy buys diskettes able to perform in all the drives without error. This might explain why I have had no problem using them with my double sided drives.

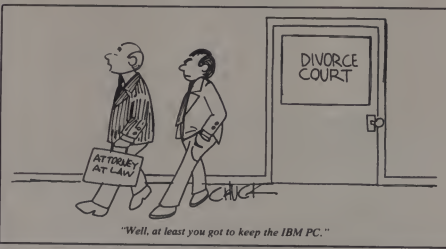
The problem may well have been localized to the box of diskettes I picked up, or even to that lot from the vendor. Under ordinary circumstances I would have let the matter rest since, after all, my problem was solved. However, I have rated Radio Shack diskettes so highly in the past that I felt compelled to tell this story.

the 8088 processor have two components, the segment address and the offset within the segment. In Basic, the DEF SEG statement is used to establish the

segment address, and the names of the subroutines are assigned the offset values. In this case, SCROLLUP is at location 0 in segment &H1FFC, while SCROLLDN is at location &HE. (Note: The &H is the Basic convention to denote a hexadecimal number.)

In this program the DEF SEG statement has been used once, so its "scope" is the entire program. That means that Basic statements like CALL, POKE, PEEK, and others that specify an offset against the current segment address are affected. This is not a problem for DEMO, but care must be exercised if a program of yours uses such statements to be sure that the correct address is being specified in each case. This might imply a DEF SEG before every such statement.

The two scroll routines require six arguments, of which four are the coordinates that define the position of the window on the display. Each coordinate is a pair, one to specify the row



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CIRCLE 245 ON READER SERVICE CARD

```

1      page 54,130
2      $ SCROLL UP/DN - Interface for BASIC to BIOS Scrolling Routines
3      $
4      $ Author:  Will Fastie
5      $ Source:  SCROLL.asm
6      $ Created: 15 Jan 83
7      $ Edited:  02 Feb 83 1520
8      $
9      $ BASIC calling sequence:
10     $
11     $ CALL SCROLLUP (NRLINES$, UL$, ULC$, LRR$, LRC$, ATTR$)
12     $ CALL SCROLLDN (NRLINES$, UL$, ULC$, LRR$, LRC$, ATTR$)
13     $
14     $ where
15     $   NRLINES - the number of lines to scroll.  If 0, clear entire window.
16     $   UL$, ULC - the "R"ow and "C"olumn of the upper left corner of the
17     $               window to be scrolled.
18     $   LRR$, LRC - the "R"ow and "C"olumn of the lower right corner of the
19     $               window to be scrolled.
20     $   ATTR     - the display attribute to be used on the blank lines
21     $               scrolled into the window.
22     $ Notes
23     $ -----
24     $ 1. All arguments passed to these two routines must be declared as BASIC
25     $   integers.  The simplest way to do this is to use the % suffix.
26     $ 2. The row values range from 0 to 24.  Column values range from 0 to 79.
27     $ 3. See article text for description of legal ATTR values.
28     $
29     $ When a BASIC CALL is executed, BASIC's work segment offset of each argument
30     $ is pushed onto the stack.  The arguments are pushed onto the stack left to
31     $ right, that is, in the order they are written on the page.  This means that
32     $ the last argument's address is on top of the stack.  The following structure
33     $ shows the organization of the stack after the call.
34     $ (I use the suffix "$" to denote "address of," out of long habit.)
35     $
36     stack  struc
37     0000  ???$???$    retx  dd  (?)    $ caller's return address (---- SP)
38     0004  ???$      bptemp dw  (?)    $ caller's frame pointer
39     0006  ???$      attrx  dw  (?)    $ attribute argument
40     0008  ???$      lrcx   dw  (?)    $ coordinate of lower right corner of window
41     000A  ???$      lrrx   dw  (?)    $
42     000C  ???$      ulcx   dw  (?)    $ coordinate of upper left corner of window
43     000E  ???$      ulrx   dw  (?)    $
44     0010  ???$      nrx    dw  (?)    $ number of lines to scroll
45     0012          stack ends
46     = 000C          frasz  equ  (offset nrx - offset attrx) + 2    $ frame size
47     $
48     0000          cseg   segment
49                      assume  cs:cseg

```

position and one to specify the column. The coordinates are stored in arrays named UL (upper left) and LR (lower right). The suffixed letter is either R (for row) or C (by now, you should have the idea). The first argument to the routines is the number of lines to be scrolled, and for which a value of zero means that the window is to be cleared. The last argument specifies the display attribute to be used on the blank lines that are scrolled in.

The rest of the program should be self-explanatory. Note that SCROLLUP is

used as a way to clear window 3 (the command area).

The Subroutine

I know what you are thinking: "Hey, Will, where'd that subroutine in SCROLLABS come from anyway?" Fair question. The answer, unfortunately, is ridiculously complex.

The first part isn't too bad. Listing 2 shows the assembly language routines SCROLLUP and SCROLLDN. Again, I think it is well-documented, so I won't overdo the explanation here. I'll make

two points. First, the "struc" declaration beginning on line 36 defines a set of names that are used to reference values on the stack. I defined this structure so I wouldn't have to remember the actual numeric offset of each value; instead, the stack is referenced by expressions such as

[BP].NRX which is the address of the number of lines argument. This simply leads to greater clarity. Second, both scroll routines are exactly alike with the exception of the function code for the BIOS

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```

50      public scrollup, scrolldn
51      ;-----
52      0000      scrollup proc far
53      0000 55      push bp          ; save caller's frame pointer
54      0001 8B EC      mov bp,sp      ; set up our frame pointer...
55      0003 EB 001C R  call setup      ; get arguments into registers
56      0006 B4 06      mov ah,6       ; function code for scroll up
57      0008 CD 10      int 10H        ; video i/o
58      000A 5D      pop bp           ; restore caller's frame pointer
59      000B CA 000C    ret frasz      ; six arguments to remove
60      000E      scrollup endp
61      ;-----
62      000E      scrolldn proc far
63      000E 55      push bp          ; save caller's frame pointer
64      000F 8B EC      mov bp,sp      ; set up our frame pointer...
65      0011 EB 001C R  call setup      ; get arguments into registers
66      0014 B4 07      mov ah,7       ; function code for scroll down
67      0016 CD 10      int 10H        ; video i/o
68      0018 5D      pop bp           ; restore caller's frame pointer
69      0019 CA 000C    ret frasz      ; six arguments to remove
70      001C      scrolldn endp
71      ;-----
72      ; This routine sets up the registers for the INT call. It can be used by
73      ; both SCROLL routines since the calling sequences differ only by function
74      ; code (AH).
75      ;
76      ; Since all the argument values are less than 256, we can cheat a little bit
77      ; by loading only the low-order byte of each word.
78      ;
79      001C      setup proc near
80      001C 8B 76 10    mov si,[bp].nrx ; get address of MRLINES argument
81      001F BA 04      mov al,[si]     ; get low order byte of value
82      0021 8B 76 0E    mov si,[bp].ulrx ; etc., for all arguments...
83      0024 BA 2C      mov ch,[si]
84      0026 8B 76 0C    mov si,[bp].ulcx
85      0029 BA 0C      mov cl,[si]
86      002B 8B 76 0A    mov si,[bp].lrrx
87      002E BA 34      mov dh,[si]
88      0030 8B 76 08    mov si,[bp].lrcx
89      0033 BA 14      mov dl,[si]
90      0035 8B 76 06    mov si,[bp].attrx
91      0038 BA 3C      mov bh,[si]
92      003A C3      ret
93      003B      setup endp
94      ;
95      0038      cseg ends
96      end

```

call. I have therefore written a common routine that is called by both scroll routines and whose function it is to set up the registers for the call. The common routine, cleverly named "setup," does use one trick: since the value passed is always less than 256, only the low-order byte of each integer is used.

In anticipation of testing the program with a compiled version of the DEMO program, I declared the names SCROLLUP and SCROLLDN "public," which simply means that LINK, the DOS linker, will "see" the names when it reads SCROLL.OBJ, the object

file. I used the same names in DEMO, and for the same reason. More on that later.

The Surgery

So now we have a program in Basic, and a routine in assembly language. How do we get them together? All my screaming and cursing did not help. The manuals did, however, and I must admit they were very clear and complete. Version 1.1 of the Basic manual includes explicit instructions for this entire process, including examples.

Nonetheless, it is a very painful pro-

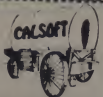
cess to connect an *interpreted* Basic program with assembly language routines. The *compiled* Basic program is simplicity itself; the linker does all the work. All that the linker does for the compiled program must be done by hand for the interpreted version.

The first step is to assemble the program and run LINK to produce a .EXE file. Use the /HIGH switch to force the program to reside in the high end of memory. Do not link the module with any libraries, and do not attempt to actually execute the result—you will be disappointed. A record of the process is

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CIRCLE 130 ON READER SERVICE CARD

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```
dir
SCROLL ASH 3250 2-02-83 4:13p
1 File(s)
C:\mass scroll...
The IBM Personal Computer MACRO Assembler
Version 1.00 (C)Copyright IBM Corp 1981
```

```
Warning Severe
Errors Errors
0 0
```

```
C:\dir
SCROLL ASH 3250 2-02-83 4:13p
SCROLL OBJ 151 2-02-83 7:41p
SCROLL LST 5906 2-02-83 7:41p
SCROLL CRF 306 2-02-83 7:41p
4 File(s)
C:\link scroll\high
```

```
IBM Personal Computer Linker
Version 1.10 (C)Copyright IBM Corp 1982
```

```
Warning: No STACK segment
There was 1 error detected.
```

```
C:\dir
SCROLL ASH 3250 2-02-83 4:13p
SCROLL OBJ 151 2-02-83 7:41p
SCROLL LST 5906 2-02-83 7:41p
SCROLL CRF 306 2-02-83 7:41p
SCROLL EXE 640 2-02-83 7:41p
5 File(s)
```

Listing 3.

shown in Listing 3.

Step two involves loading the program into memory with the debugger while the Basic interpreter is also resident in memory. This process is shown in Listing 4. The debugger is invoked and Basic is loaded. The registers are examined. The file SCROLL.EXE is named and then loaded into memory. The registers are then examined to see where in memory the program is. Note the contents of CS (&H1FFC) and IP (0), which are the same as the values used in DEMO. Registers SS, CS, and IP are restored to their earlier values, and the Basic interpreter is then executed by giving the DEBUG command G, for go.

Listing 4.

```
C:\debug a:basic.com
~
AX=0000 BX=0000 CX=41B0 DX=0000 SP=FF00 BP=0000 SI=0000 DI=0000
DS=04B0 ES=04B0 SS=04B0 CS=04B0 IP=0100 NV UP DI FL NZ NA PO NC
0ADB:0100 E9E43E JMP 3FE7
~
n scroll.exe
~
~
AX=0000 BX=0000 CX=003B DX=0000 SP=0000 BP=0000 SI=0000 DI=0000
DS=04B0 ES=04B0 SS=1FFC CS=1FFC
1FFC:0000 55 PUSH BP
~
SS 1FFC
~
DS 1FFC
~
CS 1FFC
~
IP 0000
~
~
q
```

When the command Go is given, Basic gets control. And once in Basic, it is possible to write any portion of memory to a disk file with the BSAVE command. The exact sequence of commands I needed was

```
DEF SEG = &H1FFC
BSAVE "SCROLL.ABS", 0, &H3B
```

These commands require information from the second set of registers shown in Listing 4. The value for the DEF SEG statement comes from the CS register. The offset 0 from the BSAVE command comes from the IP register, and the length &H3B comes from the CX register.

And bingo! The file SCROLL.ABS has the subroutine in a format that can be loaded by the BLOAD command, just as is done by the DEMO program. Only one thing remains, and that is to figure out how to get out of Basic, out of DEBUG, and back to DOS. Say SYSTEM to leave Basic, which in this case takes you not to DOS but to the debugger, which will report "Program terminated normally." Then use the Q command to leave the debugger.

And don't forget, the values shown in these listings may not be for you. You must do the whole process yourself and get numbers that fit your system.

The Catch

Ah yes. The Catch.

The catch is that you must have the assembler to develop and implement such routines, unless you are a master at encoding instructions into hexadecimal notation and placing them into memory by hand. The assembler isn't very much, only \$100 from your dealer, so it might be a practical addition to your software library if you have many things like this to do.

If you are interested in these routines but don't have the assembler, you can still manage. It will just take more manual labor. What you have to do is use the debugger to enter the hexadecimal values into memory, and then write the section of memory to disk. You can then use a procedure similar to the one I have outlined to get the program loaded with your Basic program. Another possibility is to take the hexadecimal values and put them into DATA statements in your Basic program. You then have to write a short routine that will POKE them into some appropriate place in memory.

You must watch one thing, though. Lines 55 and 65 of Listing 2 are CALLS to the setup routine. On the listing, they are shown as if they had been encoded as E8 001C. However, you must not use the 001C value as is. It is the actual offset in the program of the label SETUP.

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IBM Images, continued...

If you look at lines 79 and 80 you will see that value in the leftmost column. It is the linker which will fill in the actual value that is needed, which is the distance between the E8 instruction and the SETUP routine.

If the SCROLL.EXE program is in memory with the debugger, the unassembled (U) command can be used to display the contents of memory in assembly language terms, and the actual offset can be seen. The actual offsets are 22 for line 55 and 8 for line 65. Also, the offsets are stored low byte first, so line 55 should have a contents of E8 16 00 and line 65 should read E8 08 00. Note that I have shown the low-order value of these numbers first, because the 8088 expects them to be stored in memory that way.

What I craved during all this was a program that would take the .EXE file and convert it into a file to be **BLOADED**. Except for time, I would have done it. It is the one thing that would have eliminated all these crazy steps.

The Performance

The DEMO program demonstrates not only the scrolling features, but how tremendously fast they are. It is simply not possible to see any scrolling at all; things just happen. I was not prepared for quite that much speed, and it actually caused me to change the program. At first, I had cleared the command area by writing blanks into it. This could be seen to be slow, so I defined the third window and had the scroll routine clear the area.

It is nice that the performance is so good. It made me mad, though, because

Display Attributes

The DEMO program is capable of changing the display attribute used by the scroll routines. The following attribute values may be used on the monochrome display. With the exception of 1, they also work for the color displays. You can use the program to experiment with others.

- 0 No display (black screen)
- 1 Underline this character
- 7 Normal display (white on black)
- 112 Reverse Video (black on white)

the BIOS should be capable of similar speeds for writing to the display. As I have mentioned before, that process is painfully slow, a design flaw in the BIOS. The scrolling routines clearly show how quick the machine can be, particularly if you realize that the scrolling operation requires the movement of each character from one display memory location to another. Well, maybe in PC II, eh?

The Bug

Leave it to me to find a bug wandering around. You can see the effect if you have DEMO running. Give the command S followed by U or D, and a number 10 or greater. The screen goes bonkers (the best word I could come up with to describe what happens).

It appears that BIOS does not check to see if the requested number of lines is bigger than the size of the window. When it is, the scroll is not right. I call

119 No display (white screen)

To these values you can add either 8, to make the characters bold, or 128, to make them blink, or both. For example, 143 (7 + 8 + 128) makes blinking, bold white characters on a black background.

The data which are filled into the windows will not have the same attribute, because Basic uses information from **COLOR** statements when it writes to the display. You could easily modify DEMO to decode the attribute and make the appropriate statement of **COLOR** before writing anything to the screen.

this a bug because there is nothing documented to indicate that such a value is illegal and because the routine should handle all cases anyway.

The Irritation

One thing bugged me. I am used to using row and column coordinates that start at 1 because these are expected by the **LOCATE** statement. The BIOS routines want values that start at 0. This was a great hassle until I spent a few minutes marking a listing of the program and getting everything just so. You can see the problem in line 1580 of DEMO.

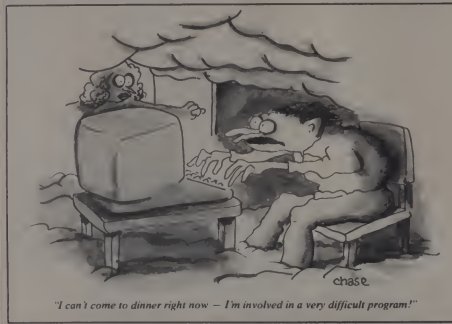
I lay the blame for this at the doorstep of Basic, because it is out of step with everything else. In BIOS, everything seems to start from 0, and therefore other languages tend to support those conventions. In defense of Basic, I must admit that human beings start from 1, so it is more natural.

The Result

The final program suite is useful for experimenting with windows. It is easily modified to support more windows; the set of routines forms a kernel around which a larger, more complex screen management program can be developed.

The DEMO program also includes several useful programming techniques. One is the use of the **INSTR** function to decode the command letter, and the subsequent use of the value to control an **ON...GOSUB** statement. Another is the statement that converts all input characters to upper case. It is interesting because it does not use "magic" numbers, and the only piece of information assumed is that the ASCII value for the letter **a** is numerically greater than that for the letter **A**.

Other routines in BIOS, and those that you might write yourself, can be interfaced to Basic using the techniques illustrated here. I hope all this information has been helpful.



"I can't come to dinner right now — I'm involved in a very difficult program!"



rings...trs-80 strings...trs-8

As we pass the fifty-first planet in the solar system known only as TRS-80, we see ahead of us a cassette magazine for the Color Computer, *CLOAD* magazine on disk, three books recommended for the Color Computer, how to make sure a program is SAVED to disk, floppies, a school newsletter, and short program that's a screen editor.

Cassette Magazine for Color Computer

The publishers of *CLOAD* magazine (for the TRS-80 Model I and III) announced a cassette magazine for the Color Computer with an ad in these pages back in June 1981.

Now that I've had Extended Color Basic with high-resolution graphics added to my Color Computer, I can finally review *Chromasette* Magazine (Box 1087, Santa Barbara, CA 93102). A subscription is \$45 a year for 12 issues, which have six to eight programs on each cassette. Six issues are \$25; a sample one is \$5.

Chromasette is very much like *CLOAD*, with a cassette wrapped in an accompanying letter that lists the programs, gives their PMODE and PCLEAR values (if needed), their locations on tape, several paragraphs of documentation about each (sometimes suggesting program alterations that change or improve the results), a variety of information about the Color Computer and some of the hardware and software available for it, and some ads.

Each issue, as with *CLOAD*, starts with a cover, just like a regular magazine. The first issue, dated July 1981, was described in March 1982 (p. 36). Briefly, the first cover shows the *Chromasette* name in script, moves it left, right, up, down, etc. The listing includes seven strings of 192 characters each, according to the letter, which goes into nice detail on how the program was written.

Stephen B. Gray

All programs are recorded twice, and are written for Extended Color Basic; 16K is required because many programs are long. Back copies of all issues are available; they'll send you a list on request.



Figure 1. *Chromasette*'s first cover makes use of the cassette-magazine's logo, moving it all over the screen, in duplicate and quadruplicate, and in various colors.



Figure 2. The second cover of *Chromasette* (August 1981) is a demonstration of the DRAW command, using the Scale, Color, and Angle modes, and the No-Update option.

Later Chromasette Issues

Subsequent issues of *Chromasette* magazine contain a version of Lunar Lander, tutorials on debugging programs, a high-precision calculator (to 900 places), "repeat-the-musical-pattern" game, Motorcycle Jump, Morse-code tutor, typing tutor, disassembler, Rubik's Cube, String Art, disk editor, Star Map (with constellations), Equations (matrix manipulation), Display Demo (28 display routines), Tape Inventory (catalogs tape programs), disk cataloger, Astromines, Pong (the original videogame), Life, Curve Fit, plus many other games, utilities, educational programs, and some great color covers.

Incidentally, in just little more than a year, *Chromasette* overtook *CLOAD*, and has more subscribers than the parent; by the end of this year, it may have twice as many, according to editor Dave, who also says his crew is working on a disk version of *Chromasette*. (Dave signs only his first name to the *CLOAD* and *Chromasette* letters, in keeping with their informal air.)

CLOAD on Disk

Speaking of disk, *CLOAD* has been available on disk since last October, at \$95 a year for 12 issues (the cassette version is \$50 a year), \$55 for six issues, and \$11 for a single copy (Box 1448, Santa Barbara, CA 93102).

If you've gotten used to the convenience and speed of disk, you may be willing to pay the extra for *CLOAD* on disk. In much less time than it takes just to find the program you want on tape, you can have the disk version up and running.

Just get into Basic, key in RUN "AWAY" and the program menu is displayed. Any time you want to get back to the menu, just a BREAK and RUN "AWAY"

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TRS-80 Strings, continued...

will recall it, unless the program is in machine language, in which case you'll have to hit the reset button and then get back into Basic again. That's all there is to it.

The Lone Survivor

Of the several TRS-80 Model I cassette magazines that were started over the past few years, only *CLOAD* is still in business. The December 1982 issue (the most recent I have on hand at this writing) is the 58th, and runs on Models I and III, either cassette or disk systems.

CLOAD seems to contain a little higher percentage of games than several years ago. The last three issues of 1982 contain 23 programs, of which three are covers and nine are games. (Two of the latter, *Swarm* and *Cave Raider*, seem impossible to beat.) The others include *Bond* (financial), *Air Nav* (flight planning for pilots), *Disk Copy* (for one-disk systems), *Menu* (reads the disk directory, displays it in menu form), *Loan Amortization*, *Logic Trainer* (teaches logic circuits), *Planets* (shows relative positions for a given date), and *Net Worth* (computes yours).

For a good mix of games, utilities and practical programs, try a sample copy of *CLOAD* or *Chromasette*, or a six-month subscription. It's well worth the money.

Three Books for the Color Computer

Three fine books for the Color Computer were recently issued by Reston Publishing Co., part of Prentice-Hall. Two are on graphics, and the third gives an idea of what can be done with this computer.

Don Inman's *TRS-80 Color Computer Graphics* (hardcover \$20.95, paperback \$14.95) concentrates on the 16K Extended Color Basic graphics. It follows pretty much the same sequence as the *Radio Shack* manual, but much more clearly, with many helpful diagrams.

Once you have fully understood this book, you may want to move on to *Assembly Language Graphics for the TRS-80 Color Computer*, by Don Inman and Kurt Inman, which shows how assembly language can be used to write programs that would be difficult or impossible to write in Basic. Learning is simplified by the use of sound and graphics programs rather than a mathematical approach, in a book written for hands-on use.

The beginner who has read *Radio Shack's Getting Started With Color Basic*, but doesn't know where to go from there, can find a variety of applications in *TRS-80 Programs and Applications for the Color Computer*, by Alfred Baker. Almost every chapter contains games, which range from *Home Inventory* to a

color version of *Mastermind*, from a checkbook program to *Spaceship*. All program lines are very nicely annotated.

If not for you, then these three would make a very nice gift for anyone who has gotten a Color Computer and wants to learn how to make real use of it.

Did It Write to Disk OK?

If you have a disk system, perhaps you just assume everything is working fine when you do a *SAVE*, and don't bother to check. But if you have ever had the experience of trying to *LOAD* a disk program, only to find that part or all of it didn't get recorded, or somehow was merged partially with another program, then you may want to check every *SAVE* with a *LOAD*.

(Most of these problems occur when your disk drive is out of alignment, and your first inkling of the misalignment is likely to be a bad *SAVE*. But even after you get the drive repaired, you may find, as I did, that it is a good idea to do a read after a write, meaning a checkout *LOAD* after a *SAVE*.)

One way of verifying a *SAVE* is to clear the screen and then do a *LOAD*, as some books on the TRS-80 suggest. But if you didn't do a *PRINT* beforehand, you may lose the entire program. This is one reason for always printing your program before doing a *SAVE*, especially if it's late and you're a little tired; it's amazing how many wrong keys get pressed after midnight. (Assuming you have a printer, or course; one of my main uses for a printer is to put every program of *Scriptit* text on a readable medium before a *SAVE*. If this seems like a great deal of work, consider the large number of backup files that have to be made constantly in business applications, just to make sure nothing is wiped out for keeps.)

But even if you did print the program, having to enter it all over again by hand, because the *SAVE* went wrong, isn't much fun. There is a simple way to look at the *SAVED* copy without first erasing the original from the screen.

If you use *Scriptit*, after you have done

```
S PROG23
```

for example, just do a load-and-chain with

```
L,C,PROG23
```

and the *SAVED* text will be displayed right after the original. If there is anything wrong with the second text on the screen, you still have the original text.

Checking a SAVED Basic Program

Reading back a Basic program after you have *SAVED* it to disk is a little more complicated than checking a *Scriptit* text, but it can be well worth the time,

especially if you have a long program and suspect there is something wrong with your disk drive. First you write the program

```
10 CLS
20 X=RND(128)-1
30 Y=RND(48)-1
40 SET(X,Y)
50 GOTO 20
```

and *SAVE* it in ASCII format with, for example, *SAVE "PG47"*. A rather than in the usual compressed format.

Then renumber the program on the screen with, for example, *NAME 100, 10, 20* which will renumber all the lines starting with line 10, change the first line number to 100, increment the subsequent lines by 20, and renumber line references within the program:

```
100 CLS
120 X=RND(128)-1
140 Y=RND(48)-1
160 SET(X,Y)
180 GOTO 120
```

Now merge this program on the screen with the original program on disk, using

```
MERGE "PG47"
```

(which requires that the original program be stored on disk in ASCII format) and the display turns into

```
10 CLS
20 X=RND(128)-1
30 Y=RND(48)-1
40 SET(X,Y)
50 GOTO 20
100 CLS
120 X=RND(128)-1
140 Y=RND(48)-1
160 SET(X,Y)
180 GOTO 120
```

That may seem like more work than it's worth, but if you have ever wiped out a long program you spent many hours on, you will find it well worth the extra time spent.

Of course, the renumbered program should have line numbers far above the line numbers of the original program to ensure that there is no interference between them. Otherwise some lines from the renumbered program might be inserted between lines in the original program, or worse, replace those lines.

This method for checking a Basic *SAVE* assumes that you are using *TRSDOS*, which has both renumbering

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Chromasette

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and solved it easily.

"To operate this program, type it in and RUN it. The cursor can be moved, without harming whatever it passes over, by using an arrow in conjunction with SHIFT. Things may be typed as normally done. Pressing CLEAR will clear everything below the cursor. You may erase single characters by using SPACE or the left-arrow.

"The T in the lower-right corner indicates text mode. To move into graphics mode, press SHIFT G. Typing in three-number sequences will produce the corresponding character. Graphics mode may be exited by pressing SHIFT T or an impossible character (such as 783)."

Line 40 puts a T in the lower-right corner of the screen. Lines 50-60 cause the screen to display the character corresponding to whatever key is pressed, unless the character is SHIFT G

(g or ASCII code 103). If it is, then the program moves to line 70, which puts a G in the lower-right corner.

Line 80 counts three key depressions, and lines 100-110 turn the three numbers (if they are between 128 and 191) into a graphics character and display it on the screen. Unless the user presses SHIFT T (i or ASCII code 116), in which case line 100 moves the program to line 40.

As written, this program, which does a great deal for such a short one, can create text or graphics on the screen but can neither save them nor edit previously written programs. So I wrote Alex to ask what he used the program for. He replied:

"I used the program to solve

DONALD

GERALD

ROBERT

where D=5, and each letter represents

one digit (no two letters are the same digit). What I did was this: I set up a chart like this:

Sonal5

geral5

robert

	greater-than	less-than	odd/even
=0 d			
1 o			
2 n			
3 a			
4 i			
d=5 e			
6 e			
7 r			
8 b			
9 t			

and when I found something out about a letter, I replaced it in the problem with the appropriate digit."

Can you solve the DONALD+GERALD=ROBERT problem with the screen editor?

```

10 ON ERROR GOTO 140
20 DEFINT A-V: DEFSTR W-Z: CLS
30 PRINT CHR$(14):
40 POKE 16383:BA '* T INDICATOR
50 Z=INKEY$: IF Z="" THEN 50
60 IF ASC(Z)>103 PRINT Z: GOTO 50
70 POKE 16383:71 '* G INDICATOR

```

```

80 Z="": FOR J=1 TO 3
90 Y=INKEY$: IF Y="" THEN 90
100 IF ASC(Y)=116 THEN 40
110 Z=Z+Y: NEXT J
120 A=VAL(Z): PRINT CHR$(A):
130 GOTO 70
140 RESUME 40

```

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views...book r

2010: *Odyssey 2*, by Arthur C. Clarke. DelRey/Ballantine, New York. 291 pp., hardcover, \$14.95. 1982.

When asked if and when we would ever write a sequel to *2001: A Space Odyssey*, Arthur Clarke spent the better part of a decade explaining that such an undertaking would be utterly impossible. He was right, of course, and his reasons for changing his mind are nearly beyond my capability to fathom.

Nonetheless, we have lately been presented with *2010: Odyssey 2*, and sheer curiosity, I should think, to some degree accounts for its having spent two months on the *Times* Best Seller list.

Having been a fan of Arthur C. Clarke and *2001* since childhood, I was not about to let the pusillanimous attempt sneak past me. I knew I would be disappointed, but somehow held out the vague hope that the author would manage to do the impossible: write a sequel to a book for which no sequel can be written.

When they don't work, sequels tend to leave an especially bitter taste on the palate. For in the worst case, they manage not only to disappoint, but to compromise their very namesakes, and in the process undermine our estimation of the original work, the supposed inspiration of the sequel.

Extremely unfortunately, I found this to be much the case with *2010: Odyssey 2*. While I would agree that the job of writing a sequel to *2001* is nearly impossible to even contemplate, I am sure that many of the pitfalls into which Clarke seems to have blithely swan-dived could have been avoided.

It should be pointed out that Clarke's short story "Childhood's End" served as a very loose framework for the development of the *2001* screenplay, and that his novelization of the film appeared after the fact. Further, his wide-ranging disputes with Stanley Kubrick nearly dissolved the collaboration on more than one occasion. Kubrick is a notorious film *auteur* of unlimited single-mindedness and perfectionism. Much of the originality of *2001* can be traced to him as opposed to Clarke, who was, by his own admission, reduced to the post of technical advisor.

In personally assuming the reins of the new work, Clarke breaks the most serious sequel commandment: he compromises the symbolism of the earlier work. This is the worst flaw in *Odyssey 2*, which treats its estimable original symbols and characters with a marked lack of respect. Dr. Heywood Floyd, a minor character from the original work, is the protagonist in the new book. He is treated deferentially enough, although he is not really a very engaging main character. But the two major characters from the original who reappear, HAL and Bowman, are treated with all the courtesy an annoyed patrolman might extend to a bag lady. I was appalled.

Poor, poor HAL. Clarke explains to us that HAL's malfunction in murdering several crew members on the original Jupiter probe was solely due to his preoccupation with the security of the mission. Not to fear: with a bit of therapy from a stereotypical AI type, HAL is as docile as a pussycat this time around. What a slap in the mouth.

The strength of HAL as a symbol in the original work is severely undermined in this weak and narrow interpretation. To me, HAL embodied all the dangers posed by the concept of

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man-made intelligence. When a conventional machine malfunctions it might stop working or work incorrectly. When a thinking machine malfunctions, however, it might become insane—and we may not realize it until it is too late. HAL was acting on irrational impulses when he terminated the crew of the Jupiter probe—any attempt to rationalize them, let alone diffuse them, desecrates HAL's original meaning. HAL's appearance in *2010: Odyssey 2* is therefore reduced to even less than a gratuitous cameo.

But this is nothing compared to what the author does to the symbol of David Bowman. Here is a character who has been immersed in the ultimate transcendental experience: he has experienced his own physical death, traveled through corridors between universes, then returned to earth as the "star child." The resurrection myth plays heavily here. Clarke now has the audacity not only to reintroduce Bowman as a character, but even allows him to recontact his old girlfriend by appearing to her inside her TV set! The reader is left to wonder about the nature of the commercials aired during his program.

Then there is Clarke's mistreatment of the monolith, which is by far the most heinous debasement of a major image from the original. I will spare you the gruesome details. Suffice to say that Clarke reduces the imagery of the monolith to a symbol with all the intrinsic worth of a "No Parking" sign.

By treating Bowman as Casper the Friendly Ghost, HAL as a woebegone Atari 800, and the monolith as an intergalactic whoopee cushion, Clarke manages to transform one of the most resplendent stories of the '60s into a segment from "Bewitched." He does, to some small credit, sandwich some new sci-fi action into the chapters describing a supplementary probe to Jupiter, tries to work in some new material discovered by Voyager, and many of his visual descriptions are vintage stuff. But these constitute precious little justification for the liberties he has taken with a now-classic story he himself knew was better left alone. *2010: Odyssey 2* does not deserve to inhabit the same universe as its predecessor. —JJA

The New Alchemists: Silicon Valley And The Microelectronics Revolution, by Dirk Hanson. Little, Brown And Company, Boston. 364 pages. \$15.95, 1982.

If you only read one book about computers this year, be sure *The New Alchemists* is it. In a highly readable, non-technical style, Dirk Hanson chronicles the history of electronics from the first attempts to harness electricity in the 1800's to the age of computers skyrocketing into outer space.

From the onset, Hanson enchants the reader with anecdotes about the electrical pioneers. Thomas Edison "zapped dogs with a thousand volts of alternating current" to demonstrate the hazards of AC which a rival and competitor proposed. Nikola Tesla, the renowned electrical investigator, claimed "that he could vibrate the entire planet." Alan Turing, one of the foremost architects of the modern computer, "died at the age of 42 from suicide by poison" after being threatened with public exposure of his homosexuality. These not-to-be-found-in-the-encyclopedia

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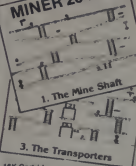
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revelations add a humane richness to the bigger than life images accorded these famed scientists.

After three chapters of historical roots, the saga accelerates, paced by its high-tech subject matter. Vacuum tubes, transistors, and Atari culminate in the transformation of the San Jose Valley from fruit orchards to the fertile hub of computer technology.

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Despite its burgeoning subject matter, electronics (where fifty percent of what electrical engineers learn is outmoded within three years of graduation), *Alchemists* is remarkably inclusive. Covering the current political scene, Hanson discusses the U.S. Justice Department dismissals of the AT&T and IBM antitrust suits, which occurred as recently as January 1982. On the scientific horizons, he foresees Diak Tracy two-way wristradio communications via satellites and gram-sized artificial brains being launched into space for exploration of the cosmos. In Toward the Silicon Future, the concluding chapter, the author toys with artificial intelligence in machines that walk and talk.

City planners and business leaders who hope to establish high-technology electronics centers in their municipalities would do well to read this book. "The microelectronics industry has been a textbook example of a capitalist production engine tuned and running to near-perfection," writes Hanson. The 3000 electronic firms in Silicon Valley foster the nation's most spectacular growth and a comfortable lifestyle for residents of this affluent area, which is also known as "Porscheland."

The author outlines a simple recipe for success: mix excellent engineering schools with a good pool of labor and plenty of energy. Sprinkle liberally with entrepreneurs and venture capitalists. Let simmer in a pleasant climate. Serve—a billion dollar industry.

The New Alchemists is a fascinating exploration of the intense human drama taking place inside the microelectronics revolution. Within the next century, I forecast that technology will mandate a revised edition of *Alchemists*. In this version, the microelectronics revolution will have progressed beyond the video games of the 1980's to a new species. A silicon species, whose machine intelligence vastly surpasses the cellular, human mind!

—Edward Joyce

ABC's of Microcomputing by Linda Gail Christie and Jess W. Curry, Jr. Prentice-Hall Spectrum Books, Englewood Cliffs, N.J. 221 pages, paperback, \$7.95, 1983.

As old hands at the microcomputer age, one of the hardest things for us to remember is that the novices don't share the common knowledge and vocabulary that some of us have been working with for years. And these days there are almost more novices than old hands. They find themselves bewildered by what seems intuitively obvious to us. The novices spend some time bumping their heads into ROMfills of floppy chips. The experience of coming up to speed can be painful. Fortunately

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most of them get through the period with a minimum of bloody noses and skinned shins. They would get through it a lot faster if they read this book.

ABC's is divided into standalone chapters. The reader can pick and choose as suits his whim. Thus a home user might skip the chapter Evaluating Educational Software or Is Security Really a Problem? in favor of Selecting a Printer. I found some of the chapters a bit disappointing. But then I have been at this a long time. 101 Home Computer Applications was titled artistically rather than factually. If you count word processing the club newsletter, your personal correspondence, and articles as three separate applications, then you come closer to 101. Still it forms a good starting point for a novice's daydreams. Other chapters fare better. Programming is like Writing a Novel contained one of the best discussions on organizing the programmer's job I have seen.

I do have a few more serious complaints, though in retrospect they may actually be strengths. This book has almost no illustrations and no photographs. This seems especially odd considering the clever and descriptive language of some of the chapters. I think a few photographs and a couple of cartoons would greatly enhance the value of the book. Second, the authors have studiously avoided making references to trademarks. This does avoid dating the book but I think the novice reader would be better served by discussions of such items as *VisiCalc* and *CP/M*.

ABC's is aimed at the adult rank beginner. It will hold little appeal to the computer literate user and is pitched at too high a level for most younger readers. It would be a good first purchase for the person who is thinking about buying a computer but doesn't know where to start.—Stephen Kimmel



"Pretty expensive target, wasn't it?"

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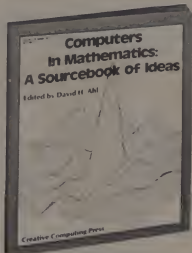
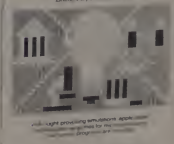
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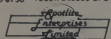
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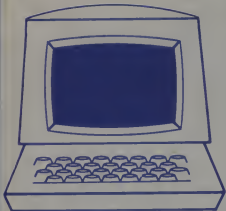
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