

Creative Computing®

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January 1983
vol 9, no 1
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**Focus On
Computer Graphics**

In-depth Reviews:

- Franklin Ace 1000
- Commodore 64
- Ada Compilers
- Apple Graphics Utilities
- Speedread+
- E-Z Learner
- Amdek RGB Monitor
- 13 Apple Games
- Aeronaut
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How to do 3-D Stereo Graphics

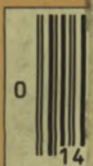
MX-80 Graphics With Pascal

TRS-80 Graphics Made Easy

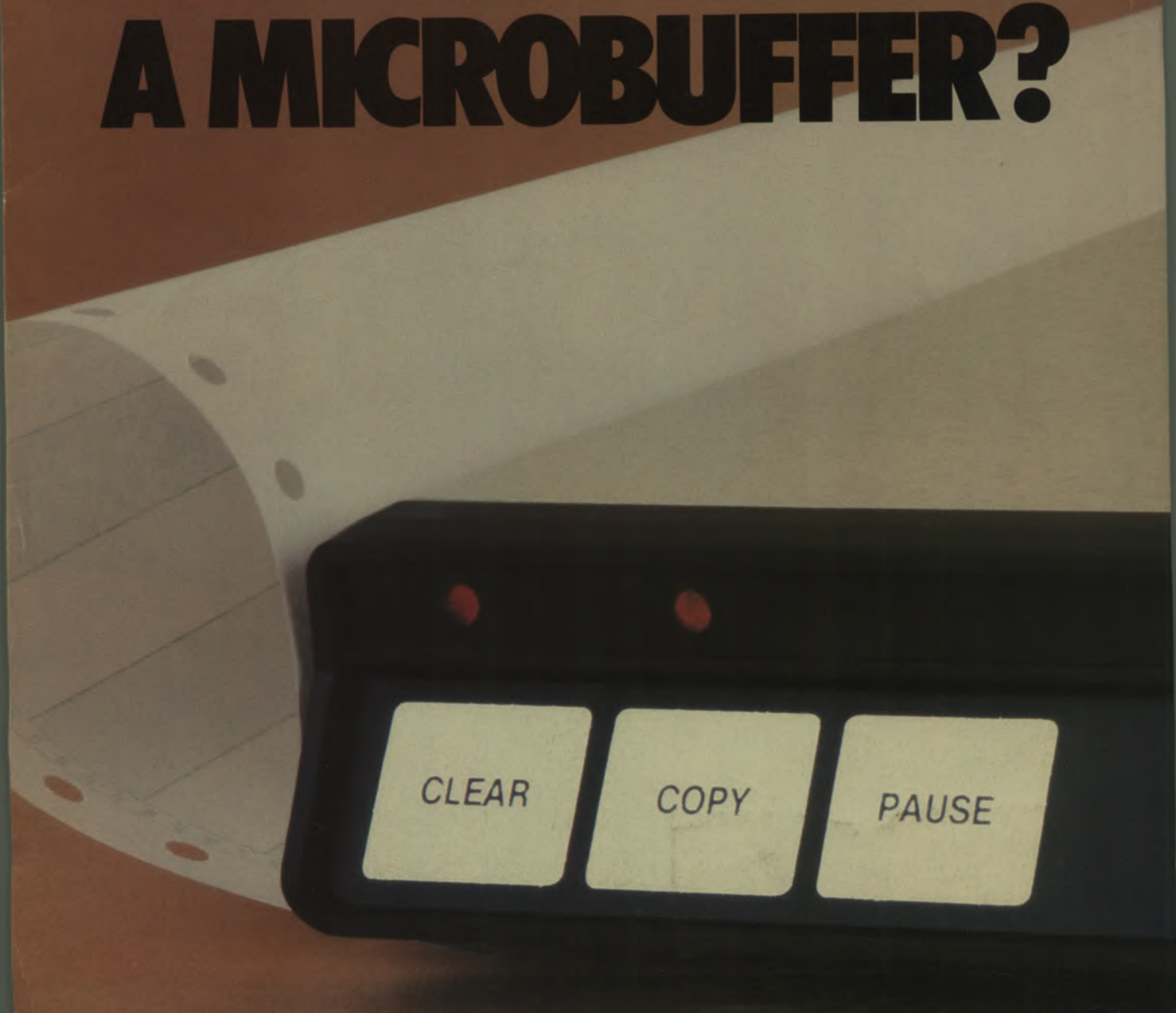
Is Computer Art Really Art?

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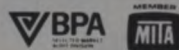
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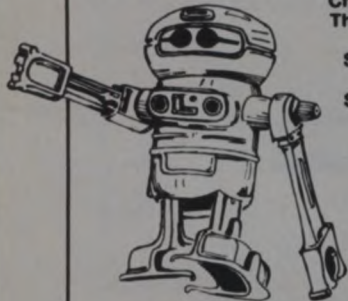
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CIRCLE 146 ON READER SERVICE CARD

ow...dateline:tomorrow...dat

David H. Ahl

An IBM Home Computer?

With demand for the IBM Personal Computer (PC) still far exceeding supply even though the company is turning out 15,000 machines a month, can IBM be eying the home market? It seems likely.

This January for the first time, IBM plans to exhibit at the Consumer Electronics Show. Interestingly, Apple and Radio Shack have both shunned CES of late, perhaps feeling that the video games image would hurt their sales to business and professional customers. But IBM is leaping into the CES arena with a large booth in a prime location.

At \$3,500 plus, the current IBM PC is not a serious contender in the truly home market, hence, it is reasonable to expect a new low-ended unit at the show. While IBM is being tightlipped as usual, at least three market researchers (Future Computing, Dataquest and the Yankee Group) also expect a lower performance computer from IBM in 1983.

Pac-Man on the Move

With bus ridership on the decline, Daniel Prins, president of Jefferson Lines, Inc. was willing to try some innovative tactics. Jefferson serves north-south routes from Minneapolis to New Orleans and hits places like Little Rock, Houston, Kansas City and Ames, Iowa. Most buses are not completely full, so Prins pulled the rear seats and replaced them with Pac-Man games.

"People just love it," Mr. Prins said. Ridership is holding up, and Jefferson is doing just fine against Greyhound and Trailways.

Prins is obviously concerned about deregulation, pricing and route structures. But he pays attention to less momentous decisions, too. "Right now I am grappling with the question of whether to continue with Pac-Man on the buses, or take my six-year-old son's advice and go with Donkey Kong. It's these really big issues that get you down."

Commodore MAX to Compete with Timex/Sinclair?

Jack Trameil, CEO of Commodore, said the company will introduce a home computer "in the \$99 range" in 1983. "Timex/Sinclair has broken the \$100 barrier, and we'll be there, too." Trameil gave no details, but one might expect that the announced but not released 2K MAX video game/computer might be offered for \$99 instead of the originally planned \$179.

Commodore also announced that production of the VIC-20 will be moved to West Chester, PA because of increased volumes of both the VIC-20 and 64. VIC-20 production will be increased from 2,000 to 3,000 per day, while production of the 64 in Santa Clara is being increased to 10,000 a month.

New Atari Computer

In a low-key announcement about shifting some computer production to Hong Kong and Taiwan, Atari mentioned that production of a new computer will begin in the second quarter of 1983. Various known by code names such as Sweet 16, 64 and Atari 600, the new machine is reported to be an updated version of the Atari 400 with a standard, full-stroke keyboard.

Video & Arcade Games Magazine to Debut

Amid an already crowded field of entries, Creative Computing will introduce a new magazine, Video & Arcade Games, in January 1983. Differentiating itself from the other me-too entries, it will have more than twice the editorial material of any other magazine and will cover four major areas: arcade games, home video games, computer games and electronic games. It will also carry in-depth reviews of games instead of the press releases carried by some other magazines. Initially, 250,000 copies will be distributed to newsstands; subscriptions may be available later.

Creative Computing Software Bows Out

With the increased emphasis on magazine and book publishing, Creative Computing has elected to bow out of the software business. The debut of Video & Arcade Games, increasing the frequency of three other magazines from bi-monthly to monthly, and a dramatically stepped up book publishing program will require all of our resources and attention. Hence, we felt we could not continue to be a leader in the software business, too.

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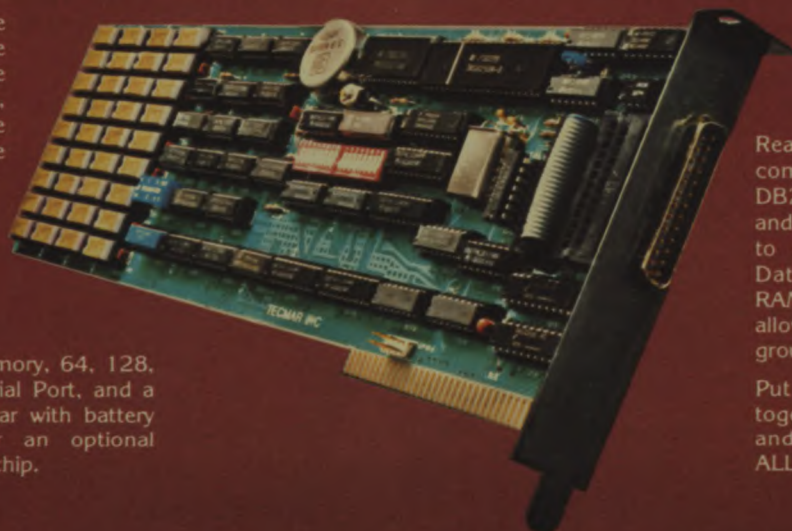
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CIRCLE 352 ON READER SERVICE CARD

Apple Work-Alike

Having one personal computer that will do most everything I want to do has always seemed highly unlikely. That is, until I tried the Franklin Ace 1000, an Apple work-alike computer from the Franklin Corporation.

By simply including a standardized, full size ASCII keyboard, the Ace 1000 comes close to meeting all my requirements, primary among which is word processing. Others include communications, hardware testing, and software development for business purposes (test, measurement and control, not accounting or inventory). Let's take a closer look at the Ace 1000; perhaps it will meet your requirements, too.

Features

One of the first things you notice is the size of the Ace 1000 assembly. Some of this added size is width necessary to accommodate the length of the full size keyboard. Inside, extra space is needed for the large power supply and the spacious main circuit board.

Extra space on the circuit board means more room between components and between cards in the

Chuck Carpenter

expansion slots. With more room between parts, cooling is improved and heat related problems are less likely to occur.

Additionally, the power supply has a built-in fan, which is noisy but not



Chuck Carpenter, 3714 Bishop Hill Drive, Carrollton, TX 75007.

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CIRCLE 162 ON READER SERVICE CARD

Franklin Ace 1000 Specifications

Microprocessor 6502 at 1.022 MHz	EMI/RFI FCC Class A Service Class B pending
Text 40 characters x 24 lines standard 5x7 upper/lower case Direct lower case entry Normal, Inverse, Flash	Memory 64K bytes of RAM 250 ns access time 6 EPROM sockets (2716)
Graphics Black and White only 40 horizontal x 192 vertical 40 vertical with 4 text lines	Keyboard 72 keys upper/lower case 15-key VisiCalc pad 2 special function keys
Hi-Res Graphics (B&W) 280 horizontal x 192 vertical 160 vertical with 4 text lines	I/O Joystick/paddle connectors 8 expansion slots
Cost \$1530 Processor \$ 379 Drive and Controller \$ 479 Drive without Controller	Physical 17 1/2" x 4 1/2" x 19 1/4" 15 pounds
	Power 115 VAC, 60 Hz, 65 watts

Table 1

objectionably so. Besides keeping the power supply cool, the fan circulates air inside the computer case to aid in component cooling.

Table 1 shows the published specifications of the Ace 1000. In using the system, I have listed some additional features which should be of interest to prospective purchasers and users.

Most significant is the full-size keyboard. It includes a sculptured design to aid the user, and the layout of the keys is similar to an IBM Selectric. All the key functions worked properly with the languages and programs I tried.

Keys on the keyboard are individually replaceable. Manufactured by Keytronic, the keyboard uses capacitive switches so there are no contacts to wear out. The "feel" is somewhat spongy with a certain amount of tactile feedback to the user. I am used to a keyboard like this so it didn't bother me.

All keys on the keyboard are repeat keys. Consider how much help this feature is when using a word processor. Text editing involving extended cursor movement is greatly improved, for instance.

Two special keys called PAUSE and BREAK are included on the keyboard. These are especially useful in Basic and Pascal programming. PAUSE generates a CTRL-S and BREAK generates a CTRL-C.

Memory for the equivalent of a 16K RAM expansion card is included on

the main circuit board. Slot 0 is not needed for this application. A cut-and-jumper area is included to allow you to use slot 0 if you need to.

Cassette capability is not included with the Ace 1000. However, space for the circuit components is included in the circuit board over (see Figure 1). I suspected that some of the Ace 1000 features used the memory space originally occupied by the cassette input/output (I/O) routines, and on investigation this turned out to be the

case. Therefore, the cassette routines are not available in the firmware. Because the Ace 1000 is not considered a hobby machine, the cassette interface was not included.

Booting with the Ace 1000 Master Disk allows you to enter Floating Point Basic in lower-case. (Similar to Basic-80 under CP/M.) When you list a program the lower-case commands and statements are converted to upper-case. Any variables entered in lower-case remain in lower-case. Under control of the Ace 1000 Master Disk, a lower-case filename is saved in upper-case. Integer Basic is converted directly to upper-case as you type.

When you boot with an Apple II Master Disk, you can enter Floating Point Basic in lower-case but not disk operating system (DOS) commands. Also you can't save a program using a lower-case filename. For Integer Basic you must press the shift lock key and enter everything in upper-case.

Otherwise, the operation and functions of the Franklin Ace 1000 are the same as the Apple II. A few minor problems arise because of the differences in keyboards. These will be discussed in more detail later. Table 2 is a summary comparison of Ace 1000 and Apple II features.

Hardware

Generally, the hardware is much like that of the Apple II. Power supply capacity is greater — about 65 watts for the Ace 1000 and 40 for the Apple II. Memory expansion (16K) is built-

Franklin Ace 1000 Comparison

Item Supplied	Apple II	Ace 1000
Full upper/lowercase keyboard	No	Yes
Cassette interface	Yes	No ⁽¹⁾
Color graphics	Yes	No
Black and white graphics	Yes	Yes
VisiCalc 15-key keypad	No	Yes
80-Character columns ⁽²⁾	No	No
Power supply with fan	No	Yes
64K RAM memory ⁽³⁾	No	Yes
Mini-assembler ⁽⁴⁾	Yes	Yes
Floating Point routines ⁽⁴⁾	Yes	Yes
Sweet-In interpreter ⁽⁴⁾	Yes	Yes
Programmer's aid routines ⁽⁴⁾	Yes	Yes

(1) Circuitry of components included on the main circuit board.

(2) Videoterm or equivalent board suggested.

(3) 16K equivalent expansion board built-in to Ace 1000 main circuit board.

(4) Available with sub-loaded Integer Basic or Integer Basic ROM card.

Note: A ROM card or memory expansion card can be used in slot 0 if appropriate cut-and-jumpers are added to the selection block area of the main circuit board.

Table 2



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Franklin Ace 1000 Peripherals and Software Tested

Peripheral	Software
Microsoft Z80 Software	Super-Text II
Apple Controller 2 drives	Sargon II
Wangen MD-Catalog	Spore Eggs
Video Board	Gorgon
Mountain Computer	Universal Boot Initializer
Clock	Flash! I/B Compiler
Wenger BPO Primer Buffer	S-C Assembler 4.0
Apple Parallel Printer Board	Data Capture 4.0/80
Micro-Sci Controller	CP/M and Basic-80
and Drive (1)	(MBasic)
Hayes Modem II	Locksmith 4.1
MPC SIO Serial Printer	CP/M and Wordstar W/P
Board	Vincalac
	Pascal

(1) Optional drive supplied by Franklin

Table 1

in, or you can use slot 11 for memory expansion of your choice. To use slot 0, you make cuts to a designated block on the main circuit board.

There are several other memory options you can select through cuts and jumpers with this board option too. They are described in the User Manual. A reset button is provided under the left front edge of the case.

Operating the Ace 1000 is much like running an Apple II. I remove all the cards from my Apple — except the language card — and insert them in the Ace 1000. Without exception, all of them worked.

I used the dual drives from my Apple for most of the test. Drives available from Franklin are Micro-Sci drives (reported to be manufactured under license by Franklin). I tested single Micro-Sci drive and controller and both worked without any apparent problems.

To gain further assurance I tried a sampling of software from my collection. Other than the minor problems alluded to above, everything worked. Table 1 summarizes the peripheral cards and software I used in the evaluation of the Ace 1000.

Software

Because most all Apple programs expect upper-case input, you must press the shift lock key to make them work (the minor problems). For instance, with Super-Text, the character X is used to print a file. A lower-case x wouldn't execute. Furthermore,

a filename typed in lower-case wouldn't save. Upper-case filenames worked fine.

Another difference, again with Super-Text, concerns shift key operation. With the Apple II and a Videx Keyboard Enhancer, a certain key sequence is required to make the shift key work typewriter style.

By experimenting, I found a sequence that performed a similar function with the Ace 1000 keyboard. First, ADD mode is selected. Next, the

shift lock is pressed, followed by a CTRL-C. Now the shift lock or shift key generates upper-case characters. Using a CTRL-P, the code for starting a paragraph, caused the steps just described to terminate their response. My solution was to use the tab function to indent paragraphs.

In addition to the Super-Text word processor, I tested WordStar running under Apple CP/M. My test was rather limited but showed that it worked at least enough to write a short letter, save it, recall it, and make local and global changes.

Included in the Ace 1000 service manual is a patch for the Applewriter II word processor. The patch lets you modify Applewriter so it will recognize the keyboard features of the Ace 1000.

Software provided with the Ace 1000 is limited to a Master Disk. Most of the programs are utilities and are much like those included with DOS 3.3. Each program is described in the Users Manual. Diagnostics are also included on the master disk. These utilities will help you locate a problem should you experience difficulty in operating the system.

Except as noted earlier, all programs from the Apple II master disk worked. Integer Basic was loaded into the expansion RAM and it worked too. In fact, the utilities such as the mini-assembler and those from the programmer's aid ROM worked very well.

Along with a check on the machine language utilities, I tried PEEKs,



Figure 1. Circuits for cassette interface are included in the circuit board chip. However, the cassette input/output routines are not included in the main ROM.

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POKEs and CALLs from the Integer and Floating Point Basics. As expected, as long as no routines from the cassette I/O are used, all access to memory locations functioned properly.

Documentation

Documentation is rather sparse. The Users Manual is all you get. If you want to learn any more than how to operate the machine, look elsewhere. There are no descriptions of programming languages included in the manual.

In fact, there is less information in the Ace 1000 manual than there was in the first Apple II manual. At least the original Apple manual included memory usage, a summary of machine language and Integer Basic commands, and sample programs. I expect some improvement in the area of documentation very soon.

If you are considering purchasing the Ace 1000 as a second Apple-like computer, all you need to know is how the new system works. More than likely you will already have all the documentation you need to describe programming languages. If Ace 1000 will be your first machine, locate and

purchase as many of the Apple II manuals as you can.

Conclusions

For those who want to use a personal computer as a word processor, the Franklin Ace 1000 is an excellent choice. The full size upper- and lower-case keyboard is a delight to use. This review was written on the Ace 1000.

If you want a system, as I do, with flexibility, ease of expansion, and functional utility, the Ace 1000 will do the job quite nicely, especially if you are considering a second computer and already have documentation. Software for personal, business, professional, and development applications is available through many sources.

If you are interested in color graphics, however, forget it. The Ace 1000 generates only shades of grey and black and white (assuming you use a black and white monitor). A color adapter board is "soon to be available." It will plug in to one of the expansion slots.

Based on my evaluation of the computer, I suspect that any software or peripheral that will work on an Apple II, will work on the Franklin

Ace 1000.

The Apple II is probably to be at the peak of its product life right now and, the Ace 1000 should help to stimulate the market for Apple-compatible products. The new Apple work-alike products won't injure the Apple market, they will enhance and sustain it.

One caveat: make sure the company manufacturing your Apple work-alike will support the product. Franklin appears to be establishing the required support network. High Technology, the local distributor, has been involved with factory training programs through Franklin. In turn, High Technology provides training and support for its dealers.

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The Commodore-64 is a lot of computer for the money. For only \$595, it comes with 64K of RAM memory, excellent graphics, a three-voice sound synthesizer, Microsoft Basic, a 6510 microprocessor, a built-in RF modulator to connect with a television, and a typewriter-style keyboard.

Although not a true "open design" such as the Apple II or IBM PC, the 64 has several easy-to-use input/output interfaces built in. There is even a cartridge slot that will allow a Z80 microprocessor or game cartridge to be added to the system.

Commodore has announced that the popular CP/M operating system will be available when the Z80 cartridge is released in early 1983. A single 5 $\frac{1}{4}$ " floppy disk (Model 1541) is available for an additional \$199.

Not A 40-Column Vic

The 64 is packaged in a plastic case that looks exactly like the Vic-20, except that it is brown instead of white. But don't let that fool you; the 64 is not a 40-column Vic. The two computers share only two features: the plastic case, and the same version of Pet Basic.

Vic programs that don't use any of the special Vic graphics or sound and that do not rely on the 22-column screen will run on the 64. Unfortunately, these constraints severely limit the number of Vic programs that will work on the 64.

The 64 uses a 6510 microprocessor. The 6502 is exactly like a 6502 (which is used by the Pet, Vic, Apple, and Atari) except that the first two bytes of page zero have been "stolen." These two memory locations are used for an on-chip 8-bit input/output port by the 6510. The 64 uses this port to control its memory map, which makes it unusually flexible.

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Ron Jeffries

For example, when a game cartridge is plugged in, the 64 automatically acts just like the Commodore Max Machine game console. This means that the 64 is an inexpensive development system for programmers who want to write Max games.

Excellent Keyboard

The first thing that impressed me when I unpacked the 64 was the excellent keyboard. Several people who have wandered by my office have tried the keyboard, and their comments have all been quite positive.

As is true of most computer keyboards, some keys are not placed where they would be on a standard typewriter. If you are a touch typist, be sure to type for a few minutes on the 64 keyboard before you decide to buy it. The placement of keys on the 64 probably won't bother you.

The keyboard of the 64 is sculptured, which means that the tops of the keys are slightly concave when viewed from the end of the keyboard. (Some keyboards look like a staircase when viewed from that angle.) Most typists seem to prefer the sculptured design, which is what IBM uses for their popular Selectric typewriter.

The 64 keys also have a matte, non-gloss surface that is attractive. The "feel" of the keyboard is above average, although for my taste it is a little softer than ideal. There is no audible click when a key is pressed, a feature I have come to appreciate on machines such as the Atari 800.

As a point of reference, the IBM Selectric keyboard is the best I have ever used. My favorite personal computer keyboard is the IBM PC. It has a sharp, "clicky" feel that works very well for me. I rate the 64 keyboard about 7 on a scale of 1 to 10, with the IBM PC rating a 9, and the Selectric getting a perfect 10. Obviously, the \$600 64 does very well in comparison with the much more expensive IBM PC.

The 64 keyboard has a somewhat high

profile. The home row of keys is 70mm above the desk surface. (The 64 looks higher than it is. For example, the fairly sleek Atari 800 has a 77mm high home row.) A low profile keyboard such as the IBM PC places the home row of keys approximately 50mm above the desk top. Research in human factors has shown that low profile keyboard design reduces fatigue in users' fingers and hands.

Commodore decided to use a slightly modified Vic plastic case for the 64, even though this meant having a high profile keyboard. On the other hand, by using existing plastic tooling, they were able to get the 64 to market several months sooner than if they had designed a new case. (They probably also saved \$20,000 to \$50,000 in development costs.)

Advanced Graphics

The graphics capabilities of the 64 are amazing. Commodore-64 graphics are more powerful than those of the Atari, IBM PC, Apple, TI 99/4A, or Radix Stack Color Computer. (The 64 also has far stronger graphics than its cheaper cousin, the Vic-20.)

The most important feature is its dedicated hardware support for rapidly displaying eight detailed objects anywhere on the screen. Each of these objects (Commodore calls them *sprites*) can be 24 pixels wide and 21 pixels high, or about the same as a block of 3 x 3 characters.

After a sprite is designed, and the dot-by-dot pattern for the display (called a *bit map*) is stored somewhere in memory, the sprite can be moved around on the screen very quickly and easily. All the programmer has to do is POKE the horizontal and vertical location into the appropriate registers of the dedicated graphics processor called the "Video Interface Chip," or VIC. The VIC chip directly supports eight sprites at one time. (In machine language it is possible to "re-use" sprites, and thus have more than eight of them on the screen at once.)

Sprites Are Versatile

Each sprite has a priority. This allows one sprite to appear to pass in front of another sprite, so that three-dimensional effects are possible. The video chip also keeps track of collisions between sprites, and between sprites and the background. This can be very useful when writing sophisticated game programs.

Each sprite can be enlarged to be twice as wide, or twice as tall, or both. However, when a sprite is enlarged, there is effectively half as much resolution, since the same bitmap of 24 by 21 pixels is used. (The pixels making up the sprite are enlarged.)

Likewise, a sprite can use four colors (instead of the normal "on" or "off") at the expense of having half as much resolution.

Until you can see an example program that uses sprites, it is hard to understand what a powerful tool they are. Machines like the Apple that do not support sprites face tough competition from those like Commodore, Atari, and Texas Instruments that do provide this facility. (See "Personal Electronic Transactions" in this issue for more on 64 sprites.)

Video Problems?

In my opinion, the quality of the video image produced by the 64 is poor. So far, I have seen the displays of six 64 computers, and have yet to find one that is as crisp and sharp as the Atari 800 or 400 models, for example. Since I am using a fairly early production model of the 64, this problem may be corrected by the time this review appears in print.

Many combinations of text and background colors produce an unreadable display.

For some reason, the characters on the 64 appear to be "smeared" on the display. This effect is least visible when there is reduced contrast between the character color and the background. I suspect that is why Commodore decided to have the 64 display light blue characters on a dark blue background when it is first turned on. However, this combination of foreground and background colors does not provide as much contrast between text and the background as other popular systems.

Many combinations of text and background colors produce an unreadable display. The background color (as well as the border color) can be changed with two POKE commands. After some experimentation, I have found that blue text on a white background looks pretty good, although it does exhibit some of the character smearing. I trust that Commodore plans to improve the quality of the display.

Music Synthesizer

The 64 produces sound using the 6581 Sound Interface Device (SID). This special chip is a music synthesizer and sound effects generator. It provides three voices that can be controlled by the user.

For each voice, you can control pitch over a nine-octave range. The waveform can be a triangle wave, sawtooth, variable pulse, or noise. (You can create great sound effects for games with the noise waveform. For example, it is easy to produce explosions, shuffling feet, or ocean waves.) For each voice, you can also control volume, and there is a master volume control.

For each of the three voices, you can control what are called *envelope generators*. The way a note or sound effect sounds when it is produced is the result of many different things. Naming the envelope of a given sound is a shorthand way of describing four of the important parameters that control how a sound is.

There are four parameters that describe an envelope: attack, decay, sustain, and release, or ADGSR for short. With the 64, the attack rate can be varied from two milliseconds to eight seconds. Both the decay and release rate can range from six milliseconds to 24 seconds, and the sustain level can range from zero to peak volume.

After spending quite a bit of time using a sound editor that makes it easy to build new sounds and then experiment with changing them, I am very impressed with what the SID can do. Frankly, I can't remember the last time that I have had this much fun (at least with a computer). When I start playing with 64 sound generation there just doesn't seem to be a good place to stop. Many 64s will be purchased solely because of the SID synthesizer.

Given the excellent sound and graphics capabilities of the 64, it is no bad that Commodore did not choose to support the new hardware at a high level in Basic. All of the sound and graphics are controlled with POKE statements that change magic memory locations. POKEs are inconvenient for experienced programmers, and completely mystifying to novice users.

Microsoft has extended Basic to support graphics and sound on other machines such as the IBM PC. So why was the 64 released with version 2 of the same old Pet Basic, which does not support the new hardware features?

I think that Commodore decided that the 64 would sell very well without an enhanced Basic. After all, the 64 is priced relatively low for the features. (Using the existing Pet Basic is another way that development costs were minimized.)

Will there ever be an enhanced 64 Basic? I think it is unlikely. My guess is that a better version of Basic will be one of the features of the \$995 P-500. The new computer will have the same color graphics and sound as the 64, and will

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also have 128K of RAM, a 10-key numeric pad, true programmable function keys, and a faster microprocessor.

The 1541 Disk Drive

In addition to supporting the standard Commodore cassette tape format for storing programs and data, the 64 can also be used with the Vix-1541 disk drive. (The original Vix-1540 drive requires a new ROM in order to work with the 64.)

The 1541 uses a 5 1/4" drive that stores approximately 170,000 bytes. The drive is a single-stick unit that uses Commodore's unique disk format, and is packaged attractively, although the case is white (like the Vix-20) which doesn't match the tan color of the C64.

The disk format used by the 1541 is compatible with the standard Commodore 4040 disk drives that have been used for several years with the Pet and CBM models. This means that disks can be transferred among the 64, the Pet, and the Vix-20.

In the case of data files, no changes should be needed when interchanging files. Pet programs can be transferred to the 64 easily. Many Pet programs work on the 64 after minimal editing. Programs that POKE screen locations must be changed, since the screen has moved.

Changing the CB2 sound of the Pet to use the SID chip isn't difficult, if you use this formula:

$$10\text{HS} = 2 + (1/12)$$

$$20\text{SID} = \text{INT}(5 + 14\text{HS})$$

$$(\text{LOG}(255/\text{CB2})/\text{LOG}(\text{HS}))$$

Where SID is the value to POKE into location 54273, and CB2 is the value that was POKE'd into location 54464 on the Pet. Naturally, you have to have the other SID parameters set up correctly for the 64 sound to work.

Commodore plans to release what they call a Pet emulator for the 64, that will do much of the dirty work for you. I think that converting a Pet program to the 64 is a better approach, since there is no runtime overhead, and you can take advantage of unique 64 features such as color, user-programmable characters, sprites, and of course multiple-voice sound.

"Smart Peripheral" Problems

The disk operating system for the 1541 resides in ROMs that are in the 1541, rather than in the 64. The advantage of this approach is that the DOS doesn't consume any RAM in the computer, since it has its own RAM on the disk controller.

Commodore takes great pride in the fact that their system has what they call "smart" peripherals. What this means is that each disk unit or printer has its own

How to Transfer C64 Programs to the PET

Taking 64 Basic programs to the Pet is somewhat complicated. After loading the 64 program into the Pet from disk or cassette, use the PET monitor as follows:

SYS 8024

At this point, the monitor will display the contents of the 8502 registers. We can ignore these, and type the M command to display a portion of the PET memory:

M04000007

The command shows the contents of the seven bytes that begin at location 0400 hex. We will ignore the values that it displays, and type the following in their place:

:04000001080000000000

After pressing RETURN, exit from the monitor with the "X" command:

X

Now, in Basic, type a zero and press RETURN. What we have done is play a trick, using the machine language monitor. We created a fake line zero in the monitor, and then deleted it in Basic. If your program already has a line zero, it will not be deleted, since Basic will only delete the first line zero that it encounters, which will be our fake line.

microprocessor, and can accept commands from the "main" computer, such as the 64.

Unfortunately, there is a fly in this intelligent peripheral ointment. Basically, the disk is a very independent device. The 64 sends it a command, the disk attempts to perform the requested action, and then sets an error code. Note that I said "sets an error code," not "tells the computer whether things worked or not."

The problem with the Commodore approach is that the user program (or the user, in the case of commands from the keyboard) is responsible for discovering that an error has occurred. When something doesn't work, the 64 does not print an error message on the screen.

The result of all this is that Commodore disk systems such as the 1541 are not among the easiest to use when compared with other personal computer systems. Evidently, there are many consumers who either don't know the difference, or don't care, because Commodore disk systems seem to sell very well.

Limited Disk Speed

The 1541 disk transfers data slower than several other personal computer disk systems. For a simple benchmark, I used a program that writes 10,000 bytes to the disk. (To keep the interpretive overhead down, the program uses a FOR loop that goes from 1 to 500. Each time through the loop a string of 20 bytes is written to the disk.) The 64 with the 1541 disk took 34.8 seconds to write 10,000 bytes. The standard Pet 4040 took 17.5 seconds, and the Atari 800 took 28 seconds with "read-after-write" disabled.

Atari is the only personal computer that automatically reads each sector after it is written. However, this Atari "feature" can be disabled by typing POKE 1913,00. With read-after-write disabled, the Atari 800 disk took 46 seconds for the benchmark. The IBM PC with IBM DOS took 11.4 seconds to write the 10,000 bytes.

I ran each disk test several times and averaged the results. Also, the old data file was scratched by using a keyboard command rather than in the benchmark program. To my surprise, I found that scratching a file from the disk takes quite a while.

Furthermore, the amount of time taken to scratch a file depends on the location of a file on the disk in several popular disk operating systems. For example, with the 1541 disk, a scratch command can take a noticeable amount of time.

Since most consumers don't bother to time the performance of their disk drives, the important question about the 1541 may be "Is it fast enough for the average user?" The answer is a qualified "yes." If you mainly use the disk for program storage, any disk is much faster than a cassette tape recorder. But if you plan to use the 64 for disk-intensive data management, you should do some serious benchmarking before making a purchase decision. At \$399, the 1541 is one of the least expensive disk units available for personal computers.

Conclusions

The Commodore-64 is an excellent value. For \$595 you get powerful graphics, a complete sound synthesizer, and a versatile computer with 64K of memory. At the moment, I think it is the "best buy" in the \$600 personal computer price range. Now if you'll excuse me, I need to get back and tune-up my 64 snare drum sound effect.

Acknowledgments: Glen Fisher at The Crite Works provided numerous clarifications of the technical details of the 64. David Rosenwald at Commodore was most helpful in providing hardware and software.

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CIRCLE 156 ON READER SERVICE CARD

7 Years Ago

in

creative computing

The November 1975 issue was almost entirely devoted to the impact of the computer on society. In the lead piece, an interview with Senator John Tunney, he expressed the opinion that in Presidential elections, computerized projections should not be announced until all polls have closed. He said "In 1964 and 1972, for example, I believe that voters in the west, after hearing projections of Presidential landslides, lost interest and didn't vote. This absenteeism especially affects statewide and local races and issues." Prophetic words. Tunney was defeated four years later for probably those same reasons.

We published the results from a major survey of public attitudes towards computers. Many results were not surprising, but one that was was that nearly one-fifth of the respondents believed that most errors were made by the computers themselves and not by programmers and operators. Let's hope that computer literacy has improved a bit by now.

Terry Ireland and Norm Click wrote a wonderful piece, "Eccentric Programming Languages," in which they longed for intuitively extensible languages. "Perhaps," they said, "the ultimate instruction will be, 'You know what I want. Do it!'"

I visited Terry recently and he felt that Ada and Pascal were hardly steps in the right direction, and did not encourage new classes of users to learn about computers.

In that issue we reviewed the first episodes of *Space: 1999*, a new TV show (lasted two seasons). We speculated that videodisks would be commonplace in 5 to 10 years (we were wrong). We mentioned the newly-formed Micro-8 User Group for people building computers with the Intel 8088 (not 8080) chip (it lasted 1 1/2 years). And we announced *Computers Recreations*, a system like *The Source* and *Microbit* but five years too early.

Craig Johnson's monster *Spas-O-Vision* computer predicted that the height of the public's negative reaction toward computers would occur in 1985 when a computer would erroneously schedule 9 million reservations in Yellowstone Park causing the great vampire wars. We'll see.

January 1985 • Creative Computing

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ambush



by Peter Folkos

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High Quality Hi-Res

Many computer users have been attracted to the Apple II because of its ability to produce color video graphics. Those users whose visual ambitions go somewhat beyond zapping the Klingons will probably be interested in obtaining the best possible display of Apple video.



Figure 1. The Amdek Digital Video Multiplexer (DVM) board (foreground) for the Apple II, and the Color II 12" red-green-blue (RGB) monitor.

An off-the-shelf Apple can produce images on two types of hardware: regular television sets through a radio-frequency (RF) modulator, and mon-

itors led by the composite video signal available at the Video Out jack.

The first of these is adequate for home entertainment, but the RF modulator, being in essence a tiny TV transmitting station, is subject to all manner of interference, causing jitter, ghosting, and general degradation of the image.

A video monitor, gives a much more stable picture as the computer signal is piped directly into the circuitry of the monitor. However, image quality is highly dependent upon the quality of the monitor and its ability to make sense out of the Apple video signal which deviates significantly from the standards with which a monitor is designed to work.

The best monitors can give quite a good picture, the worst are hardly better than television sets. Some will not accept the Apple video signal at all. Top-quality professional graphics devices, those used with mini and mainframe computers, do not use a composite video signal. Rather they work with three separate signals, one for each of the color guns in the display tube—red, green, and blue, hence the acronym RGB. The Amdek Corporation (formerly Leedex) of Arlington Heights, IL, has made this professional display technology available to Apple II users with their Digital Video Multiplexer (DVM) and Color II RGB monitor.

monitors led by the composite video signal available at the Video Out jack.

The first of these is adequate for home entertainment, but the RF modulator, being in essence a tiny TV transmitting station, is subject to all manner of interference, causing jitter, ghosting, and general degradation of the image.



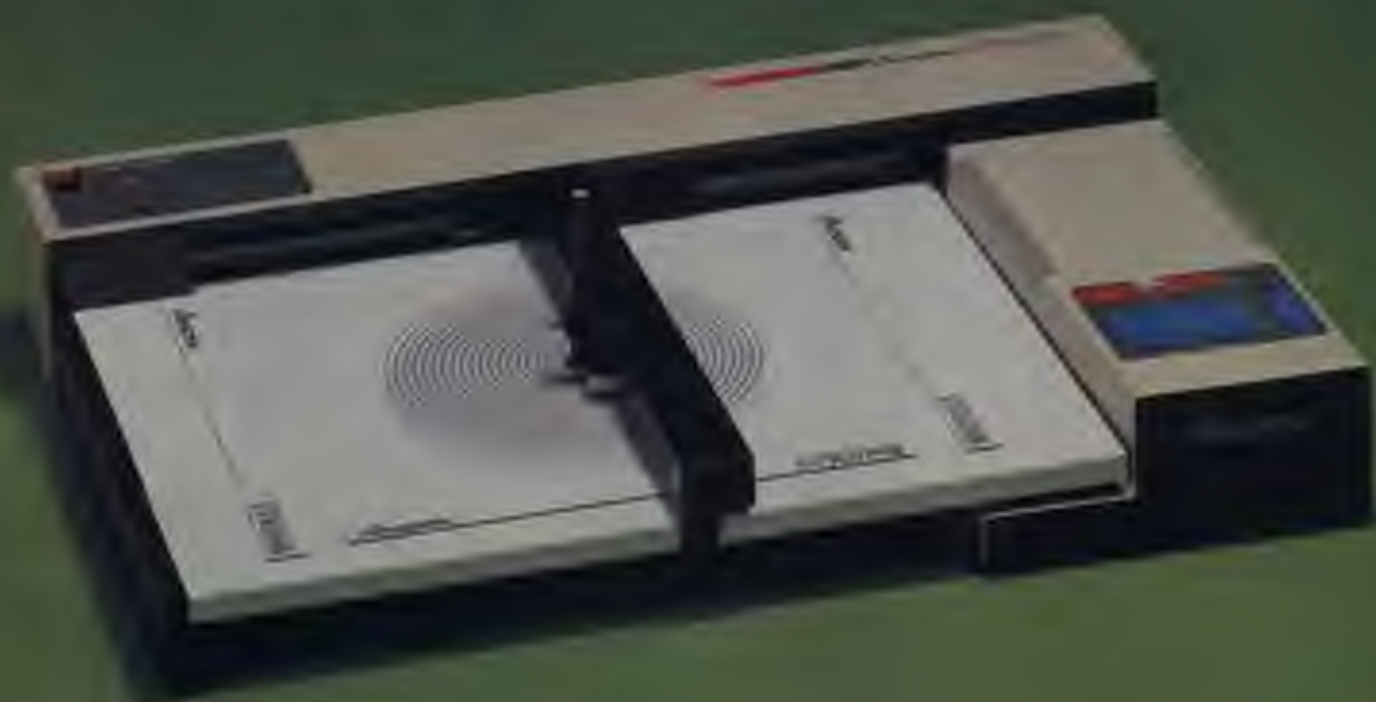
Figure 2. The full range of the Apple lo-res colors as displayed on a composite video monitor.



Figure 3. The Apple lo-res colors as they appear on the Amdek Color II red-green-blue (RGB) monitor. Colors are limited to black, red, green, yellow, magenta, cyan, and white. The Amdek text is clear and free from color fringes.

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CIRCLE 107 ON READER SERVICE CARD



Figure 4. A familiar Apple II-era image, shown on the Amdak Color II monitor, driven by the DVM board.

Digital Video Multiplexer (DVM)

The DVM, which retails for \$199, is the heart of the Amdak system. It picks signals from various parts of the Apple video-generating hardware and puts out red, green, and blue signals along with separate horizontal and vertical timing pulses. Timing information is critical to image quality; that produced by the DVM appears to be much closer to industry standards than that produced by the Apple.

The main printed circuit board of the DVM is a large one. Eleven inches long, it extends well toward the front of the computer case, with its top front corner cut off to clear the case cover.



The board carries 37 integrated circuits (ICs) mounted in sockets.

In addition there are two satellite "daughterboards" which fit between certain of the Apple ICs and the motherboard. A cable connects the daughterboards to the main DVM card. A second cable supplies input to a 9-pin D-type connector but also makes a branch to pick up 40-column text input from pin 2 of the Molex connector at location K-14 of the motherboard. Obviously the production of well-timed RGB output is not a trivial matter.

Three channels of the DVM supply red, green, and blue signals. A fourth channel is provided for use with an 80-column text board.

High-Resolution Monitor

The Color II high-resolution



Figure 3. The image as it appears on a high quality video monitor.

monitor superficially resembles a nicely-designed 13" color television set. Its large and black plastic case measures 16 1/2" x 14 1/2" x 15", and its feet are spaced so that it will just fit on top of the Apple case. It retails for \$899.

A look at the controls makes it apparent that the Color II is not just another TV: on-off, contrast, brightness, and vertical hold. Period. There is no volume (there is no speaker), no color, no tint, and, of course, no channel selector. This is a specialized machine.

The documentation supplied with

Figure 6. The same picture on a television receiver, driven by a popular radio frequency (RF) modulator.



Figure 7: A close-up of the Atari image.

the Color II is "consumer oriented," disappointingly so, in my opinion, considering the professional quality of the monitor itself. Seven of the eleven pages in the booklet are taken up with such matters as location of controls (since there are only five controls, this is not too complicated), how to turn the set on (ditto), and several pages of precautions, with little cartoon figures beset by sweat-droplets, X's, and exclamation points illustrating such warnings as "Do not hold anything by the power cord" and "Do not apply a shock by dropping, crushing, etc." I mention this simply because I believe that those who purchase expensive, professional-quality equipment ex-

pect, deserve, and need professional-quality documentation.

The last four pages get down to facts, describing the signals received by the Color II, giving a pinout of the input connector, and offering diagnostics in case the input signal is not correct.

Input is through a standard Type-1 8-pin video connector which expects red video, green video, blue video, horizontal sync, vertical sync, and ground — exactly the signals produced by the DVM board.

Installation and Setup

Installation of the DVM involves more than simply dropping the card into a peripheral slot; integrated circuits must be removed from the motherboard and inserted into sockets on the daughterboards which, in turn,



Figure 8: A close-up of the video monitor image.

must be inserted into the motherboard. One who has never handled ICs would be well advised not to learn by practicing on the computer.

On the other hand, anyone with even a small amount of experience should have no trouble with the installation, although the price of an IC puller and inverter should be figured into the total cost.

Having issued these warnings, I will say that installation is straightforward and shouldn't take much more than twenty minutes.

The manual includes instructions for connecting to a Video Vultterm.

Figure 9: A close-up of the TV image. Notice the dramatic differences in resolution.



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Software is the part that tells the computer what to do, the way a driver tells a car what to do.

Without software, a computer can't do anything.

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You have to buy both.

Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember, it's the software that knows how to get things done), it makes good sense to pick the software first.

Start by making a list of the things you want to use the computer for. It can include almost anything—any kind of inventory, filing, accounting, graphics, reporting, record-keeping, analysis—you name it and there's probably a software program that does it.

Next, take the list into a computer store and ask the salesperson to give you a demonstration of the program, or programs, that will do the things you want.

Even though you'll need a computer for the software demonstration,

keep in mind the computer is just a vehicle. The software is the driver. And once you've decided on the software, picking out the rest of the computer system will be much easier.

The simpler the better.

Look for software that's easy to learn, easy to use, and that does the job in the simplest way possible.

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CIRCLE 267 ON READER SERVICE CARD

35-column text card, requiring the soldering of three male Molex pins to the Videoterm. These pins were not included with my evaluation unit, nor was the connecting cable fitted with the necessary female connectors. With nothing more to go on than the blurred photographs and skimpy pictorial information in the preliminary manual, I would have to forget the Videoterm connection, although Amdex assures me that the results are spectacular.

Use and Evaluation

The Color II/DVM is transparent to the user; that is, nothing special or different needs to be done when the system is in use, with two exceptions. First, the manual recommends that, when in the home mode, plots should not be made in the coordinates at the extremes of the screen—X coordinates 0 and 279, Y coordinates 0 and 129 (mixed mode) or 191 (full screen mode). When references are made to these coordinates and "artifacts" may appear on the screen. This means that the graphics display area is reduced slightly and that minor modifications may have to be made in existing programs.

Second, the three color channels are software selectable. Any or all of the guns can be turned on or off by accessing the appropriate memory locations. In much the same way that Apple screen modes are selected.

Shutting off a color gun will, of course, have a pronounced effect on a graphic image, but if the red and blue channels are defeated, the Color II becomes, in effect, a green-phosphor monitor which is wonderfully easy on the eyes for text work. (An executable language, Forth, for example, allows commands such as GREEN and COLOR to be added to the language

system to take full advantage of this capability.)

The Plot

The first thing I noticed when I brought up the Amdex system was its silence. I spent a lot of time in front of cathode ray tubes (CRTs) and I'm often made uncomfortable by the high-pitched whine so characteristic of TVs and monitors. The Color II is silent.

Silence is golden, but graphics is where the virtues of the Color II/DVM really become apparent. The image, first of all, is stable. It doesn't flicker or twitch or crawl or heave; none but sits there rock-steady like the image on a mainframe terminal. If noise should appear it can usually be eliminated by adjusting a trim pot on the DVM board.

And, oh, the color! I have seen my graphics work on everything from discount house television sets to studio monitors, but I have never seen anything like the Color II/DVM system. The colors are deep and rich; the blue is that blue usually obtained only by oversaturating a regular monitor; the orange is very close to red. Yet when switching back to the text mode there are no color fringes around the characters.

However, leave me think we're in heaven; of the 15 in-res colors, only black, red, green, yellow, magenta, cyan, and white are available. (See Figures 2 and 3.)

The screen image is not only stable and colorful but has extremely sharp resolution and focus, a good thing since the manual gives no hints as to how focus or convergence may be adjusted.

I am a computer artist (the word of a better term). I make my work portable through photographic reproduction, usually 35-mm color slides shot from a video screen. It was natural, then, to test the Color II by showing a group of slides for comparison with those taken from other devices. The slides show, rather dramatically, the superior clarity and resolution of the Amdex when compared to identical pictures from a high quality composite video monitor of the same screen size. Of course there is absolutely no contest between the Color II and a standard television receiver. (See Figures 2-4.)

It would be nice to report that I preferred the Amdex slides in all cases, but occasionally their clarity was outweighed by the broader range of colors available on composite video monitors. The Color II slides also

showed minuscule "barrel distortion"—all four sides of the image being markedly convex. This surprised me as the actual screen image appears to be quite rectilinear. The distortion may be due to some optical effect between screen and camera or it may be that the squareness of the Color II is more psychological than actual. (Some amount of distortion is unavoidable when shooting from any CRT.) These complaints notwithstanding, the slides from the Color II were excellent.

The Cums

Someday, perhaps, a perfect product will be made, one about which nothing negative can be said. To the best of my knowledge, that day has not arrived. I do have a few other minor gripes about the Amdex system when I shall now list in no particular order.

My eyes find the 17" screen too large for comfort when the Color II is sitting on top of the Apple. I have had to move the unit to the table behind the computer where it stays very well.

The Color II does not provide a way to kill the color for black and white work. Because of the unusual Apple color structure, a white rectangle may have one green side and one violet. Put another way, the accuracy of the Color II points up the oddities of Apple color video output. Sometimes this can be annoying.

The unique connector of the DVM does not fit neatly in any of the access slots at the rear of the Apple; it simply hangs out at the end of its cable. This may seem like a minor matter, but it is a striking bit of inelegance in a well-designed system.

And, of course, expense must rear its ugly head. The Color II/DVM combination is not cheap, saving for just about what a bare-bones computer costs. For what market is the system targeted? Amdex estimates that from 10% to 15% of all Apple users are involved in various graphics applications and with the potential customers. Doubtless, others will be able to afford the best for their more recreational pursuits.

Having voiced the preceding complaints, I shall conclude by saying simply that it doesn't get any better than this. If you don't like Apple graphics on the Amdex Color II/DVM system the chances are that you won't like Apple graphics anywhere. Both devices are well conceived, free of frills, and meet or surpass their advertised claims. I recommend them highly to those who want the best in display devices. □



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Great Graphics Simplified

The best software programs are those which help you to explore the capabilities of your hardware, which open up new possibilities, and which stimulate your creativity. Stoneware's Graphics Processing System (professional version) for the Apple II is this kind of software.

Let's face it. The most attractive feature of the Apple II is its ability to put great high-resolution color graphics on the video screen. What isn't interesting, walking into a computer store and watching an Apple II go through its paces for the first time, with the graphics which flash on the video screen. When Apple added the graphics capability to the Apple II, they built in a most effective sales device.

Once you have your Apple safely positioned in your home or office, the next impulse is to do something with it—to add some of those great graphics that you saw in the computer store. That's when the GPS comes in.

GPS saves you the trouble of learning the programming tricks (worthwhile as they are to know) in your Applesoft Tutorial and Applesoft Manual. Instead, you are called upon to master a step-by-step tutorial which GPS has written for the individual who shies away from programming. It is a short course you can master in three or four hours of work, and at the end graphics will flow from the tip of your light pen.

Actually, a light pen (Syntex's is specified) is only one way of operating the program. You have the options of using a joystick, game paddles, a Hiplus or graphics tablet. For the purposes of this profile, we tried it with the joystick, light pen and Apple Graphics tablet. The tablet proved to be the quickest and easiest instrument to work with.

The best feature of the GPS package is its speed. It loads fast and brings up the options from its many and varied menus quickly, expediting your work. To make a menu selection, requires only that you

Brian Murphy

guide the cursor, using your drawing instrument, over the option you desire. It lights up, and then, to choose it, all you do is press the pen down (or push the paddle button or touch the light pen ring).

The entire program, as you may have gathered, is menu driven. You access the branch menus from a main selection offering the options of Draw, Erase, Modify, Duplicate, Display, Group, Information, and Cancel. Draw is the default selection (the one you get if you don't guide your cursor to another selection before pressing the button).

The Draw Menu

In the Draw menu you do the actual creative work. Your options are freehand or line drawing, change of line color (more in color in a moment), erase, cancel and end. Freehand, of course, is the option that lets you draw whatever shapes you prefer. The only limit is the amount of memory you fill up as you

draw. Freehand is the easiest option to change when you have an Apple Tablet.

Making a freehand drawing using the game controllers or a joystick is awkward and the results are frequently unsatisfying, unless you were a champion *Each-A-Ketch* user as a kid. Good results are obtained with the Syntex Tablet.

The line option is more suited to the paddles. In this mode, the cursor moves a dot on the screen where you press the button. You move to the next point and press the button and a line appears connecting the two points. Moving on from the second point a line will connect it to the third point when you press the button, etc. The only limit is the amount of memory you fill up. In the line mode you can create geometric figures (e.g., if you gain skill in using the GPS, detailed line drawings of illustrate reports, etc.).

A word about color. In the default mode, the line color in freehand or line drawing is white on a black screen. This translates to black on a white background if you decide to print hard copy of your graphics. Thus, if you are generating computer graphics to illuminate a report, you don't have to tinker with the color option.

If you use the color option, you have two whites, two blacks, a green, an orange, scarlet, and a light and a dark shade of blue with which to work. Some of the colors can be blended with others. If you select two at a time, but this process is better suited to the filling procedure, which we'll get to later. It is enough to say that you can put down scarlet, light blue, dark blue, white, and green lines. You can also place black lines on the screen, but you'll have no heck of a time seeing them.

After you have created one of my figures, you may decide that you don't like any of them. If so, you can choose the cancel option and the figures will disappear; the memory will be freed up and you can start over.

There is, however, the possibility that you are dissatisfied with only one side of one of your geometric figures. Using the

creative computing

SOFTWARE PROFILE

Name: Graphics Processing System

Type: Graphics generation system

Systems: 40K or 64K Apple II with Applesoft, disk drive, choice of joystick, paddles, Syntex light pen, Houston Instruments Hiplus or Graphics tablet

Format: Disk

Language: Applesoft

Summary: Software that truly simplifies graphics

Price: \$99.95

Manufacturer:

Stoneware Incorporated
50 Belvidere St.
San Rafael, CA 94901

Brian J. Murphy, 33 Pine Road Rd., Hartford, CT 06103

Apple Graphics, continued...

erase option, you can erase your line drawings, one line at a time. In the same mode, you can rub out portions of your freehand figures.

Modifying The Picture

With a finished figure, you now have the task of choosing the end option. This makes the picture you have drawn an "object," which is an important distinction in several ways. For example, in the Modify option of the main menu, you can take the object you have created and fill it in with solid color. You can combine blue with scarlet, any of the colors with white or black, or scarlet with green. In the blended colors, the lines are not solid; the effect is achieved by alternating horizontal lines of the colors you are mixing.

If you prefer, you can change the background color in the Modify/Color mode. If you opt for a white background, you can return to the Draw menu and, by selecting the color option from that menu, add new objects drawn in black. (You'll remember that a black line was invisible against a black background.) If you print hard copy of the result, you'll get what appears to be a negative image—white lines against a black background.

If you are drawing maps or charts, you can use the Modify/Color mode to give you an all-green or all-blue background, thus eliminating some of the labor of filling in color for large areas denoting sea or land and also saving precious memory.

While you are still in the Modify menu, you can choose to move an object using the Position option, to squeeze it, using the Proportion option, or to enlarge or reduce it, using the Size option. In fact, using the Size option you could, for example, make detailed drawings of many different objects, reduce them, and put them all in the same picture (switching back and forth between the Draw and Modify menus). Or, if you like, you can take one object from your picture and focus on it, omitting undesired objects from your finished product without having to erase.

If the positioning is okay, but the object appears to be out of kilter horizontally or vertically, you can rotate it, using the Rotation choice in the Modify menu. This leads to the interesting possibility of creating a series of pictures of the same object, by spinning the same picture around a single point of reference. A series like this looks nice in hard copy.

Finally, the Modify/Order option allows you to take the objects you draw and stack them on top of one another. For example, if you were to draw a picture of an apple tree, then of Adam and Eve,

you could have them hiding away behind the tree.

We have arrived now at the only serious limitation of the program: the amount of memory it occupies. Chances are, if you are doing a complex freehand drawing, at some point the Apple II will beep and the text window will come up with the single, ominous prompt, "Memory Full." If you have a 16K RAM card (that is, if you have at least a 64K system) you press the button once to return to the main menu and select Cancel. Then you move the cursor off the screen entirely and hit any key. The screen will go blank. Then press the B key.



The screen will immediately light up again with the picture you have been working on. The difference is that it is now in the background; the program has put all the information in the 16K card, freeing up memory for more drawing. There are restrictions on what you do now. If you add an object to the picture and then try to use the Modify/Size option, the object will grow, but not the background, which includes all the objects you drew right up to the Memory Full statement.

The Display/Zoom Option

There are other manipulative tricks available. Using the Display/Zoom option, for instance, you can zoom an object by several orders of magnification and then return to the Draw menu to add detail. When you have finished, you can return to the Display/Zoom mode, elect not to zoom, and the picture, with your additions, will zoom back down to scale.

GPS comes with an extra diskette, containing the "Special Features," one of which is the text font. This font proved to be hard to manipulate; I found it very difficult to get the letters in a word to sit evenly and in line. Anyone who has struggled with transfer lettering knew what I am driving at.

The problem is that, hard enough though it would be to keep all the letters level if you could see them, they remain unseen until you have guided them into place with your cursor. As I said, I found it very difficult, but I suspect this with

more practice it can be mastered.

Also, on the Special Features disk is a Grid Maker, which does just that: it puts a grid of lines on the screen for use in preparing graphs. Once you store the grid on disk, it is treated by the GPS format as an object, to be enlarged, reduced or otherwise as will. This could be a valuable feature in preparing quick graphics to go with a word-processed report.

At last, skipping over other features and functions too numerous to detail here, we arrive at the important part, the storage to disk. Once your work is complete, you need only choose the Duplicate menu and select the Apple option. This will give you the opportunity to select a name and store the picture data on disk, ready for use in any Applesoft program. If it is hard copy you need, the selection of the Duplicate/Printer option will instantly set your printer in work duplicating your graphics onto paper.

This is one big software package, for \$99. The Graphics Processing System gives you a great deal of flexibility to draw what you want, in the detail and colors you like, and to get those graphics into your program the way you would want. To do the same job that the GPS program does in only a few minutes would take a great many program lines, much dot plotting and a great deal of time, accord only with the Applesoft Tutorial, fine as it is.

Somebody suits it up claiming that what a word processing system is to text, or an advanced spreadsheet program is to numbers, GPS is to graphics. It's the simple truth. This program does no tricks with slope cables, animation, animation paths and so forth, but for a business user who wants to add graphics to his word processor-generated reports quickly, or the teacher who wants to add graphics to his software and to the home user, who just wants to explore his hardware and his creativity, this program will be flexible and useful.

Graphics Magician

Have you ever wondered how adventure games like *Mystic's Cave* and *Cybernetic Master* get all those pictures onto one disk? If you have taken the time to learn the graphics portion of the Applesoft Tutorial, you might have noticed that the pictures you make tend to use up a great many disk sectors. A picture weighing in at 33 disk sectors may not seem very large, but your Disk II diskettes can store only 496 sectors of information. That works out to about 15 pictures 33 disk sectors long.

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long it must take to create one of those drawings? The hi-res art in, for example, *Crusader Manor* does not challenge the artistic avant garde, but those pictures are hard to recreate, piece by piece, using the methods outlined in your AppleSoft programming books. You could spend hours and days working on just one of them.

creative computing SOFTWARE PROFILE

Name: The Graphics Magician

Type: Graphics program,
programming aid

System: 48K Apple II or II+ with
AppleSoft, disk drive, paddles

Format: Disk

Language: Machine language
and AppleSoft

Summary: Excellent programming
aid for print and
advanced amateurs.

Price: \$99.95

Manufacturer: Penguin Software
830 Fourth Ave.
Geneva, IL 60134

There is something that explains all these mysteries, the *Penguin Graphics Magician*, by Chris Jochimsen, David Lubar and Mark Pelczarski. This software package is the answer to the prayers of serious programmers who need good, hi-res graphics, in quantity, in a reasonable length of time. Not only that, the *Graphics Magician* lets you do the kind of tricks with animated shapes that you see in the best games. The message I am trying to get across (the heck with being subtle about it) is that the *Graphics Magician* is miraculous and marvelous.

Using game paddles only, which I regard as fairly inefficient means of drawing under ordinary circumstances, I was able to create drawings using this software that would not look at all out of place in any of the current best-selling adventure games. Another few minutes of homework with the supplied documentation, and I was able to work the pictures into my own programs — as easy as a HIMEM, a POKE, and a CALL, to paraphrase Penguin's manual.

Picture/Object Editor

It is the Picture/Object Editor mode of the *Graphics Magician* which lets you do this part of the magic. To get there, you select, obviously, the Picture/Object Editor option from the main menu which appears at the beginning of the program when you load the disk. The options which you are offered when the Picture/Object mode comes up are to catalog the disk, load an old picture for new work, or

start a new picture.

In the new picture mode you see a blank white screen with a flashing cross hair cursor. You are in the line mode, which means that when you press the button in paddle 1, you will establish the starting point of a new line.

With a little practice it all comes together quickly. Using the button on paddle 0, you can draw a line from your starting point to the present location of your cursor. If you want to start a new, unconnected line, you just press button 1 and move the cursor to the desired spot.

This kind of flexibility, so simple and so logical, allows you to put lines of images on the screen, fast. Soon you will be ready for fill-in color. Here's where the real fun begins.

You have a palette of 192 colors from which to choose. In a picture I drew of a castle gate and drawbridge, for example, I used two shades of brown, two of blue, two of green, and four of grey. Blues are mixed by alternating bands of color and darkened by the addition of dots and lines. The result is that you have a very wide range of color selection. The difficulty encountered in drawing curved lines is more than made up for by the colors which can be used.

If you make a mistake, correction is simple. You can either type D to delete the last command given or go into the Edit mode to delete the mistake manually and, if you like, insert new ones. This makes it easy to get your proportions right and to change colors, if necessary.

When you have a finished picture, the program will store it on disk. The programs are easily retrievable, using up about two disk sectors of your 48K in writing the appropriate commands in AppleSoft or machine language to bring the picture up.

Animation

You would normally assume at this point that I have described about all there is to this program, but now we come to a new and even more magical segment of the package, the Animation System. In this mode you create color shapes (available colors are blue, white, orange, violet and green that you can later animate). The job of animation is done literally by by bit, using single key commands to maneuver a minuscule cursor and to imprint a color bit as desired. Going slowly and patiently you can create rather realistic airplanes, figures, flying saucers, etc.

You will find, when you choose this mode, that there are seven sets of cursors. Over each cursor is an orange bar. You can turn off a bar by typing a number (the documentation tells you which bar corresponds to which number) and turn it back on again with the same number. As you maneuver the cursor and imprint the dots, you get identical pictures for each cursor with the bar "on". Nothing drawn where the bar is "off".

If you like, using this feature, you could have your figure (if a man, for example) appear to move his arms and legs as he walks by moving the limbs a little in each of the seven shapes you draw. On the other hand, if you wanted to draw a car smoothly gliding along, you would leave all the shapes "on" at the same time, repeating the shape seven times.

In animation the "car" would move, but there would be no internal movement. Were you to leave one or two of the pictures off for the entire shape creation process, the animated shape would seem to disappear briefly.

Having created a shape and animated it, the program now enables you to create



Apple Graphics, continued...

a path for it. Again, by using single key commands, you can send your shape in any of eight directions on the screen. The path is saved separately from the shape.

It is in the Animation Editor that you put the shapes together with the paths to create complete routines which you can add to your game programs or graphic demonstrations. At any time you can go back and edit any part of the routine you have created. You can take the path you have used and ally it with different shapes. You can take a shape from another file and mate it with the path for an entirely new routine. These possibilities give you a good idea of how flexible this software really is.

It should be noted that the documentation, while giving you a basic rundown on the program commands you need to integrate your pictures and animation into your programming, is written with experienced programmers in mind. Beginners will find the documentation to be rough going at first, but with practice they will soon be able to put the Animation System and the Picture/Object Editor to through their paces.

Super Shape Editor

Another aspect of this software package is the Super Shape Editor. This time you work with Applesoft shapes, which are defined either as pictures on screen or in tables. Once you figure out how the system works, the drawing goes quickly.

You can draw as many colors; your line may be from one to 255 points in length. It can be lengthened or shortened at any time. Using the paddle button, you determine the tilt of the line and give the command when it is to be drawn. Using lines one or two points long, and after practice at setting the angles, you can make curved lines or sharp, geometric shapes as you prefer.

A nice thought is that the shapes take up about half as much memory space as an Applesoft shape table would need. This means extra space for text and pictures in your programs.

The capabilities in the Penguin Graphics Magic are like those of the Apple II. What they can do is limited only by the creativity of the user. Creative programming pros will find that the Graphics Magic allows them to do more, do it quicker and make the end result more attractive and exciting. That's all anyone could ask of a graphics magician. □

Figure Notes: All Penguin graphics are by the author. They were drawn in the On-Line style of graphics as a bonus to their games. All GRS graphics are frecklehand creations of the author.

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Ada for CP/M

The following review of two Ada subset compilers is the third in a three-part series on the Ada language.

You have to feel some compassion for anyone who would try to implement the Ada language on an 8-bit microcomputer. Face it, Ada is huge! Stuffing all of Ada's features into a Z80 processor would be like trying to pour Lake Michigan into a bathtub.

Yet reasonably complete versions of PL/I and Cobol languages, which are much more at home on big mainframes, have found their way into the 8-bit world. But could the power and complexity of Ada be crammed into my little desktop friend? I was (and am) skeptical.

Tentative answers to the Ada-for-CP/M question have been provided by Supersoft Inc. of Champaign, IL and RR Software of Madison, WI; the other implementations that I have seen advertised run on the better 16-bit machines.

Supersoft Ada

Being a cautious proleer, Supersoft is quick to point out that theirs is "presently an incomplete implementation of the Ada programming language." But they promise that their compiler "will be further developed to enable implementation of the complete Ada language." When? "By the time that Ada has been recognized by the microcomputer community as a viable language for software development." Okay.

Geoff Gilpin

Supersoft Ada is supplied on disk and is available in most CP/M formats. The disk contains ADA.COM, the Ada compiler; CODE 8080, a program which takes Ada pseudo-code and generates a COM file; and Kspac, the Kernel Ada Program Support Environment, a collection of I/O and other useful routines that loosely conform to specifications for the STANDARD and INPUT OUTPUT packages provided by the Department of Defense.

creative computing

SOFTWARE PROFILE

Name: Supersoft Ada
Type: Ada subset compiler
System: 48K CP/M
Format: Disk
Language: Machine code
Summary: Very limited subset of Ada
Price: \$250
Manufacturer:
Supersoft Inc.
P.O. Box 1620
Champaign, IL 61820

In addition to the three system files, Supersoft provides several sample programs including two games, Star Trek and Manowar. As an Apple II owner running Ada on the Microsoft Z80 Software, I

should mention that some of the demo programs require an 80-column screen and would have to be re-written for the Apple. Even though I use a Video 80-column board, some of the programs used cursor-positioning commands that did funny things on my screen. Be warned.

Two documents are supplied with the disk—Supersoft's Ada manual and the DoD's own Military Standard reference, bound in khaki and written in an appropriately faceless militaryese. In contrast to the DoD manual, which is thick and exhaustive, the Supersoft document is quite terse—a mere 29 pages. Mostly, it describes the differences between standard Ada and Supersoft's version. The longest section lists the parts of the language that Supersoft has left unimplemented.

The Compiler

Operation of the compiler is straightforward. Once an Ada source program has been created with ED or another CP/M text editor it is compiled by typing "Ada" followed by the filename. If you have included the PRINT or LIST pragma in the source text (pragma is the Ada term for a compiler directive) you will get a program listing on either the screen or printer, as requested.

Syntax errors are noted by an arrow pointing to the spot where the compiler found a problem. In my experience, Supersoft's error messages aren't always to the point. For example, as the compiler was parsing a program containing the following statements:

```
var a: integer;  
value array(1) to 10;
```


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How about some beach toys and hardware to let the soldiers know you're around? After all, you don't want friendly ones getting hit by the beachies. The beachies are a lot

funnier at first, and a little more serious the more they see.

And our service? Have us get your luggage in and remove it! While discussing and organizing it, naturally. paratroopers that work, and commandos we'll get every back and call. We'll have to apologize for their different behavior and control things. It's so hard to get good computers into these days.

You want something? You've got something! This is the best thing like it. Let's check out that CG — where you can find it in the 25 (in this case, in the 25th year of the 25th year).

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an error was indicated at the loop statement, and a message saying "assignment operator expected" was printed when the problem was obviously a missing semicolon on the previous line.

My long association with Pascal has convinced me that a compiler should at least be able to catch missing semicolons. Other misleading error messages are produced when the user tries to redefine Ada's reserved words—another thing a compiler should be able to snuff out.

There are a couple of other minor quirks. Although the advertising promises "primer output," the documentation doesn't mention how it's done, and so far none of the several methods that I have tried has sent a single character to my Qume. Also, the "list" pragma (for sending program listings to the CP/M LST device) doesn't work (I have tried it on two different systems).

Many Omissions

I recognize that these are the kind of small flaws that could be found in the first release of any major software package. I do have one serious complaint, however, which will appear after a more thorough tour of Supersoft Ada.

There are more data types and structures in Ada than in any other language that I have seen. There are seven predefined numeric types; seeds of data structures including such exotica as array slices and variant records; and an infinite number of custom-built types and structures.

From this potpourri, Supersoft has implemented just six data types and a single data structure: arrays. No records. No user-defined types. Just the usual integers, Booleans, and characters.

A similar situation exists in one of Ada's most crucial areas: program organization. Modularity is the hallmark of Ada, and it is supported through features such as subprograms, separate compilation, packages (collections of Ada resources something like "units" in UCSD Pascal), and program libraries. The intent is to divvy up Ada programs and data in little boxes which can be accessed only through the correct protocol. This should encourage portability and make it easier to build large systems from small standardized building blocks.

How does this philosophy of divide and conquer fare in Supersoft Ada? Consider this:

Ada subprograms (specifically procedures, although functions are also supported) can accept three types of parameters—in, out, and in out. The last are used in subprograms which accept a value, modify it, and return it to the calling environment. Incredibly, Supersoft Ada supports only in parameters. That's

right—any variable which is to be modified by a subprogram must be declared globally, just as in Basic. And this is the most sophisticated kind of program structure available in the Supersoft compiler. So much for modularity.

There are other strange omissions—like the lack of an *exit* statement to terminate a basic Ada loop—that would make serious programming very difficult.

In fact, only one of the unique features of Ada seems to have been implemented—subprogram overloading (the creation of two or more subprograms that share the same name).

After all that, I believe that the nature of my "serious complaint" should be pretty obvious. It is, *ahem*, this: *They only implemented a tenth of the language!*

To be fair, I realize that the Ada language itself is still in a period of transition. Some of the 16-bit versions haven't yet implemented the more esoteric features. Even the DoD's language definition hasn't quite solidified yet.

But does this justify a price of \$250 for what is essentially a "mini-Pascal"?

Supersoft is apparently sticking to its intention of providing the full language. But they have many man hours ahead of them, and if the cost of the updates (which would comprise about 90% of the language) is proportional to the first release, I don't know anybody who will be able to afford them.

Janus

Fortunately, there is an alternative—Janus, the Ada compiler offered by RR Software. RR doesn't call their product "Ada" because they have no intention of bringing it up to the full DoD standard. That's good.

The large-scale, exotic features of Ada—such as inter-disk communication and generic program units—create so much overhead in an 8-bit machine that their implementation is, in my opinion, just plain unrealistic. RR has wisely avoided such exotica and produced a subset of Ada that is both useful and workable.

Even with this economical approach, Janus is no lightweight. Consider:

- The Supersoft compiler takes up 16k; Janus occupies 130k (nearly two full disks on my Apple system).

- Supersoft's manual is 29 pages long with a page and a half describing error messages; RR's is 128 pages, ten of which are devoted to error messages.

- Janus supports ten programs; Supersoft implemented two (one of which doesn't work).

- Janus supports boxed numbers, attributes, enumeration types, subtypes, packages, and a host of other Ada features not

creative computing

SOFTWARE PROFILE

Name: Janus

Type: Ada subset compiler

System: 56K CP/M

Format: Disk

Language: Machine code

Summary: A useful and powerful language

Price: \$300

Manufacturer:

RR Software

P.O. Box 1512

Madison, WI 53701

found in the Supersoft implementation. In fact, there really is no comparison. Coming to Janus after using the Supersoft product is like being given *rose blush* at the Rita after a week of sipping nothing but crums and tap water.

The thoroughness and careful attention to detail that went into Janus are evident from the first compilation. The user is presented with an array of compiler options that do everything from suppressing debugging code to informing about differences between Janus and standard Ada. During the four passes of the Janus compiler, information is provided on available memory, code and data addresses, table size, and anything else that might save debugging time. In fact, Janus gives you more information than the IBM Optimizing Compiler for PL/I.

Error Handling

I was particularly impressed with the kindness displayed by Janus in error handling. Syntax errors are spotted early in the compilation process, a thoughtful feature for impatient programmers using a four-pass compiler. The much trickier run-time errors generate a useful "walk-back" that greatly simplifies debugging. Consider how Janus would handle the following, fatally flawed program.

```
PROGRAM ONLY TEST 10
  FUNCTION FIVE (X, Y) INTEGER
  BEGIN
    RETURN 5/0;
  END FIVE;

  BEGIN
    FIVE(10, 20);
  END ONLY;

  DIVIDE BY ZERO (X) 10
  END ONLY;
```

The run-time error occurs in the fifth line (assuming blanks) of the program where X is divided by zero. Most compilers would just give a message such as "Divide by zero at line 5" and leave it to

Ada, continued...

the programmer to track the problem down. Janus gives you this:

```
*** Divide by zero exception
on this array 5 is test,100
called from line number 15 in test,100
called from line number 15 in test
```

I imagine that this would be a godsend for people working on a big, convoluted program.

The Janus language itself represents a hefty subset of Ada—perhaps as much as 60% of the DoD specs with more to come in updates. Janus really looks like Ada; not like a warmed-over Pascal.

All the Ada operators are here (including relational operators for arrays, records, and enumeration values), along with most of the data types including derived (new) types, the access (pointer) type, and the non-Ada byte type. (The task and limited private types, for multi-programming and data hiding respectively, will remain unimplemented.)

Good News For Systems Programmers

There are several extensions to Ada that make Janus particularly attractive to the systems programmer. (This isn't surprising—RR uses Janus for all their in-house programming.)

There is an ASM statement that allows insertion of in-line assembly code or other binary data. For instance, the following Janus procedure will re-boot CP/M.

```
PROCEDURE RE_BOOT;
  JUMP (ADDRESS) TO (F000);
  --- BOOT SECTOR NUMBER
  --- ADDRESS IN RAM
  --- "HARD DISK"
  --- "TAPE"
  --- "FLOPPY"
  --- "DISK"
  --- "TAPE"
  --- "FLOPPY"
  --- "DISK"
  --- "TAPE"
  --- "FLOPPY"
```

```
END RE_BOOT;
END RE_BOOT;
```

There is also a "conditional compilation" feature that causes certain portions of code (specifically, those statements preceded by an @ marker) to be ignored by the compiler unless the user says otherwise in the command line, or toggles the CONDCOMP pragma within the source program. This feature has already saved me some debugging time and, again, I imagine that it would be invaluable in the development of a large system.

Business programmers will be pleased to know that strings in Janus are handled differently than in standard Ada. To the great relief of all, Janus strings have a dynamic length attribute. In other words, the statements

```
SI STRING(100) OF "FREDERICK";
...
S IS "FRED";
```

```
will print "Fred";
```

will print "Fred" instead of "Frederick." Thank you, RR.

In addition to the language itself, several program libraries are included on the distribution disk(s). (The whole Janus package takes up four Apple disks or one single-density 8" disk.) There is a library of string-handling routines (STRINGLIB) to help with the everyday tasks of searching, replacing, and extracting strings from other strings.

A HEAP.LIB provides several low level functions such as garbage collection (reclaiming unused memory), individual bit testing and setting, and a MEMAVAIL procedure to keep you informed of how much space is left.

The third library, IO.LIB, is RR Software's solution to the somewhat controversial problem of Ada input/output. As defined by the DoD, I/O functions aren't really a part of the language itself; instead, a group of generic I/O routines are instantiated by each programmer whenever they are needed (somewhat like using a single stencil for drawing multiple copies of a design).

As far as I know, however, none of the current versions of Ada (even the 16-bit implementations) offer generics. To complicate the problem, the DoD recently re-defined the procedures for handling random-access files. It seems that we can expect a year or two of daffy anarchy before the dust settles in this area of Ada.

IO.LIB contains the Janus routines for creating, reading, writing, deleting, and otherwise manipulating disk files. Other peripheral devices—the CP/M CON and LST devices, for instance—are also recognized. The procedures in IO.LIB, although not "standard," look enough like those in the Ada Reference Manual to be fairly portable. The current version of Janus (release 1.4.3) does not support random access I/O, although the people at RR assure me that that is one of their priorities.

One beautiful thing about text I/O in Janus is that get and put have been extended to work with floating and

enumeration values. (Since this feature depends on instantiation of generic packages in standard Ada we won't be seeing it in other versions of the language for some time.) To illustrate, the statements

```
TYPE PERIMETER IS (CIRCUMFERENCE,
  SQUARE, TRIANGLE,
  RECTANGLE, POLYGON);
SALLY: PERIMETER;
PUT(SALLY, CIRCUMFERENCE);
...
SALLY: PERIMETER OF SQUARE, CIRCUMFERENCE;
FOR SALLY: PERIMETER
  DO
    PUT(SALLY);
  END LOOP;
```

would print

```
CIRCUMFERENCE OF SQUARE
```

This is a really good feature (sadly missing in Pascal) which I intend to use frequently.

Omissions

There are a couple of omissions in Janus. Real numbers and multi-dimensional arrays are not supported as of this writing, although both should be available by the time you read this. The only important feature of Ada found in the Supersoft compiler and not in Janus is overloading of procedures and functions. The people at RR inform me that overloading is being contemplated for a future release.

So, for now at least, the jury is in—Janus encompasses at least five times as much of Ada as Supersoft, including many of the more exotic features of the language. Janus is a really useful tool, especially for systems programmers and people who wish to get a head start on learning Ada (you will learn little about Ada from the Supersoft product).

The Janus package provides nearly four times as much software (including the compiler, an 8080 assembler, a disassembler, the support libraries, and fully-documented run-time source code) as Supersoft for about \$50 more.

I will leave to you the decision of which product to buy. □

Ada Errata

The author has found a few bugs in the previous two installments of "The Creation and the Computer Language."

In Part One (November), Page 192, top right column, the test "if MEEKNESS is ADA_QUALITIES" would produce a type error when compiled. To make this test legal, ADA_QUALITIES would have to be declared as a subtype of another enumeration type that had MEEKNESS as a possible value.

At the bottom of the same column, the declaration "PERIMETER: SIDES * LENGTH: 1/NIT;" is also illegal. The problem is that a constraint pro-

meter (SIDES in this example) can be used only in declarations of arrays. The correct line is "PERIMETER: array (SIDES) of integer;"

In Part Two (December), Page 219, column 1, the line "procedure SQUARESUM (X: in integer);" should read "procedure SQUARESUM (X: in out integer;". The "out" specification allows the next assignment statement to work properly.

Near the end of that installment, the statement "use FRED'S_IO_PACKAGE, SALLY'S_IO_PACKAGE;" should be removed. This statement would cause confusion for subsequent "put" statements.

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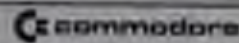
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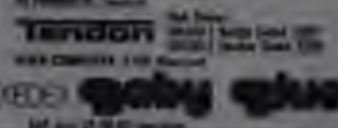
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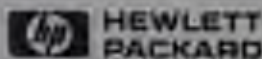
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A Structured Graphics Language

The best thing I can say about Ceemac is that I never bought a piece of software for so little that was worth so much. It is not easy to find. You just have to run across an ad. Brooke Boering, the author, is operating on a shoestring at this time. His ads are one inch classifieds.

How then, you might ask, did I happen to buy Ceemac? Well, Mr. Boering had a marketing idea that was a combination of three genius and audacity. He made a demo disk of the kind of graphics that Ceemac is capable of creating, supplied it to computer stores, and asked them to give copies free to their customers. That was my introduction to Ceemac.

I was enchanted with that demo and would have paid the \$40 he asks for Ceemac, for the demonstration disk alone. The demo disk holds 35 screens, as the author calls his programs. At the touch of a key, the display changes from one dazzling display to another. On disk you find a series of programs which describe the various screens, the company, Vagabondo Enterprises, and Arthur, the language with which these test programs were created.

For your \$40, you get a diskette and a manual—not a manual, but a manual. It suggests that you take one of the many demonstrations and experiment with it—learn by doing.

Ceemac is not a utility to aid you in the creation of hi-res graphics using the standard Apple commands. It is a stand alone

Ed Jackson

language complete with pre-defined variables, macros, line editor, commands, and error messages. It is a structured language. You do not enter program line numbers. (Nor does Ceemac. There are no line numbers.)

It points out syntax errors by placing the cursor at the beginning of the blunder, and beeping once. If the editor cannot detect the error until execution, it immediately lists the program, gives an error message, and places a prompt on the offending line.

creative computing

SOFTWARE PROFILE:

Name: Ceemac
Type: Graphics art
System: 80K Apple, DOS 3.3
Format: Disk
Summary: Incredible, and a bargain.
Price: \$40.
Manufacturer:
Vagabondo Enterprises
1300 E. Algonquin - M
Schweitzberg, IL 60195

Using The Program

What you create is not always what you set out to create, but it is always stunning in its beauty and speed of execution. You can make a paddle control the speed, or make it control a variable. You can use the buttons to start fresh, to change the color of your drawings, or to change the background color. These changes occur very rapidly.

Editing possibilities include upward and downward scrolling, list from the top, delete, replace, insert, or add a line. All of these commands are started with only one key.

The only control characters are control-a for moving from edit to execution, and control-c to move to DOS mode.

If you are familiar with Applesoft, some of the commands will seem familiar. These include GOTO, GOSUB, FOR, and AGAIN. If you forget, type NEXT, the editor forgives you and immediately replaces it with AGAIN. Commands that are different from Applesoft and Integer are output, mcolor, ncolor, vline, fcolor, wcolor, and setup. Among the things you can do with these commands are: set the symmetry of the pattern, setup a ratio between x and y coordinates, set xscale and yscale and rotation, and draw shapes. Ceemac does not have a shape generator. There are, however, instructions for creating shape tables.

There are also many commands unique to Ceemac. For instance, "sky" gives you a sky, complete with number of stars you want, in any color you want, instant-

ly. And "absx" draws boxes, rectangular or square.

You can create sounds with *Cesmac* or have music from your cassette control the graphics. You also have a "trace" function, and the command that I think is the cleverest of all, is. If you type $x1 = x1 \% 5$, $x1$ will increment itself to the edge of the screen and then decrement itself back down. And vice versa.

Another great feature is the printer option. By keying in shift/prtscr slot, you can print out your own scores, or the ones on disk to study. You can also get hard copy from any of the test files.

I believe that the manual was not designed as a tutorial for three reasons: one, Mr. Boering wants you to experience the thrill of discovery and the joy of accomplishment; two, a tutorial which fully explained all the possibilities of *Cesmac* would probably put the cost of production out of the shooting category; and three, too detailed explanations would stifle your creative and experimental instincts. I believe that the limitations you encounter will be your own, not *Cesmac*'s.

About The Author

I could fill many more paragraphs with more features, but I prefer to close this

with a word about Mr. Boering. When I ordered *Cesmac*, I said that I hoped it was user-friendly as I was pretty dumb. You can imagine my surprise when I got my check back with a personal letter from Mr. Boering, saying that *Cesmac* was not for everyone, and that it took some understanding of programming techniques to use. I quickly re-ordered, thanking him for his concern, and quite quickly received my disk and yet another very kind letter.

Cesmac is a fine disk for learning and enjoyment. It sets a very fine example of excellent programming, business ethics, and advertising that larger companies would be wise to imitate. □



Sample output from a *Cesmac* program

Figure 1. Sample *Cesmac* program from the demo disk.

```

SCREENS: 25-45001 AT NEW DESK
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1 INITIALIZE
2
3 CLEAR 10:01
4 SPEED 10:01
5 V1 = 0
6 V1 PATTERN'S DEPTH
7
8 V4 = 7
9 V4 = SYMMETRY
10
11 PWIN DOWN
12
13 FLIP COLOR OF PATTERN ON SCREEN
14 PAUSE 11:01
15
16 GET COLOR OF NEXT PATTERN
17 COLOR = PATED
18
19 GET START POINTS OF NEXT PATTERN
20 Y1 = RANDOM(5000)
21 X2 = 400
22
23
24 DRAW PTHN ERASE AFTER 5TH PTHN
25 FOR V1
26   BLINE 10:04
27   ERASE 10:01
28   Y2 = Y2 + V1
29   X2 = X2 + V1
30 NEXT V1
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Auxiliary Memory 2 5 1/4 and optional 3 1/2 inch disks, 40- 100K bytes or 5.25 floppy disk drive	Language BASIC, Pascal, FORTRAN, FORC, assembly COBOL	2nd Mode 256 characters and 16 colors* 4-color resolution 500 x 700*
Keyboard 83 keys, 40 point sensitivity to stroke rate*	Printer Bibb/roll*	Communications RS-232C, parallel Automatic word wrap/scroll program*
Diagnosis 8 function self-testing diagnostic program*	System 12 character alphanumeric 1.5 Mbytes of memory*	Power Supply 14 or 200W line powered and uninterruptible*

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Bud Stalker

Rising above the glut of "me-too" game programs for the Atari home computers announced at the West Coast Computer Fair last spring is a self-improvement program called *SpeedRead+*. It is a serious attempt to help users boost their reading speed and comprehension by using well designed eye training exercises.

The principle behind *SpeedRead+* is a simple one. If you can train yourself to concentrate on reading text efficiently, you will save time, understand more of what you read, and feel less tired at the end of a long reading session.

To help users achieve these goals, the publisher, Optimized Systems Software, provides a machine language program that flashes words and phrases on the TV screen at speeds from five to five thousand words per minute. Three literary classics are included as test files with the program: Washington Irving's "Rip Van Winkle" and "Legend of Sleepy Hollow," and Bret Harte's "Outcasts of Poker Flat."

Easy to Use

Each eye training exercise is accompanied by tips on how to use it to best advantage. Once an exercise is selected, the user can control both the display

speed and the width of the text window by using either the keyboard or the Atari joystick—a nice touch. An option menu and display of the current reading rate are always just a keystroke away.

SpeedRead+ starts by loading the text of your choice into memory, automatically using all the space available. It

counts every word of text, so that you can start a session by specifying the very spot at which you left off last time.

The words flash by on the screen, centered under a stationary dot that gives the eyes an anchor in the vast expanse of the video display. The idea is to hold your eyes steady, letting you absorb the information without backtracking or "tuning out." As you feel more confident with the exercise, you can select wider phrase modes (up to 38 characters, nearly the width of the Atari display) to broaden peripheral vision, or you can increase the display speed—or both.

Several Ways to Train the Eyes

From here the alternatives vary, depending on individual needs. A "double phrase mode" displays text alternately on the left and right sides of the screen. This exercise trains your eyes to jump to a predetermined point and instantly recognize the phrases. It also develops the timing and rhythm necessary to read printed text efficiently.

A "random phrase mode" displays text anywhere on the screen, although the user can select the approximate distance from the central stationary dot. The purpose of this mode is to expand peripheral vision, an essential element in speed reading. I found that it took some practice to keep my eyes glued to the dot and still comprehend the text flashing on the screen.

creative computing

SOFTWARE PROFILE

Name: *SpeedRead+*

Type: Self-improvement program

Systems: 16K Atari 400 or 800,
16K Apple II

Format: Disk

Language: Machine

Summary: Useful tool for developing good reading habits and increasing comprehension

Price: \$39.95

Manufacturer:

Optimized Systems Software, Inc.
10725 Lakeside Ave.
Capitola, CA 95014
(408) 446-8899

Bud Stalker, Landmark Towers, Apt. 1106, 311 S. Whiting St., Alexandria, VA 22304

Speedread +, continued...

The "column phrase mode" most closely approximates the kind of reading we all do once we tear ourselves away from the computer. This exercise trains the eyes to travel from top to bottom of a column of text, stopping only once per line and focusing at the center of each line.

The program displays each column for a predetermined number of seconds, then replaces it with more text. By pulling forward or backward on the joystick, I was able to synchronize the speed so that the text changed just as my eyes hit the bottom line of the column.

Method Used In World War II

SpeedRead+ is an updated version of the old tachistoscope, a mechanical device that presents visual material for brief periods of time. During World War II, naval aircraft spotters were trained to differentiate friend from foe based on images flashed by tachistoscopes equipped with mechanical shutters. The technique was highly successful. But when they used the machine for character and word recognition, researchers found that average reading rate gains were unimpressive (though some people achieved spectacular gains). To this day the effectiveness of the tachistoscope is an inter-



Intermediate School Read + more.

of controversy. Because *SpeedRead+* is essentially a computerized tachistoscope, it must be evaluated with caution.

Shorelandings

The program makes no attempt to break the text into meaningful phrases; it simply calculates how many words it can display at a time and considers that a phrase. This hinders its ability to locate true phrase recognition and overall comprehension.

While it would have been possible to mark appropriate phrases in the text (by setting the high-order bit of the first character as a flag, for example), this would

have entailed a great deal of work, would have raised the cost of the software considerably, and would not have solved the problem of marking user-specified text.

There are other problems, too. For one thing, the three texts are supplied entirely in upper case. When was the last time you read a book printed in all capital letters? Author Zeiseman claims that it is easier to recognize words when they are capitalized. I was taught just the opposite in college design classes. He may be right in the case of the Atari, however. Its lower-case character set is so—well, so whimsical—that it could interfere with rapid comprehension.

Why Host Haria?

The choice of texts puzzles me as well. While Bret Harte and Washington Irving are colorful authors, they hardly typify the standard fare of today's readers. Their styles and vocabularies are somewhat dated, and they appeal, I suspect, to a limited audience. I would have preferred to see the *SpeedRead*® manual included on disk so that I could have absorbed it for practice.

Once you have read *Harris* and *Living* a few times, of course, you know every twist in the plots, and I found a tendency to let my mind wander when I should

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CIRCLE 116 ON READER SERVICE CARD

Videx, a frontrunner in microcomputer peripherals and software, announces two exciting new programs that will make existing software compatible with the 80-column VIDEX VIDEOTERM.

APPLE WRITER][pre-boot with 80-Column Display

This program allows an 80-column display for your APPLE WRITER][, and access to true upper and lower case input from the keyboard. When combined with the ENHANCER][, this program will provide a complete word processing package.

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VisiCalc™

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For those who need even more power, a more advanced version combines all the above features with the ability to use many of the memory expansion boards currently available. A configuration editor allows VisiCalc to use a mixture of different kinds of memory expansion cards. Just tell it what memory cards you have and which slots they are in. For example, you could use more than one language card equivalent. The memory cards can be combined to give you access up to 176 K of memory!

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CIRCLE 384 ON READER SERVICE CARD

Speedread+, continued...

have been concentrating. The author has thoughtfully provided an explanation of how to create new text files using any Atari-compatible text editor (or the Assembler cartridge). A good way to acquire lots of text is to pull it in over the phone lines from a remote system like the Source or Comparative.

Classroom Use Encouraged

Along with *SpeedRead+* and the test files, OSS includes the framework for an examination program that lets teachers prepare computerized multiple choice tests. The exam system, which includes automatic score keeping, is designed to check students' comprehension levels. Each exam may have up to 255 questions.

The sample test is sketchy indeed, and I couldn't help wishing it had been based on "Outcasts of Poker Flat," a relatively unknown work to many students (and to me). It is probably asking too much of a teacher to make up a computerized exam for much text covered in class, but a school system with several Atari might use the comprehension exams to advantage.

I suspect *SpeedRead+* will find its way into more homes than classrooms, since it is best used on a regular basis in a quiet place, rather than for a week or two at a time at school.

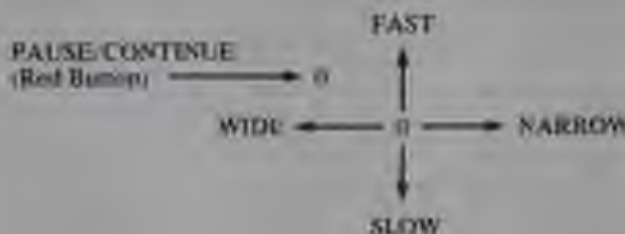
I found *SpeedRead+* a practical and useful tool. The morning paper has always been my nemesis; a careful reading takes as much as an hour a day. By using *SpeedRead+* as an exerciser, I have raised my comprehension level (though without, alas, cutting my reading time). The improvement may be due to the constant reminders in the manual to concentrate while reading, rather than to any improvement in eye movement or phrase recognition. At any rate (pun intended), I am enjoying my reading more now, and I am convinced that *SpeedRead+* has contributed to my pleasure.

Good Manual and User Support

Optimized Systems Software provides an excellent 25-page manual that explains the theory behind each exercise, outlines sample exercise sessions, and gives simple start-up instructions for first-timers less impatient to read the whole manual. The two disks come with a strongly worded licensing agreement.

OSS has an excellent reputation for support of its Atari operating system and basic upgrades, and can be expected to stand behind this product. They do promise telephone support, though I was unable to find any significant bugs.

There is a hint also of future updates at reduced rates (or no charge) to licensed users. OSS released the Apple disk version of *SpeedRead+* in May, and they hope to have disk versions available soon for the TRS-80 and IBM PC.



Keyboard commands can be initiated from Atari joystick controller.

This program is a welcome reminder that home computers can be much more than game machines. I would like to see

more personal development tools of this caliber. *SpeedRead+* has much to recommend it, and I do so without hesitation. □

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Assimilation Aid

E-Z Learner came across my desk at the crucial moment — just as I was about to undertake the life-or-death task of learning enough French to keep from starving to death on my first visit in Paris.

Nothing, they say, brings out the good veal like a few compliments on the restaurant's decor when phrased elegantly in French. Unfortunately, though my grasp of grammar is good, my vocabulary as of the time I received *E-Z Learner* was, shall we say, limited.

Setting aside my worries about starving in the culinary capital of the planet, I looked at the brochure which comes with the program. Silicon Valley Systems makes no elaborate claims about this software. They say that the program is simple to use, that it will help you to assimilate large amounts of information and that it will enable you to learn the information, rather than merely memorize it for the short term.

I brought all my French manuals together, dumped them beside my Apple II, and booted up *E-Z Learner*. I saw on my monitor a menu and the directive to hit the space bar for instructions — which explained what the nine menu commands did. In about five minutes I was ready to create my first file.

I found out very quickly that what I was about to create was a set of electronic

flash cards, which I could tailor to my own needs, including only information I needed. I titled my first file "French Vocabulary" and plunged ahead.

On screen there were now two blank flash cards. By adding an I before my entry, I could alter the format to center my question at the top of the card, so I wrote "un verre." Beneath that I typed

"a drinking glass." I repeated the process about a dozen more times, adding words with which I would need to be familiar and their translations, and then hit control-S to stop.

That command brought me to the first menu for the actual flash card "power review," where I had the options of having the questions put in the original order (the question in French and my translation in English) or in reverse order (with the question in English and me attempting to come up with the answer in French).

Having selected the original order, I landed in a new menu, which offered me the option to start or continue the review, start over (which lands you back in the menu where you decide whether you are asked the question or the answer first), or return to the main program menu. After a brief monitor display indicating that the order of questions was being randomized, the first question came up.

Perfectly centered at the top of the flash card was "un verre." The on-screen prompt said to press the space bar for the answer. Attempting to type the answer didn't even make the cursor blink. So I intoned "a drinking glass," hit the space bar and the answer came up, "a drinking glass." A triumph! In order to get the next question I had to type C if I was right or W if I was wrong. I typed C and the next question came up.

I completed all twelve questions, and

Brian Murphy

creative computing

SOFTWARE PROFILE

Name: E-Z Learner

Type: Teaching program

System: 48K Apple II, disk drive with 3.5 DDI

Format: Disk

Language: Machine language

Summary: Effective self-teaching tool

Price: \$39.95

Manufacturer:

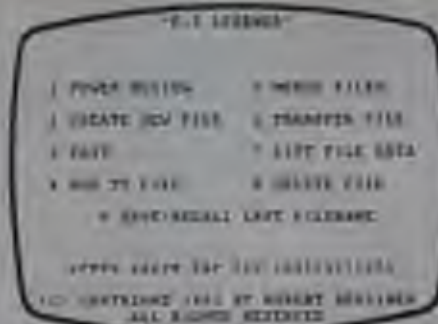
Silicon Valley Systems
1625 El Camino Real, #4
Belmont, CA 94002

Brian J. Murphy, 131 Bow Road, Fairport, VT 05430.

my monitor informed me that after one review I had eleven right and one wrong. The menu option to start or continue the review brought me back to the question I had wrong. I got it wrong again. The same menu option landed me back on that same question and would continue to do so. I surmised, until I got it right. Once I did, I had the option of starting the review over from the top or going to the main menu.

Did it work? Was I able to expand my vocabulary? The answer is yes. Using the technique of reviewing previously entered questions and then adding new questions to the file daily, I was soon able to translate quickly and accurately ever-increasing amounts of vocabulary. The material stuck with me. I was able to use my new vocabulary in formulating sentences and phrases. I had, as the documentation promised, not merely memorized but *learned*.

This program is perfectly adapted for home use by students who have a great deal of material to learn. I recall, with horror, some of the rote learning I had to do in high school and college. An Apple II with *E-Z Learning* would have been a godsend in those days, as I memorized the steps in the process of cellular mitosis and important dates in U.S. history. Not



all learning, after all, is of concepts.

The home user from grade 6 up will have no difficulties using *E-Z Learning*. The instructions are clearly phrased, the prompts are simple to follow, and the

***This program is
perfectly adapted for
home use by students.***

program offers real flexibility in creating files.

Files are saved on work disks, which means that you can have an unlimited

number for future reference and review. Notes transcribed into flash card form on these files can be stored indefinitely and could be a real bonus at final exam time, or when preparing for SAT or GSAT placement tests.

The program enables you to take files and transfer them to disks or to merge them, so that, in a final exam situation, for example, you can take the material you have studied unit by unit and review it as a whole. At any time you can delete a file or, if you have made a mistake, edit individual questions to add, delete, or correct information. Once a file is created, it can be expanded at any time with new questions, the only limit being the storage capacity of your disk.

Teachers interested in using this program in the classroom should note that the program is not really suited for unsupervised review. The program will believe the child if he says he got all the answers right. For students who want to review, for their own benefit, material for examinations or quizzes, the program is ideal, since the file can be tailored to meet the students' exact needs.

The documentation says the program is menu driven, but it is also multiuser driven. If you want to learn, then *E-Z Learning* is a perfect tool for the job. □

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CIRCLE 231 ON READER SERVICE CARD



An Avalanche Of Apple Games

There's no rest for the weary, and also no rest for the avid Apple-gamer. So many high quality games have been introduced in the past several months that it's hard to keep up with them all. In our effort to keep you up to date, here are some of our findings.

Borg

No, Borg is not a Wimbledon simulation in which you attempt to win six straight championships. Rather, it is a superior game in the class that included Dataquest's *Thief* and the popular arcade game *Berzerk*. In Borg, your mission is to reach The Grub, destroy him and then escape. In order to accomplish this you must navigate through 10 rooms, avoiding dragons and a kangaroo with wings named Borg.

In the first room, the dragons are unarmed; in all subsequent rooms, they have weapons and are intent on putting you out of your misery. Luckily, dragons are by nature dull-witted (you know that, right?) and will sometimes shoot each other or collide. One must also be wary of the objects in each room, since some are electrified and will cause a quick demise at the slightest touch. If

that weren't enough, there's still the small matter of Borg to contend with.

Borg appears just about the time you are getting things under control. You are making for the exit, intent on vaporizing the last couple of dragons when an ominous call for "Borg" rattles your Apple's speaker. Out hops Borg, straight toward you, crashing through everyone

and everything in his way. If he reaches you before you reach the exit, it's goodbye, Charlie.

The rooms themselves are excellent examples of Apple hi-res graphics. The quilt room is typical: patches of color are laid out in a pattern pleasing to the eye, but devilishly tricky to navigate. The figure of a man that you are controlling can run and fire his weapon in eight directions, and the animation is remarkable for a shape so small.



A menu at the start of the program lets you choose which control to use. Options include using either game paddle, a joystick, an Atari joystick connected to a Sirius Joystick, or keyboard controls. I found the Atari joystick made to order for Borg. During the game, you can toggle sound effects on or off with CTRL-S or restart the game by pressing CTRL-R.

Hitting the ESC key causes the game to pause so you can answer the phone or

David H. Ahl
Randi J. Rost
Dan Jacobs
Chris Vogeli

creative computing SOFTWARE PROFILE

Name: Borg
Type: Arcade game
System: 48K Apple II, II +
Format: Disk
Language: Machine
Summary: Great graphics and action
Price: \$29.95
Manufacturer:
Sirius Software
10764 Rockingham Dr.
Sacramento, CA 95827

Randi Rost, 1425 Woodland Ave., Fairmount, MN 5601.

Dan Jacobs, 4508 Dartmouth Ave., Sacramento, CA 95811.

THIS GAME'S GOT BUGS

But you **LOVE** *them*



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 - Evaluation of a position
 - Return to board or switch to command menu
 - Take back a move (reversible)
 - Play move suggested by look-ahead search
 - Chess plays neither side
 - Switch sides
 - Chess plays against itself—one level against another
 - Replay through most advanced position
 - Skip to most advanced position
 - Start new game
 - Leave program
 - Save, get, and delete games to and from disk
- All features self-documented; all choices cursor-controlled. Screen shows "outward" and "look" features being used.

THE PEOPLE BEHIND THE PROGRAMS:

Larry Atkin & David Saxe: Authors of the Northwestern University Chess 4.7 program—World Computer Chess Champion, 1977-1980

Peter Frey: Northwestern University professor, Editor, *Chess Skill in Man and Machine*. One of U.S. Othello Assoc.'s top-ranked players



Chess's features



Back to play and win (from Checkers documentation)



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CIRCLE 218 ON READER SERVICE CARD

Apple Games, continued...

wipe the sweat from your brow. About the only thing missing is a high score feature. After playing *Borg* for four straight hours, I would have liked to have seen what my best score was.

A color TV or monitor is definitely necessary for playing *Borg*. The color of the obstacles helps a lot in determining which are electrified and which are not. It may take some time to get past the first room, and some may even give up in frustration. If you are looking for an easy game you can master right away, this is not the one. *Borg* is enough to challenge even the championship arcade's skill, but can be a lot of fun for beginners too. If you like *Berzerk*, you'll love *Borg*, because *Borg* has more—more color, more challenge, and more nail-biting excitement.—RJR

Computer Foosball

Foosball lovers unite! You now have an outlet for your frustrations in a new fast-paced simulation of the popular parlor game. *Computer Foosball* is an exciting rendition of this sport, which has playability remarkably similar to the real thing.

The game has one, two, and four player versions which involve a match between the Gruds and the Robots. In the single-player version, you control the Gruds (no offense intended) and your mighty Apple controls the Robots. The first one to score five goals is the winner, and is treated to a few bars of a rousing fight song.

The game begins by prompting for the number of players and the difficulty level. Normal and fast options control the maximum speed of the ball. The normal speed is by no means slow, and will require some practice before your Gruds can avoid embarrassment by the Robots.

The players are controlled by game paddles, which move them up and down. Pushing the button causes the players to kick the ball. The button is held down to avoid stopping the ball when it is already going the right direction (toward the goal).

Another feature that is notably similar to the actual game is the action in the



corners of the field. The author, Keithen, simulated the banks of the foosball table, which serve to keep the ball in play. If the ball does come to a stop (as it does at times in the real game), hitting CTRL-B will re-serve it. These extra features make the game feel far superior to Pong-like versions I have played before.

The two and four player versions can be even more invigorating. With two people playing, the second player controls the Robots. This may come as a relief; if your opponent is less skillful than the Apple, you may actually be able to win a game.

With this option there is the additional excitement of head-to-head competition, a feature seldom found in Apple games. So what could be better? Four players, of course! This option, available to owners of the Series Joystick, is the only one I have seen that enables four players to play simultaneously with all four pushbuttons operational.

Besides normal retail sales, the game is available free with the purchase of a Joystick. Either way, foosballers and non-foosballers will enjoy the action in this fast-paced game.—DJ

Horizon V

The microcomputer game industry is getting more sophisticated by the day. Game authors have begun to implement multiple scenarios, realistic three-dimensional graphics, and automatic increases in difficulty.

Horizon V is an excellent example of

creative computing

SOFTWARE PROFILE

Name: *Computer Foosball*

Type: Arcade game

System: 48K Apple II, II+

Format: Disk

Language: Machine

Summary: Realistic foosball simulation

Price: \$29.95 or free with purchase of Joystick

Manufacturer:

Strat Software

2064 Rockingham Dr.
Sacramento, CA 95827



Apple Games, continued...

what a little imagination and some programming prowess can produce. A graphical masterpiece by Nasir Ghobli, it catches your eye immediately and beckons you to play.

The game starts by prompting for the mode of control—keyboard or joystick. It also has an option for modifying the keyboard. This is a feature I would like to see become standard in the future. Although there is no prompt for it (and there is no mention in the instructions), the game is compatible with the Sirius Import (hit control/shift/T).

In the first part of the game, you are hovering just above the surface of a gridded planet. Checking your radar display in the upper right of the screen (a la Battlezone), you spy the dots that represent the angry G-bellians, who think you've kidnapped Paulette the G-belly dancer.

The G-bellians are obviously not familiar with our "innocent until proven guilty" concept, and proceed to attack. You have a limited amount of fuel, and must shoot as many adversaries as possible before trying to refuel.

The ship you are in always faces one direction, so maneuvering involves using the controls to move forward, backward, and laterally. This is made even more challenging due to a mysterious random wind of some type that tries to change your trajectory. It is the ability to counter this randomness quickly that separates the good players from those who are merely target practice for the G-bellians.



"Jaxx, it's impressive, but I like the computer-enhanced photographs better!"

Before you know it, you find yourself low on fuel, and must abandon your delight to get more. This is accomplished by checking the fuel direction indicators which tell you where the time tunnel entrance is. If you can hover above it long enough, you will be whisked into the tunnel, where you must shoot more G-bellians.

However, here they are worth only 100 points each, whereas above the planet a shot could earn up to 600 points. This means strategy for high scores involves staying on the surface as long as



possible, despite the risk of running out of fuel. This part of the game is sure to cause the player mental anguish and heart palpitations.

As if that were not enough, you will must shoot a number of these guys before you can proceed. Next stop is the fueling area, which appears as a series of growing concentric rings, a beautiful graphics effect.

By centering a crosshair in the middle (battling the mysterious wind all the while) you earn enough fuel to return to the surface. The planet has now changed colors, and the G-bellians are more aggressive.

The game continues in this cycle for as long as you can hold out. When the G-bellians have finally won out, high

creative computing SOFTWARE PROFILE

Name: Horiana V

Type: Arcade game

System: 48K Apple II, II+

Format: Disk

Language: Machine

Summary: Superb 3-D shoot-em-up

Price: \$34.95

Manufacturer:

Gibelli Software, Inc.

1787 Tribeca Rd., Suite G

Sacramento, CA 95814



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Apple Games, continued...

scores' names are recorded with up to six letters, a race track that will keep you coming back for more.—DJ

Shuttle Intercept

The object of *Shuttle Intercept* is to retrieve friendly satellites. At your disposal you have a high speed space shuttle, which always flies at the left side of the screen. Its vertical position is controlled by a paddle controller.



To start the game you press the paddle button once and the bay doors open. A sound pulse raises your sky hook and fires your laser cannon. To retrieve a satellite, you must touch it with the upper part of your sky hook, which must be fully extended. Merely flying over it with your craft does you no good.

Unfortunately, in addition to friendly satellites, there are also enemy flying saucers, satellites, meteors, and missiles flying in the same air space. Each of

avoid, except if they are too close to a satellite you are trying to retrieve. On the other hand, missiles will track your shuttle and destroy it. I found the best strategy was to wait until they got close and then quickly move out of the way.

The game has four levels of play of increasing difficulty. In addition, at 5000 points, the speed of the missiles increases, and at 10,000 points the meteors begin to travel faster. Frankly, I was pleased with scores of two or three thousand. Any score over 1000 allows you to enter your name or initials as the higher scorer for a session, but scores are not saved on the disk.—DMA

Star Maze

Your mission is to find the nine power jewels in each level of the *Star Maze* and return them to your mother ship. Do this for all 16 levels and you become an Ace. That is an understatement! I had a tough time just retrieving five of six jewels on the first level.

In this game, you are flying a small space ship around the corridors of a maze. The maze is considerably larger than will fit on the screen, so you see only a small portion of it at one time.

The program employs outstanding graphics which cause the maze to scroll by in a direction corresponding to your direction of movement.

You start out at the mother ship with a full fuel tank, three anti-matter bombs, and high hopes. A power jewel may be picked up by flying over it at a speed of 200 or less. This sometimes proves to be quite a challenge because, although it is relatively easy to locate the jewels, it is not always easy to slow the momentum of your ship sufficiently that you can

creative computing SOFTWARE PROFILE:

Name: *Star Maze*
Type: Arcade Game
Author: Gordon Eastman
System: 48K Apple, disk drive
Format: Disk
Summary: Space Jewels for the picking.
Price: £14.95
Manufacturer:
Sir-Tech Software, Inc.
6 Main St.
Ogdenburg, NY 11661

creative computing SOFTWARE PROFILE:

Name: *Shuttle Intercept*
Type: Arcade Game
Author: John Van Ryzin
System: 48K Apple, disk drive, paddle
Format: Disk
Summary: Retrieve Satellites
Price: £14.95
Manufacturer:
Hayden Software
30 Essex St.
Rochelle Park, NJ 07662

these must be dealt with somewhat differently. Enemy craft and satellites can be destroyed with your laser cannon. If they are not destroyed, enemy satellites will destroy your shuttle while enemy craft will simply push down your sky hook and close the bay doors.

Meteors and missiles, on the other hand, must be avoided by skillful piloting of your craft. Meteors fly in a predictable course and are relatively easy to



Actual

The story, of course, is a third generation Saul about All Has come back again. The 110-20 is not a new CD or a personal collection.

[illegible]

Dr. John W. Gault, Chairman, The
Citizenship Education Committee,
and Director of the Department.



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EPSON

pass over them at such a slow speed.

Furthermore, to drop the jewel off at the mother ship you must also be traveling slower than 200. In fact, if you fly over your mother ship with a speed of 100 or less, you will also refuel. The need to refuel is indicated by both a fuel gauge and an audible warning.



You have three star fighters with which to complete your mission. Flying around the maze, you will find alien cruisers, scout ships, starfighters, UFOs, missiles and even a strange little train of outer space bugs. You can destroy an enemy either by shooting bullets at him (bullets in an outer space game?) or by firing an anti-matter bomb.

In a tight situation, you may also elect to enter hyperspace which transports you to another part of the maze. This is not always a good idea since hyperspace uses a great deal of fuel and you may wind up in the middle of a screen full of enemy ships.

The game may be played from a keyboard, with a standard joystick, or with a switch-type joystick with the Series Joystick. Frankly, I found none of them entirely satisfactory. In keyboard mode, ten keys are in use, although only six are

used regularly. That's too many for my unconditioned fingers. Regular joystick mode is somewhat easier, although you still need the keyboard to detonate anti-matter bombs or enter hyperspace. But perhaps I am just being petulant because I was never able even to come close to mastering the game.

However, at the risk of adding yet another control, I feel that a speed break would increase the playability of the game. On the other hand, the momentum of the ships is very realistic and perhaps is what one ought to expect in outer space. —DNA

Seafox

As a submarine captain of the Seafox, you must destroy all of the merchant ships (the top row of ships on the screen) in order to move on to the next mission. Harassing you are other submarines which try to ram you or shoot torpedoes at you. Also, hospital ships frequently come between you and the merchant ships.

If one of your torpedoes hits a hospital ship, it bounces off it harmlessly and

friends in those waters and they don't take too kindly to it. Giant clams may also interfere with refueling so it is best to collect your supplies quickly.

Your submarine may be controlled by either the keyboard or a joystick. Paddle control is also theoretically possible, but nearly impossible for normal humans. I also found keyboard control very difficult since 11 keys are used to control directions, and firing. A self-centering joystick is by far the most satisfactory. However, both firing buttons must be operational since button O fires torpedoes up and button I fires them forward. Although you may move your sub in any direction, forward is always to the right side of the screen. Thus, the only way to get a submarine approaching from the left is by using your upward torpedoes when you are under it.



On the lower levels, I found Seafox considerably easier to play and much less frustrating than several of the other submarine games on the market. Although the hazards increase on the upper levels, I generally had a nice sense of accomplishment as I progressed through the game. My applause goes to Ed Hobbs for creating a game which can be enjoyed by dinks and experts alike. —DNA

creative computing SOFTWARE PROFILE

Name: Seafox
Type: Arcade Game
Author: Ed Hobbs
System: 48K Apple, disk drive;
joystick recommended
Format: Disk
Summary: Challenging underwater
battle
Price: \$29.95
Manufacturer:
Broderbund Software, Inc.
1938 4th St.
San Rafael, CA 94901

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Apple Games, continued...

them, but the entire surface is not covered with barriers.

The barriers form paths (or pens) around treasures and deadly Mars Cars. Your challenge is to beat out into this land of barriers and Mars Cars, retrieve the four treasures in the corners of each of the 16 boards, and head for the exit (which is actually the entrance to the next level).

On the lower levels, the Mars Cars simply bounce around within their pens and follow predictable patterns around

you may be prepared to deal with.

Once you have all four treasures on a level, you must head for the exit gate at the center of the right side of the screen to reach the next level. There you will find more treasure, more barriers, and more "devious" Mars Cars.



Although I tried every trick in the book in this Martian demolition derby, the highest I ever got was the 11th level. But wait until tomorrow; I'll make it to level 15 yet.—*DNA*

creative computing SOFTWARE PROFILE

Name: Mars Cars
Type: Arcade Game
Author: David Hensch
System: 48K Apple, disk drive, joystick recommended
Format: Disk
Summary: Martian demolition derby
Price: \$29.95
Manufacturer:
Datacube, Inc.
3744 Canyon Ave.
Chatsworth, CA 91311

which you can generally maneuver. However, on the higher levels, the cars become more intelligent and seem to pick up your scent as they close in for the kill.

You score 10 points for each barrier you destroy and 100 points for each treasure. While it is quite easy to destroy many barriers for big scores, this has the peril of releasing more Mars Cars than

creative computing SOFTWARE PROFILE

Name: Marauder
Type: Arcade Game
Authors: Burke Wengert and Eric Hammond
System: 48K Apple, disk drive, joystick
Format: Disk
Summary: Battle the alien homeland; two games
Price: \$34.95
Manufacturer:
Serge On Line
36573 Mudge Ranch Rd.
Coomesville, CA 93614

This should be used sparingly since there is a five-second interval between permissible uses of that function. You must destroy seven defense installations (nine at higher levels of play) before you fly into the ruins of the fireball launcher and enter the labyrinth of the city.

Needless to say, these defense installations are not just sitting still waiting for

Marauder

In Level 1 of *Marauder* (the first game), you are the pilot of a ship attacking an alien planet and its defense installations. The first line of defense is an energy shield which covers the surface of the planet. You can maneuver your small craft around the screen using a joystick (or keyboard if your fingers are more coordinated than mine).

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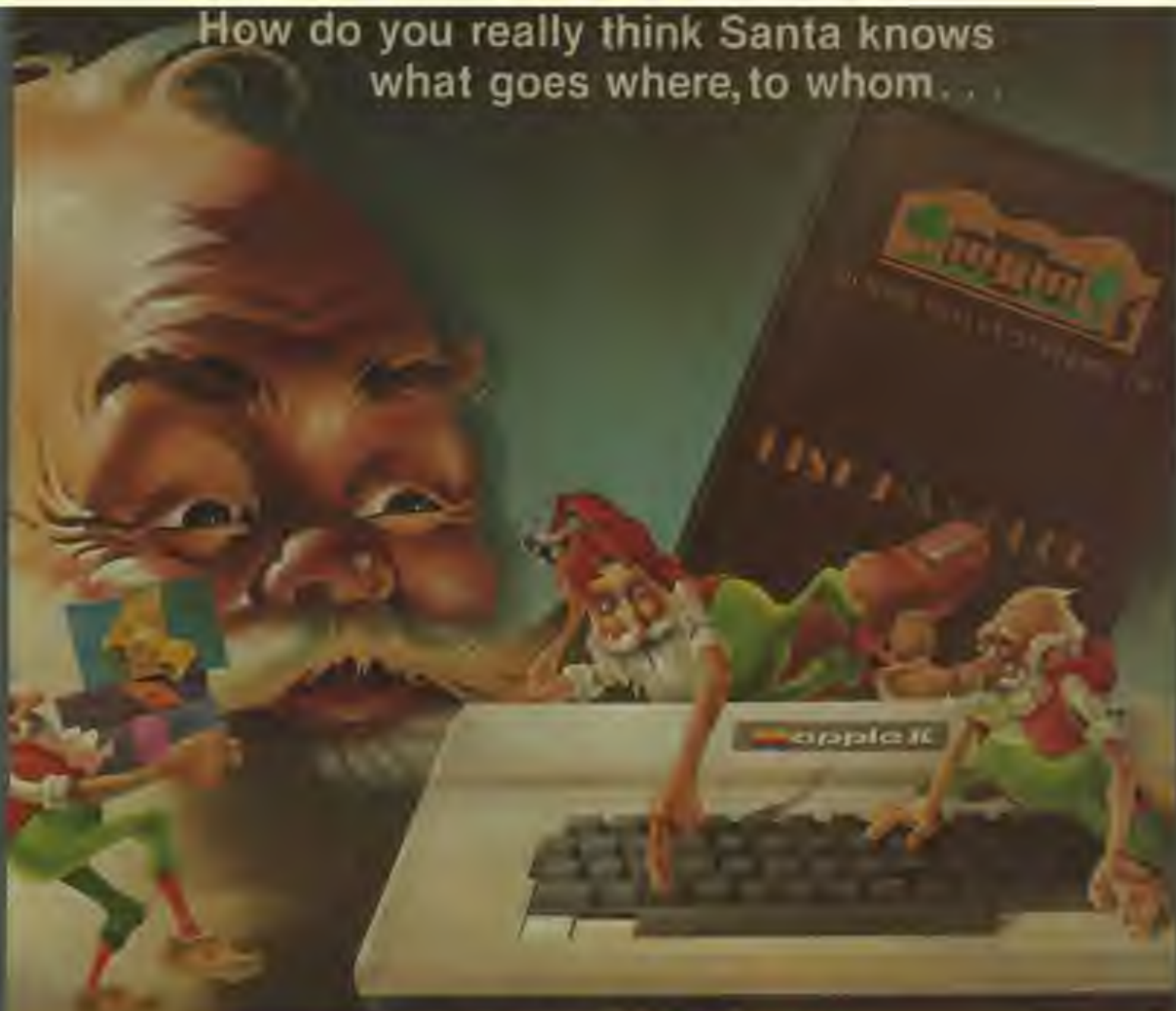
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CIRCLE 255 ON READER SERVICE CARD

Apple Games, continued...

you to knock them out. There are guided missile buses, mine launchers, lasers, and fireball launchers, all of which are sent on your instructions. Missiles and mines can be destroyed, but the fireball cannot, so it is the one of which you must be most wary.

Level II (the second game) begins when you enter the city and start searching for the power station which supplies life support for the defending aliens. Naturally, the power station is guarded by nasty robot guards which communicate with one another as well as see and hear your shots as you wander around the Berzerk-style maze. You, on the other hand, can see only those robots that are within your field of vision.



Your marauder can be killed by either shots from a robot or falling bricks from the ceiling. If you survive the robots and get a direct hit on the power center with your hand weapon, you get whatever bonus points are still on the timer when you destroy it.

However, destroying the power center starts a chain reaction which eventually destroys the entire alien world. After hitting it, you have 2000 units of time to return to your ship before the ceiling begins to fall. A safe return leaves you ready for your next planetary assault. There are 16 levels of play on the disk, more than enough to challenge even the best arcade. —DHJ



Mission Impossible

If you have been with computers for even a little while, you have probably heard someone talking about adventures. The adventure game began years ago on the big systems and found its way to the micro thanks to the efforts of Scott Adams.

creative computing

SOFTWARE PROFILE

Name: Mission Impossible
Type: Hi-res Adventure
System: 48K Apple, disk drive
Format: Disk
Language: Machine
Price: \$29.95
Manufacturer:
Adventure International Inc.
P.O. Box 3435
Longwood, FL 32750

Scott took the original game and scaled it down somewhat to produce his first program, *Adventureland*. Since then, Scott has formed his own company (Adventure International), and adventuring has become a popular pastime among computer people everywhere.

Scott has recently re-written his 13 adventure programs to include graphics and speech. Using a special picture packing technique, he has managed to cram over 100 high-resolution color pictures into a single adventure disk. The result is the Scott Adams' Graphic Adventure (S.A.G.A.) series.



Although the graphics are spectacular, the real fun is listening to the speech. If you have a Votrax Type-N-Talk unit, you can specify speech output at the beginning of the game and enjoy audible prompts throughout the game. Don't worry if you don't own a Votrax, however. The program will run fine without it. A complete menu allows you to customize the game to suit your mood. If you don't want the pictures, or you feel like playing without the speech, you just se-

lect the appropriate option from the main menu.

Mission Impossible is an adventure set inside a nuclear reactor. It has been rigged to explode and you must deactivate the bomb before detonation. Armed with only a bomb detector and a tape recorder, you race against the clock to save the reactor.

It is hard to imagine a micro owner who doesn't have at least one adventure game in his files. If you already own a non-graphic *Mission Impossible*, don't throw it away. The old version is exactly the same as the S.A.G.A. series and is an excellent way to enter the world of adventuring.—CV

Shuffleboard



Innovative Design Software is known for their non-violent games. Games such as *Juggler* and *Pool 1.5* have done extremely well and have earned the praise of gamers everywhere. Their latest release, *Shuffleboard*, is sure to equal its predecessors in popularity and playability.

On the top half of the screen, the playing surface is displayed. If you are not familiar with the layout of a standard shuffleboard, don't worry, the instruction manual is very thorough in describing the rules and the scoring. Two game options, "Tally All" and "Cutthroat" are available.

creative computing

SOFTWARE PROFILE

Name: Shuffleboard
Type: Simulation
System: 48K Apple, disk drive
Format: Disk
Language: Machine
Price: \$29.95
Manufacturer:
IDSI Inc.
P.O. Box 1658
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Apple Games, continued...

Aiming the puck is accomplished with the U and D keys. All you have to do is line up the puck and the aimer. After you select the force with which you will push the puck, the S key sends it sliding down the floor.

If you can't find anyone around who wants to play a game, *Shuffleboard* has a computer play mode which is always ready to go. While playing against the Apple, we were surprised at the fairness of the program. Sometimes, computer routines cheat by making moves too accurate for humans to reproduce. Not so with *Shuffleboard*. The computer is a challenging player, but not impossible to beat.

Shuffleboard is a pleasant computer adaption of a classic game. Whether you are a shuffleboard fan or not, this package is worthy addition to any software library.—CP

Zenith

Zenith is a 3-D action game in which you must defend a helpless space colony from alien attack. These aliens just don't want any humans to occupy their galaxy. In fact, they are ready to destroy anything that you may try to build. To rid yourself of these troubling creatures, you must blast their ships with your lasers and then capture the alien pilots with your rescue claw.

So far it sounds pretty much like any other game. However, why would anyone want to capture the alien? Why not let them die out in space? Well, it turns out that the aliens are necessary for your survival. During play, fuel, shield, and laser energy are consumed by your ship. The only way that you can replenish your supplies is by purchasing them from the aliens' base ship. The currency is, of course, your alien hostages.

creative computing SOFTWARE PROFILE

Name: Zenith
Type: Arcade
Author: Naur Gebeli
System: 48K Apple, disk drive, joystick optional
Format: Disk
Language: Machine
Summary: Excellent 3-D graphics
Price: \$24.95
Manufacturer:
Gebeli Software Inc.
1771 Tribble Rd., Suite A
Sacramento, CA 95816

After you gather four aliens to your collection chamber, your ship is automatically drawn to their base and your cargo is exchanged for fuel. It sounds easy, but catching the alien astronauts is



extremely difficult.

In addition to the task of retrieving the astronauts, there is a time limit involved in play. If you do not bring your hostages back to their base soon enough, they begin to suffocate, and will die in minutes.

The entire battle takes place over an animated 3-D grid. As you are turning, diving, and climbing, the ground pattern changes to give you the feel of flight. Even our best programmers were amazed at the animation techniques employed in *Zenith*.

In summary, *Zenith* is a well executed game that is sure to amuse everyone. The graphics are excellent, and the idea is new. *Zenith* gets our highest rating.—CP

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An Adventure Game for the Apple II With (Almost) Everything

Robert Plamondon

What would you expect from the ideal adventure game? A good plot, of course. A game that gives you many options would be nice — too many games practically play themselves. Excitement (maybe combat) is important, too. Perhaps a series of adventures would be more fun than just one. And, of course, the game should be without obvious flaws.

Many games meet these criteria, but very few are available for less than \$5 per adventure. And only one is designed to allow you to write your own adventures without actually doing any programming. This game is called *The Wonderful World of Eamon*.

Description

Eamon is an all-text adventure game, revolving around the activities of a make-believe character in a make-believe setting. The Computer describes the setting, and the player controls his character with two-word commands, such as GET TREASURE, or FREE PRINCESS. The adventure is usually a quest: the character must recover something, such as a kidnapped princess or a cure for the Black Plague.

Unlike most adventure games, the difficulty in succeeding in the quest is caused by unfriendly creatures, not by a series of riddles. The problem lies in reaching the goal before being hacked to pieces, not in trying to puzzle out a series of ambiguous clues. This makes *Eamon* more exciting than many adventure games.

Eamon Plamondon, 447 NW 11th Street, Corvallis, OR 97331.



Illustration by Gerald Gidycz, 454 First Street NE, Corvallis, OR 97331, Corvallis, Oregon

Eamon has a Master Diskette which contains the programs for creating characters, buying goods, and so on. It also contains a short adventure, called The Beginners' Cave. To the best of my knowledge, Eamon is available only for the Apple II, but it could be adapted to other computers, since it is written entirely in Basic.

Playing Eamon

When you boot up the Master Disk, you are asked for your character's name. The program searches through the list of your old characters. If it finds an old character with the same name, it reads in that character's statistics and sends you to the next program; the Main Hall.

If it doesn't find a character, it assumes you want to create a new one and rolls up some statistics. Characters have three major attributes: hardiness, agility, and charisma.

Hardiness is a measure of the character's strength and his ability to take punishment. Agility is related to his ability to hit what he is aiming at. Charisma is the ability to deal amicably with other creatures.

The Main Hall program allows you to purchase weapons, armor, and spells, and to sell the loot obtained on adventures. New characters start with a small amount of money — enough to buy second-rate armor, a weapon, and maybe a weak spell. After browsing through the Main Hall, the character is ready for an adventure.

Adventures

There are 25 Eamon adventures available now, and several more in various stages of completion. The adventures vary enormously in style, the wide variety being one of the best features of the game.

Unfortunately, they vary in quality, as well — but the best adventures are very good, and all of them are *very* cheap, so you don't waste much money if you happen to choose a poor one.

When you are ready to go on an adventure, the Main Hall program will tell you to put the adventure disk in the drive and hit the C key to begin your adventure.

The adventure usually starts with a description of what is going on. A typical situation is that some villain has done something unspeakable, and has kidnapped a princess as well. Your job is to kill the villain, undo the evil deed, and rescue the princess. (This scenario is amazingly durable; it appears not only in the usual fantasy settings, but in adventures such as The Death Star, as well.)

After informing you of your plight, the disk spends a minute or so reading in

the Base Dungeon Program and data for the adventure. After the computer has digested a few thousand bytes of data, the adventure begins.

Most features of Eamon will be familiar to adventure gamers: There are unknown areas to explore, treasures to be found, and problems to solve. Most Eamon adventures lack a save game feature, which makes it impossible to quit in the middle without consigning your character to oblivion. On the other hand, it avoids one problem of the other games, in which you can save the game as insurance — by saving the game every five minutes, you can undo a character's death by loading in the saved game.

A typical situation is that some villain has done something unspeakable, and has kidnapped a princess as well.

This tends to make the adventure a test of game-saving strategy, rather than a test of skill in the game itself. In Eamon, when a character dies, he stays dead. This makes adventuring a lot riskier, but risk makes the game more exciting.

Critters and Combat

While most of Eamon is similar to traditional adventure games, it has two unusual features: the ability to make friends during the adventure, and a complete combat system.

Creatures in Eamon come in all shapes and sizes. Some are friendly, some are hostile, and some can be either, depending on the character's charisma and luck.

Interaction with other creatures is rudimentary: if a critter likes you, it follows you around and helps fight your enemies. If it dislikes you, it attacks you. If it is neutral, it ignores you, and refuses to attack either your friends or your enemies.

Gifts can influence a creature's reaction to a character. Giving out gold can sometimes make a hostile creature friendly. Giving a friendly creature junk to carry may make it hostile. A character of mine once gave a destroyed 'droid to the Wookie in the Death Star adventure. The Wookie displayed his resentment at being used as a pack animal by killing my character.

Combat is a major ingredient of these adventures. Eamon was designed with fantasy role-playing games in mind, and has an excellent combat system.

When one creature tries to hit another, its ability to hit is equal to its weapon skill minus the dodging skill of the target. The amount of damage done by a blow is determined by the weapon type. Armor absorbs a certain amount of damage per blow; the remainder is subtracted from the defender's hardiness. If the creature's hardiness drops to zero, it dies.

This applies to characters, too: characters die quite often in Eamon. Fortunately, these deaths aren't random or arbitrary (as they are in some of the poorer commercial games). Combat is dangerous, and if you fight, your life is in danger. If you pick your fights carefully, you lose fewer characters.

Every time your character uses a weapon or spell successfully, there is a chance that his ability in that skill will increase. This lets your characters learn from experience, and as their skill increases, they can tackle progressively more difficult adventures.

Figure 1 shows part of a game, including combat.

Designing Adventures

One of the special Eamon diskettes is the Dungeon Designer Diskette, or DDD, which has a collection of programs to help you create your own adventures.

Eamon is structured so that information about the adventure, such as monster descriptions, room layout, and artifact data, are all stored in disk files. The Base Program uses these data to run the adventure.

This means that all you have to do is write the data files; the adventure program is already written. The upshot is that Eamon adventures can be written without doing any programming at all.

The programs on the DDD prompt the user for input, and have several useful text editing commands, making it easy to input the data for an adventure. The procedure for typing in an adventure is really quite simple; the hard part is coming up with good ideas for adventures.

Recommended Programs

Eamon was developed by Donald Brown for the purpose of putting a computer role-playing games system in the public domain. While most designers are content to design each adventure from scratch, Brown designed an adventure system, with programs to help authors create their own adventures.

Since Eamon is in the public domain, it is legal, ethical, and fun to make cop-

What if
“what if”
isn't
enough?



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The most personal software.

ies of the programs for your friends. Finding them is something of a task, however. While I know of 25 adventures, there may well be hundreds of which I have not heard, because the authors haven't made their creations known.

A complete list of adventures known to me is in Figure 2. The adventures I recommend for beginners are:

Eamon Master Diskette by Donald Brown. You must have this diskette to go on adventures. The Master Diskette includes The Beginners' Cave (a simple adventure), a couple of utility programs, and the special Master Diskette program.

The Temple of Nguret by James and Robert Plamondon. This is a very sophisticated adventure, if I do say so myself. My brother wrote the adventure itself, and I tinkered with the programs. Your character is sent on a quest to steal the medallion of the demon Nguret.

Death Star by Donald Brown. This is by far the funniest adventure. Your character must shut off the tractor beam in the Death Star so he can escape in the Millennium Falcon. The Storm Troopers are even worse shots than they were in the movie. Donald Brown told me that this adventure was supposed to be a serious science fiction adventure, but failed. I think it is a great success as a shipstick fantasy adventure.

The Caves of Mondamen by John Nelson. Second only to Nguret in sophistication, this adventure pits you against the evil Mondamen, who has an army, a magician, the demon Vapeak, a captive princess, and an underground stronghold. You have your wits and two friends, a big guy named Fred, and a short guy named Barney. This one is difficult, but fun.

Finding Eamon disks

Donald Brown told me that a group called Magnetic Fantasies is the official Eamon distributor. Whether this actually means anything is unclear. I have been unable to find Magnetic Fantasies' address, and I know nothing about them, beyond the fact that Donald Brown recommends them.

One source I do know something about is the Apple Avocation Alliance, Inc. (AAA). The AAA has 20 of the 25 "known" adventures, and will probably have them all by the time you read this.

The AAA's main function is to distribute public domain software for the Apple at low cost. There are several ways of getting programs from AAA:

1. Send a disk with ten Apple programs that aren't in AAA's catalog, and receive a disk of AAA programs in exchange. AAA even pays return postage.

2. If you don't have programs to exchange, you can always pay cash. The fee for copying AAA disks onto your disks is \$1.00 per disk side (a common practice is to put programs on both sides of the disk).

3. If you don't want to send disks, you can buy them with the programs. AAA charges \$3.50 for Verbatim Datalite disks, for S3 Memorex disks, and \$2 for used disks.

There is also a fee of \$27 on your first order or exchange.

Send orders and inquiries to Ron Maleika, Apple Avocation Alliance, Inc., 721 Pike St., Cheyenne WY 82001.

A third source of Eamon adventures is John Nelson at 1226 E. University, Des Moines, IA 50316. John has written several excellent Eamon adventures, and always seems to have a few more in the works. He is also trying to coordinate the Eamon adventures by making sure new adventures don't have the same names and volume numbers. People who are considering writing an Eamon adventure should drop him a line.

There are some differences between John Nelson's inventory and AAA's, mostly because AAA doesn't have all of John's adventures at this writing.

Eamon adventures can be obtained from John Nelson for \$5 each.



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If you reply card has been received, please write to the Small Computer Book Club Dept. 1-345, Richmond, N.J. 08040 or direct to the publisher's address for correspondence.

Eamon, continued...

Figure 1: Part of an Eamon adventure. A character named Marcus Antonius buys a spell in the main hall, and goes adventuring in The Beginner's Cave. After meeting a friendly warrior named Heinrich, Marcus Antonius encounters a wolf and a cave man.

AS YOU WANDER ABOUT THE HALL, YOU
REALIZE YOU CAN DO ONE OF SIX THINGS—
1. GO ON AN ADVENTURE.
2. VISIT THE WEAPON SHOP FOR WEAPONS
AND/OR ARMOR.
3. HIRE A WIZARD TO TEACH YOU SOME
SPELLS.
4. FIND THE BARBER TO SHAVE OR
WITHDRAW SOME GOLD.
5. EXAMINE YOUR ABILITIES.
6. TEMPORARILY LEAVE THE UNIVERSE.
[PUT THE KEY FOR YOUR CHOICE, 1-6]

YOU ARE THE WIGHTY MARCUS ANTONIUS

YOUR ATTRIBUTES ARE:
HP=14 AC=23 DX=12

YOU KNOW THE FOLLOWING SPELLS—
NO SPELLS

YOUR WEAPON ABILITIES ARE—
ARE YOU CLUB SPEAR SWORD
NO YES YES YES YES YES

ARMOR: LEATHER AND CHIEF AC=9

GOLD IN HAND=12, BANK=0

WEAPONS: (NONE) (NONE)
DAGGERS: (NONE) (NONE) (NONE) (NONE)
[PUT ANY KEY TO CONTINUE]

AS YOU WANDER ABOUT THE HALL, YOU
REALIZE YOU CAN DO ONE OF SIX THINGS—
1. GO ON AN ADVENTURE.
2. VISIT THE WEAPON SHOP FOR WEAPONS
AND/OR ARMOR.
3. HIRE A WIZARD TO TEACH YOU SOME
SPELLS.
4. FIND THE BARBER TO SHAVE OR
WITHDRAW SOME GOLD.
5. EXAMINE YOUR ABILITIES.
6. TEMPORARILY LEAVE THE UNIVERSE.

[PUT THE KEY FOR YOUR CHOICE, 1-6]

AFTER A FEW MINUTES FRUSTRATED SEARCHING,
YOU FIND HENRY (NAME), THE OLD MAN, HE
LOOKS AT YOU AND SAYS, "SO YOU WANT TO
TRY TO LEARN YOUR SOME MAGIC, NOW WHEN
WELL, IT'LL COST YOU, TODAY MY FEEL ARE

STAFF 1000
SPEAR 500
POWER 40
SPEED 100

WELL, WHEN WILL IT BE?

[PUT THE KEY FOR YOUR SPELL, 8, 9, 0 OR 91
POWER]

HENRY REMINDS YOU YOUR SPELL, TAKES
100 FEEL, AND RETURNING TO HIS STAND ON
THE BAR. AS YOU WALK AWAY YOU HEAR
A WOLF AND A WIZARD DRAGON ALONG.

AS YOU WANDER ABOUT THE HALL, YOU
REALIZE YOU CAN DO ONE OF SIX THINGS—
1. GO ON AN ADVENTURE.
2. VISIT THE WEAPON SHOP FOR WEAPONS
AND/OR ARMOR.
3. HIRE A WIZARD TO TEACH YOU SOME
SPELLS.
4. FIND THE BARBER TO SHAVE OR
WITHDRAW SOME GOLD.
5. EXAMINE YOUR ABILITIES.
6. TEMPORARILY LEAVE THE UNIVERSE.

[PUT THE KEY FOR YOUR CHOICE, 1-6]

WIZARD CHARACTERS WITH ADVENTURE ARE 1000

THIS SUGGESTS FOR BEGINNERS CASE IN
ONE DRIVE IN SLOT 111. DRIVE ARE THEN
HIT '1'

YOUR COMMAND FILE

YOU ARE STANDING IN
THE MIDDLE OF A LONG PASSAGE

11 HENRICH IS HERE.
12 WOLF IS HERE.

YOUR COMMAND FILE

YOU ARE IN A SMALL, STARK CELL WITH A
DOOR ON THE WEST SIDE.

11 HENRICH IS HERE.
IN THE ROOM IS A CAVE MAN, WEARING A
CRAGGY SKIN OVER A LONG TUNIC. HE IS GRABBED
IN ANOTHER HIDE, AND HAS A BIG CLUB ON
THE FLOOR NEXT TO HIM. HE SAYS TO YOU AND
GRINS, "PAT ADVENTURER," HE SAYS, "YOU
WELL."

YOUR COMMAND ATTACK CAVE MAN
HENRICH ANTONIUS ATTACKS CAVE MAN
--A WOLF

CAVE MAN TAKES DAMAGE HIT
12 STILL ON GOOD SHAPE.
HENRICH ATTACKS CAVE MAN
--A WOLF.
CAVE MAN ATTACKS MARCUS ANTONIUS
--A WOLF.

YOU ARE STANDING IN
AN EAST CELL

11 HENRICH IS HERE.
12 CAVE MAN IS HERE.

YOUR COMMAND

ATTACK CAVE MAN
HENRICH ANTONIUS ATTACKS CAVE MAN
--A WOLF HIT

CAVE MAN IS VERY EASILY INJURED.
HENRICH ATTACKS CAVE MAN
--A WOLF.
CAVE MAN ATTACKS MARCUS ANTONIUS
--A WOLF.
WEAPON DROPPED

YOU ARE STANDING IN
AN EAST CELL

11 HENRICH IS HERE.
12 CAVE MAN IS HERE.
YOU SEE THE CAVE MAN'S CLUB, IT'S A HUGE
PIECE OF WOOD, BOUND WITH IRON BANDS.

YOUR COMMAND 2

YOU'RE IN THE MIDDLE OF THE LONG HALL.
DOORS ARE DOULTED ON BOTH SIDES OF THE
EAST AND WEST. THE HALL EXTENDS NORTH
AND SOUTH.

11 HENRICH IS HERE.

YOUR COMMAND 2

YOU ARE IN A SMALL, STARK CELL WITH A
DOOR ON THE EAST SIDE.

11 HENRICH IS HERE.
IN THE ROOM IS A WOLF. IT COMES UP
FROM WHERE IT WAS SLEEPING, AND BARES
ITS LONG YELLOW TAIL.

YOUR COMMAND ATTACK WOLF
HENRICH ANTONIUS ATTACKS WOLF
--A WOLF.
HENRICH ATTACKS WOLF
--A WOLF.
WOLF ATTACKS MARCUS ANTONIUS
--A WOLF.

YOU ARE STANDING IN
A WEST CELL

11 HENRICH IS HERE.
12 WOLF IS HERE.

YOUR COMMAND

ATTACK WOLF

MARCUS ANTONIUS ATTACKS WOLF
--A WOLF.
HENRICH ATTACKS WOLF
--A WOLF.
WOLF ATTACKS MARCUS ANTONIUS
--A WOLF.

YOU ARE STANDING IN
A WEST CELL

11 HENRICH IS HERE.
12 WOLF IS HERE.

YOUR COMMAND

ATTACK WOLF
HENRICH ANTONIUS ATTACKS WOLF
--A WOLF.
HENRICH ATTACKS WOLF
--A WOLF.
WOLF ATTACKS MARCUS ANTONIUS
--A WOLF.

YOU ARE STANDING IN
A WEST CELL

11 HENRICH IS HERE.
12 WOLF IS HERE.

Figure 2: The Known Eamon Adventures.

No.	Name	AAA No.
1	Master Disk & The Beginner's Cave	E01
2	The Lair of the Minotaur	E02
3	The Cave of the Mind	E03
4	The Zephyr Riverwoman	E04
5	The Castle of Doom	E05
6	The Death Star	E06
7	The Devil's Tomb	E07
8	The Abductor's Quarters	E08
9	Attack on the Clock Master	E09
10	The Magic Kingdom	E10
11	The Tomb of Malmar	E11
12	The Quest for Treasures	E12
13	The Caves of Treasure Island	E13
14	Furiosa	E14
15	Hayes Castle	—
16	The Caves of Minotaur	E17
17	Merlin's Castle	—
18	Hagworth Castle	—
19	The Death Trap	—
20	The Black Death	E20
22	The Senator's Chambers	E19
23	The Temple of Nigori	E18
—	The Lost Island of Apple	E17
—	The Underground City	E14
—	Dangoon Designer's Diskette	TDD
—	EAMON Utilities	EU

The numbers in the left-hand column are the ones John Nelson uses. The ones on the right are the AAA catalog numbers.

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Hot Air Ballooning With The 99/4



Have you ever wanted to operate your own hot air balloon? You can do just that with a new program from Simulations called *Aeronaut*. It was written by Al Kanda in TI Extended Basic and is a simulation of the sport of hot air ballooning.

When I saw that the program was written in TI Extended Basic, I expected to see some fast moving and detailed graphics. What program written in TI Extended Basic doesn't make use of sprites in motion? As I read the accompanying instruction manual, I began to think that I was going to be disappointed.

On page 3 of the manual, there was a paragraph describing the program. In part it reads: "This program should not be judged on the basis of entertainment value alone (it may in fact seem slow to one accustomed to a steady diet of arcade-style games) but also on the basis of the unique experience it provides. The intent is for you to be an aeronaut while you are running this program and experience what it is like to fly a balloon."

OK, what would you experience if you were to fly in a balloon? Why don't we go on an imaginary ride? I suppose it would be something like this. Once the balloon is inflated to an upright position, we turn on the blast valve of the burner to increase the temperature in the balloon. This makes us airborne and off we go.

Because we want to obtain a certain

Robert Cashman

height, we open our blast valve and keep it open until we reach our desired altitude. Not too much heat in the balloon now. We don't want it to overheat.

Boy, I'm glad we picked a beautiful day to go. You can see for miles. Doesn't the countryside look terrific from up here? Look! There's the town hall, and over there is the church steeple. Look how small they are! Ahh, this is great. Just floating by. No engine sounds. No control of direction. The wind just taking us where it will.

Can *Aeronaut* really simulate our imaginary ride? Yes and no. First of all, the program is extremely technical in its approach to familiarizing the user with the sport.

After a nice introduction on your screen, both graphically and musically, you are asked if you want instructions. By pressing Y, you get facts about your balloon — facts such as its volume is 56,000 cubic feet and it has an 11 Mega-BTU/hour burner. You have 20 gallons of propane fuel. The maximum temperature your balloon can accommodate is 250°F. And your maximum payload is 650 pounds at sea level and 70°F (draws 8 pounds per degree over 70°). The manual explains these facts further, but it would not hurt to brush up on your physics.

creative computing SOFTWARE PROFILE

Name: *Aeronaut*

Type: Game

System: TI99/4 or TI99/4A

Format: Cassette

Language: TI Extended Basic

Summary: A simulation of hot air ballooning

Price: \$19.95

Manufacturer:

Simulations Computer Software
Box 2494
Scottsdale, AZ 85257

Running The Simulation

Next, you press ENTER for a display of your flight instruments. Here you find your variometer, pyrometer, altimeter, fuel level indicator, and compass. The variometer is for vertical velocity. It reads positive when you are ascending and negative when you are descending. The pyrometer reads the balloon temperature. The altimeter reads your altitude. The fuel level indicator keeps track of the amount of propane used. The compass indicates your heading.

Next, press ENTER for displays. These include the ambient temperature, the wind speed/direction, which is displayed in knots and the direction in degrees from which the wind is blowing,

which is measured clockwise from north. The distance drifted is the distance that your balloon is carried by the wind and is measured in feet from the launch site.

The display section also mentions that your height relative to the terrain along your flight path is displayed here. When your altitude exceeds 1550 feet, the display scale changes. In other words, at 1550 feet your balloon disappears from your monitor. It is at this time that the scale of what you were looking at changes so that you can once again have the balloon and the terrain on your screen together.

Pressing ENTER again gets you your control keys. The spacebar turns your burner on allowing you to ascend. If you want to descend, simply allow the balloon to cool. Should you want to descend in a hurry, press M. This opens the manometering vent to release hot air. Pressing D opens the deflation port to deflate the balloon rapidly after landing so it won't be dragged along the ground. Pressing Q allows you to quit or abort a launch. Pressing T allows you to switch fuel tanks.

The next areas discussed are your preparation for launch, inflation and lift off, display boundaries, and landing. As all of these areas are discussed at length

in the manual, I will not describe them here.

Now that we are ready for our trip, let's discuss the object of this simulation. The object is to travel in your balloon over terrain which includes obstacles without crashing or being shot down. The obstacles include a couple of small mountains, a large mountain, a fruit orchard, some power transmission lines, and a military base by the name of Yellow Sands Proving Grounds. The balloon crashes if it collides with any slope or ground obstacle, or if it makes ground contact at a downward velocity in excess of 800 feet/minute. The balloon will be destroyed by heat-seeking missiles if the distance drifted is greater than 24,800 feet.

Evaluation

Now Simulsoft never called this program a game. It is a simulation, I suppose that means it should be considered as a realistic adventure in a hot air balloon.

Aeronaut succeeds in the technical aspects as it acquaints the user with the sport of hot air ballooning. But at the same time it fails to stimulate the desire to ever partake in such an adventure.

As mentioned during our imaginary trip, much of the excitement of balloon-

ing comes from the sensation of the panoramic views below — being on top of the world. Aeronaut does not simulate this.

Let's look at the program from an entertainment point of view. If there is no panoramic scenery, what is there to hold the user's interest? The main thing is the realization that if I don't properly control the valve, I'll crash. It is unfortunate that obstacles that would require a spontaneous reaction were not included. It would have made Aeronaut much more fascinating. What type of obstacles? How about a sudden thunderstorm complete with lightning and torrential rains? Or a flock of birds coming right at you? I think you get the idea.

It is apparent that Mr. Kanata and Simulsoft spent a great deal of time and effort in producing this program. As the owner of a TRS-80, I appreciate their developing software. I do, however, wish that they had taken the program a couple of steps further toward a more realistic simulation.

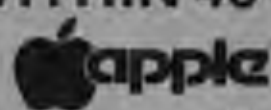


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Cypher Bowl

"OK, Hixson, Zorn's hurt and out for the rest of the game. You're our man—now go out there and get it!"

"Coach, you can count on me... Guys, it's a 32 Up and Out. Largest, I'll be looking for you at the five. Break!"

A wild fantasy from the deranged mind of a short, slow, and (slightly) overweight sports nut? Not entirely—not with my Atari 800 and *Cypher Bowl*, an excellent two-player football game program by Bill Depew. Now we would-be jocks can step into the electronic shoes of a Jim Zorn, a Walter Payton, or a Jack Lambert to live our fondest fantasies in perfect safety. No injuries, unless you count acute "controller thumb," a malady now surpassing tennis elbow in popularity.

Cypher Bowl is attractively packaged in a sturdy, colorfully illustrated box. Both cassette and diskette versions are included (they run the same). The documentation is very good. The user manual explains the game clearly and gives good tips on playing techniques. Two playcards are included, laminated in plastic to withstand a lot of handling. Each playcard includes the offensive and defensive formations and plays. Sketches of each play show the patterns that the receivers, blockers, and defenders will run.

Wayne E. Hixson, 145 NW 36th Street, Seattle, WA 98107.
Sheldon Leeman, 14400 First St., Oak Park, MI 48237.

Wayne Hixson and Sheldon Leeman

Once you have read the instructions and studied the plays, the game can begin. The program is self-booting and no cartridge is needed. The opening display is of the title, manufacturer, copyright notice, and a portion of the field. The crowd roars, and you're ready to go! Pressing any key turns on the standard display.

creative computing

SOFTWARE PROFILE

Name: *Cypher Bowl*

Type: Football Simulation

System: Atari 400 or 800, 16K

Format: Disk or Cassette

Language: Machine language

Summary: Excellent combination of strategy and action

Price: \$49.95

Manufacturer:

Artsci, Inc.
10432 Burbank Blvd.
N. Hollywood, CA 91605

In the center of the screen are the field and the two five-man teams. You have a blimp's-eye view of the field, which runs vertically on the screen. The view is always centered on the ball. About 30 yards of the field are visible. The score, quarter, and time remaining are displayed on the top of the screen. On the bottom are the down, yards to go, and the time-outs remaining.

The game is played in four simulated 8-minute quarters. There is no kick-off. The blue team starts with the ball on their 20-yard line, with the white team defending the top of the screen. Each player begins by selecting one of four formations from the playcards. On offense, you can spread your receivers, or play them in tight. The defense can put everyone up front, or drop up to three players back to play pass defense. After both have chosen, the teams move into position.

The players scrutinize each other's calls, then pick one of four possible plays allowed for the particular formation. Offensive possibilities range from quick openers to the bomb. The defense can opt for a strong pass, strong run, or balanced defense. What you choose depends on the formation your opponent unveils. For example, if you call a defense strong against the run and the offense deploys in a spread formation, you can still make the best of it by calling a zone defense to protect against the probable pass. However, your chances are poorer than if you had elected a strong pass defense formation to begin with.

SINGLES' NIGHT AT MOLLY'S

By Norman J. Wizeney Jr.



You never dreamed Solitaire could be so fascinating.

Respite in a saloon can be fun, but it's better on your Apple.* Fate warning: If you get hooked on Solitaire, beware of this game! "Singles' Night at Molly's" is actually two basic solitaire card games with several variations permitting you to use the skill level and strategy you enjoy most. Play alone or against other players, where a rating system declares the winner. Features High Resolution color graphics, full user documentation and various scoring potentials. There are hours, days, even years of pleasure

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"Singles' Night" runs on the Apple II. AppleSoft is IBM. ©1988 SIB ON READER SERVICE CARD. S.D. DOUGLAS Disk Data.

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This method of play calling is well thought out and superior to the other games I have played. Both players have options after they see the other's call, instead of the defense only.

Another nice touch is the way *Cypher Bowl* handles the 30-second clock. There is no delay of game penalty, but the clock is automatically stopped after 30 seconds until the play commences.

If you make the right call, your left and will take the right line-backer out of the play, and leave a hole a truck could drive through.

The *Cypher Bowl* clock also stops between quarters, for the two-minute warning, for time-outs called by the players, and on incomplete passes and out of bounds plays.

After selection is complete, play is initiated as the offensive player moves the joystick. Instantly, the scoreboard information disappears and your view of the field increases to fifty yards. This is especially nice on pass plays, as the receivers would soon run out of view otherwise. During play, the offensive player controls the quarterback or the receiver, whichever has the ball.

As the manual points out, it is easier if you visualize yourself as controlling the ball, with the player coming along for the ride. On defense, you control the middle linebacker. The remaining eight players are controlled by the computer, following the patterns shown on the playcard.

Think about that for a moment. A total of ten players, moving in individual patterns. How? Aren't there only four players in Atari Player/Missile graphics? Yes, but *Cypher Bowl* shows just what a good programmer can do with this system. In order to get more than four players, single players are moved to different screen locations between TV frames, every 1/60 second. The images alternate so fast that the eye can't discern the change, except for some minor flickering.

As a result of the individual control of each player, blocking, passing, and pass coverage patterns are exceptionally realistic. If you make the right call, your left end will take the right line-backer out of the play and leave a hole a truck could drive through. However, if your opponent outguesses you and

fills that area, you will be lucky to get back to the line of scrimmage.

Cypher Bowl excels in its simulation of the passing game. This was also the hardest part of the game to learn. Not only do you have control of passing direction, you must also control distance. In the other games I have played, a thrown ball will travel indefinitely, until it hits a receiver or defender, or goes out of bounds. Any eligible receiver (offense or defense) in the path of the ball will catch it, whether 6 or 60 yards from the quarterback.

Cypher Bowl adds a third dimension—height of the ball above the ground. Now you can throw the ball over the head of the defender. Of course, this also enables you to overthrow your own man, which I have been able to do very consistently. A pass is launched by pressing the joystick button and pushing the stick toward the target. The distance is determined by how long you hold the button down.

The height of the ball cannot be shown on the screen, so sound is used. A rising tone indicates a rising ball, and vice-versa. Once thrown, you can control the direction of flight with the joystick to "fine tune" it to the receiver. I think that this is one weak point of the program. The ball is too controllable. You can start it toward one sideline and then steer it clear across the field, or even reverse it back toward the quarterback. The magnitude of control should be reduced to a little nudging.

Another superior feature of *Cypher Bowl* is the option to throw to either of two receivers on most plays. You also have some control of the receivers on pass plays. Once the ball starts its downward flight, pressing the joystick button causes the receivers to break off their patterns and move back toward the ball.

As you can imagine, orchestrating all this activity in the period of about two seconds requires a lot of practice, but what a feeling when you floor the ball over an onrushing linebacker to the tight end cutting back in front of the safety. A caution—there is only a five to seven yard window in which the receiver can catch the ball. If you overthrow, the defender is likely to get it.

You might think all this control would make an accomplished player unstoppable. Not so! This game provides a few tricks for the defense as well. If your defensive linemen get within a few yards of the quarterback before he throws, the ball will be batted down. Once the ball is in the air, you can make your defensive backs cut inward it by pressing the joystick button. All in all, the offensive/defensive balance is good.

The kicking game is good. The ball is kicked by pressing the button. Instead of going a random distance, the longer you wait before you press the button, the farther the ball will go. A split second too long, though, and it will be blocked. There is no difference between a field goal and a punt. If the ball goes between the uprights, it's worth 3 points.

I have played *Cypher Bowl* for over 30 hours now, and the more I play, the more I like it. The realism is a step above the other games I have played. The graphics, in spite of the lack of detail, are quite good. Player/Missile graphics, fine scrolling, and mixed modes are used very effectively. The animation is both smooth and fast.

The playability is good, and it's not an easy game to master. I'm still below 50% in the passing game, but I'm getting better. I think it is this continuing challenge in any game that keeps you playing it, along with the fun.

In summary, this is a worthwhile game. If you're a "stats junkie," it probably won't be your cup of tea, but if you like a sports game that makes you think and participate, I believe you'll love this one.

Now, guys, how about a solitaire version? I have a hard time finding opponents during my normal game-playing hours. —WH

Krazy Antiks

Don't be confused by the pun. The Antic that everyone associates with Atari computers is the support chip that makes possible the superb graphics needed for all of those neat arcade-type games. The Antiks in the title of this product refers to the insect you need in order to have a picnic. When the two get together, you wind up with a neat arcade-type game with great graphics, and everyone has a picnic.

Krazy Antiks is the fourth game cartridge released for the Atari 400/800 computers, and it bucks the trend of "me-too" arcade-style games. Lately it seems that everyone is trying to cash in on the arcade craze by serving the warmed-over remains to computer owners. Even K-Byte's earlier ventures into game programming tended to follow the heavily beaten path. But *Antiks* has just enough of a twist to be considered a new idea in a market saturated with rehash.

I must concede that the locale of the action is nothing novel—the ant hill in question strongly resembles the type of maze used in any number of games spawned by that prolific precreator,

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(By: Norman J. Wazaney Jr.)



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Action and Antiks, continued...

Pac-Man. But the scenario is a fresh one. You play the role of the White Ant, and your purpose is one familiar to students of biology—to perpetuate the species. You start the game with about 30 eggs, which represent your capacity to reproduce, at the bottom of the screen.

Arrayed against you are several adversaries. First, one ant each of the

turn the lower part of the anthill into a disaster area, minus the federal aid.

With the odds against her, the lone ant has little chance for survival. Fortunately, if she can find a safe place in the maze in which to lay an egg where it will not be eaten by another ant, after she is gone, the egg will hatch, and another white ant will take her place. Moreover, she has a weapon she can use.

The other ants are busy laying eggs also, and when she eats one of theirs, she begins to glow, letting you know that the next egg she lays will be deadly to the other ants, if laid directly in their path. At each level, play continues until the white ant is killed, without leaving any eggs in the maze, or until all four of the other ants have been killed without surviving offspring.

If the latter occurs, the game proceeds to the next level, and four new enemy ants come marching in to the tune of "When Johnny comes Marching Home" (which seems like to think of as "The Ants Go Marching Two by Two").

Each maze has 99 levels of difficulty. If that fails to provide enough variation, there are six different maze configurations to try out.

Krazy Antiks rates a high score for playability. Even an experienced player



four basic ant types—yellow, blue, green, and red—circulate around the maze, trying to devour you. Another natural enemy is the dreaded ant-eater, who strolls into the picture every so often and sticks his tongue into the anthill, sucking up friend and foe, ant and egg alike. Finally, periodically a rain shower

creative computing

SOFTWARE PROFILE

Name: *Krazy Antiks*

Type: Arcade

System: Atari 400/800 IIA

Format: ROM cartridge

Language: Machine

Summary: Put ants in your pants

Price: \$39.95

Manufacturer:

CBS Software
Columbia Group, CBS Inc.
Hagerstown, MD 21740

can get caught early on by a freak accident, which inevitably leads to "just one more" game. There is a pause option, for those disturbed by the inconsiderate intrusions of friends and family. Unfortunately, there is no multi-player option. But if you don't mind going it alone, you'll bless the day when ant met Antic. —G.

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PANDEMONIUM



Dragons, Acorns, and Other Micro-Innovations

Guy Kewney

I'm starting to have this vision of the computer of the future — one which shows it as a sort of puppet master, manipulating and directing external storage, external displays, external audio, external communications, and the like.

But unlike a puppet master, this computer will have nothing like the power of the things it controls.

This (perhaps unnecessary) philosophy was brought in by the most impressive display add-on I have seen, at the Personal Computer World Show in London.

In fact the device, called Pluto, is making me wonder whether graphics might not be just as versatile, useful, and profitable an area as microcomputers have shown they can be.

Pluto is a video platter capable of drawing 100,000 pixels per second. It

peaked at the show in London recently.

The really worrying thing about it is not the fact that this is less than the cost of an arcade games machine with a considerably lower screen precision and considerably slower computation — but the things that people are planning to do with it.

According to designer Graham Rowan, head of IO Research in London, the device has been keenly examined by writers of ordinary business software. They have, he says, "all gone away talking rapidly about the things they plan to do by enhancing their business programs with fast changing graphics."

The reaction is one micro pioneers will recall from the days when we all saw our first microcomputer running *Tim Basic* — the reaction which says, "Hey, this isn't marvellous; it's useful!"

On top of that, Rowan has been approached by advertising graphics designers, CAD specialists, entertainers, and a wildly varying host of different types all united only in their conviction that this is what they have been looking for without knowing it.

In particular, a local company called Robocom is connecting its BitStik to the Pluto. BitStik is nothing more than a swanky games joystick, used to move a rectangular "frame" around a display screen. The frame can be enlarged, and can be focussed onto the smallest detail on the screen. Then, that small detail can be expanded to fill the whole screen. Again, the frame can be focussed on a small detail, and that detail enlarged.

The BitStik can be used to draw, to position pre-drawn details, and to position color fill. Coupled with the incredibly accurate and fast color display of Pluto, the potential for designers makes the integrated circuit design machinery of the last ten years look primitive.

So far it has been interfaced to most popular micros available here, and the designers say that adding a new machine is the work of a few weeks only.

Micronet 800

The other big step forward for visitors to the PCW Show, was the arrival of Micronet 800.

There is no relationship between Micronet in America, and Micronet 800 in Britain, other than the name and the fact that they are aiming to do the same thing — provide an information handling and forwarding utility.

The basis of the British scheme is the famous Prestel (now called Teletex in fashionable circles) network which British Telecom, the old Post Office, set up in vain hopes of turning the country's TV sets into terminals.

It has at last dawned on them that it is easier to turn a pretty smart computer into a teletex receiver/transmitter, than to use an ordinary domestic television as a data display/responder.

By joining forces with an enterprising local businessman called Richard Heave, the Prestel authorities may have brought their baby out of its birth coma at last. Heave has fingers in publishing, and in computer retailing, being the first distributor to be appointed by Clive Sinclair here. Normally, Sinclair restricts himself to selling through the mail, or a chain of stationary stores, W. H. Smith.



The Pluto video platter can draw 100,000 pixels per second. 16,000,000 colors is a bit of an exaggeration; 256 is more like it but still a lot.

uses 192K of very fast storage to do this, and has its own Intel 8088 chip (the one inside the IBM PC, the Digital Rainbow, and the Victor 9000) to control it.

The really interesting thing about it is not just the detail, nor the speed, nor even the fact that each pixel can have its choice of any of 256 colours.

It is the £600 sterling price tag which the little box was carrying, when it ap-

Guy Kewney, 38 Ditch Green, London SE 20R.



Pluto generated the image on the screen faster than you can read this caption.

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His plan is to have a big database of free software, predominantly games, and to sell a £1 sterling per week subscription to owners of popular micros, which will enable them to use Prestel as their program storage area.

Any program held on Prestel can be downloaded, say the Micronet 800 people, in far less time than it takes from tape, and very reliably. The key to the scheme, of course, is the cost of connecting a computer to the phone.

The big breakthrough that Heave and his colleague Bob Denton hope will be ready for the official launch in January, is a £50 sterling modem plus interface, suitable for the Sinclair ZX81 and similarly cheap micros.

And for the bigger machines, they hope still to keep the hard-way solution to around £100 sterling.

If the plan works, said Micronet 800 managers to recruit the necessary 10,000 subscribers by June, Prestel will take one of its spare computers out of mothballs, where it has spent the last year waiting for the expected boom in teletex. Heave will then be able to start using the net-



Bob Denton of Micronet 800 aims to sign up 10,000 subscribers for £1 per week to download software, mainly games, from a huge central database.

work to sell business software on a "try it on the screen, order it through the network" basis. Electronic mail will be free after business hours, but profitable during peak time.

At the Show, Micronet 800 were demonstrating several simple software download routines, which actually appeared to work.

Acorn Ecoset

Even more impressive to the visitor, however, was the Acorn stand, where the maker of the BBC Microcomputer was demonstrating local networking.

Acorn's Ecoset was evolved in response to classroom needs — where one machine is useless, and simple multi-keyboard access even more so. Ecoset gives every Acorn processor (or makes two: the BBC and the Atom) access to a central file server with hard or floppy disks, and freedom to use an



Ecoset from Acorn allows both Atom and BBC machines access to a central file server (left foreground) of hard or floppy disks.

area of that disk system as its own. In addition, it allows the file server to monitor each node, copy the screen at that node, and observe when system calls are being made. If necessary, the master system can be transferred to any node.

Best-seller of the show was an Acorn machine, the expanded Model B of the BBC micro. It was in plentiful supply, despite a chronic shortage of machines from Acorn. Where, asked angry users, were these machines coming from, when they had all been waiting up to nine months for their own models?

The answer, it seems, was that certain dealers who were out of patience with Acorn's slowness in building up volume production, had taken matters into their own hands. They had ordered the upgrade parts, paid money for the readily available Model A, and had done the conversion themselves.

This perfectly plausible explanation failed to satisfy many, who went about muttering about black markets and corruption in official circles. Others, more practically minded, switched their orders to a machine called the Dragon.

The Dragon

This was also selling well at the show, being essentially a Tandy Color Computer for £200 sterling. The machine is so essentially a color computer that it



The Dragon 32 is a British-made computer that is software compatible with the Tandy (Radio Shack) Color Computer.

will, if you take a color computer cartridge and file off the bumps, run most Tandy cartridge games.

It proves how wrong Tandy has been by being so reluctant to let anybody other than a Tandy store sell Tandy micros. Britain is sparsely supplied with the Texas company's outlets, and sales are proportionately lower than in the U.S. Everybody knows this, it seems, except Tandy, whose British executives resolutely insist that its products sell entirely on merit, and that distribution has nothing to do with it.

The Show

The show itself was a great success in its own right. People through the door were counted at over 50,000, making this the biggest micro show in the world now, and all that is really needed is a better venue.



EOS (Electronic Office Systems) had an immense stand (booth) at which they were showing an impressive array of hardware and software, mostly for the IBM PC.

The Barbican has space enough for the exhibitors, but not for the visitors — not surprising, as the building was put up as a multi-story car park, before it was discovered that there was more demand for exhibition space than car parking.

Organizers of the show still fail to arrange a trade-only day. Pressure from disgruntled exhibitors will certainly lead to that mistake ending next year.

Finding another venue, however, won't be so easy. It is a matter of dubious legality, but a rival exhibition organizer is able to prevent any other computer show besides its own from being held at either Earl's Court or Olympia stadia, under the terms of its contract with the hall owners.

The owners have a virtual monopoly of suitable sites in London. Until somebody, with the money needed to challenge this monopoly in the courts steps forward, PCW must choose between London and comfort. And for the next year, at least, London will be the higher priority. □

Random Observations On Life In England

Telephones, Toilets and Car Parks

Betsy Staples

Last year in our report on the Personal Computer World Show we commented on, among other things, the showers and telephones in England. The showers haven't changed much, but here we bring you an update on phones and other items of interest to readers who want to learn about life beyond Harold's and the Inter-Continental.

This year, I, liberated, independent woman of the world that I am, flew to England alone, rented a tiny Ford Fiesta, and set off to see the countryside.

The few difficulties I had driving on the right side of the road were the result mainly of my preconceived error. It wasn't bad at all. But then, I can't tell my left from my right, don't know which way faucets are supposed to turn, and have to think every time I unlock my front door.

I drove to Oxford and staggered into a 200-year-old inn with 6'5" ceilings and stairs of different heights. As I chatted with the proprietor, he suddenly lowered his voice to a confidential whisper and asked, "Why are you traveling alone? Did you have a fight?" I attempted to explain the situation to him, but should have been hereawards; it was a question I was to ask myself more than once in the coming days.

After spending a day each in Oxford, Bath, and Salisbury, I concluded that traveling alone is for people made of sterner stuff. It just wasn't for me, and I will not give up eating, so distasteful did I find sitting alone in strange restaurants.

Parking the Car

Thanks to my rented car, I did discover an interesting British innovation that I had not noticed on previous trips: automatic car parks, as parking lots are called. The best kind provides a numbered card from the automatic card-spinner-unit at the gate. As you leave, you stop the car at a little check-out station right before the exit gate. You enter the number of your card through a membrane keyboard, the display flashes the amount you owe, you deposit the correct amount, the gate rises, and you drive away.

The other kind is similar to our metered lots, the main difference being that there are only three or four meters per lot or level. You park your car, walk to the nearest meter, set a dial for the

amount of time you plan to stay, and deposit the indicated amount of money. A slip of paper with a bit of mechanism on the front emerges from the machine. You then return to your car and stick the paper in your windshield. I never saw anyone parking or checking these lots. I suppose they rely on the innate honesty of the British people.



It does strike me as strange that a country with such a high rate of unemployment which has failed to automate some of the lowliest functions known to man, would eliminate such a good source of low level jobs.

Cleaning the Toilet

And speaking of automation and low level jobs, there is in London at least one automatic toilet. David Tibbitt of Custom Software took us (by this time I had met Dave Ahl in London) to the ultimate in modern sanitation right on the sidewalk in Soho Square. When you place the appropriate coin (about 10 pence, I think) in a slot in the shiny, white, cylindrical structure, a door slides open and you enter a (presumably) sanitary little restroom. When you are ready to leave, the door slides open, you exit, the door closes, and the whole interior (we were

told) is brosed down, shaken up, or otherwise washed and sanitized.

There is only one catch. If you stay longer than 15 minutes, the cylinder concludes that something must be wrong, opens the door, and begins its cleaning cycle. Rumor has it that more than one unfortunate soul has been caught with his pants down.

Sanitizing the Phone

Sanitizing, it seems, is something which is of great importance to the British people. For example, when was the last time you looked upon your telephone as a vector of disease? Not too recently, right?

Well, here is something to join Toxic Shock Syndrome, Extra Strength Tylenol and Copperheads in Northern New Jersey on the list of "Things We Never Had to Worry About Before": filthy phones.

The first time I saw the cherry Phonotas woman on a poster in an Underground station I thought it was a joke. "Keep your conversation clean!" she urged. "Call Phonotas to clean the whole phone!" Come now, they couldn't be serious.

So incredulous was I that I called the number given on the poster. A very earnest man answered and explained that the service was offered only to businesses and that he could not give me any idea of the cost until one of his representatives had visited our offices and made a thorough survey.

He explained further that Phonotas provides a uniformed cleaner who comes to your office weekly and "sanitizes" the receiver against infection. The process takes about one minute per visit per phone "except, of course, the first time when it usually takes longer to get the phone up to scratch."

He asked for my address, promising that a salesperson would call within the week. I hadn't the heart to tell him my office was in Morris Plains, New Jersey, USA, so I mumbled something about calling back when my phone was dirtier and hung up.

My conclusion: the phones in England don't work any better than they did last year, but they must be cleaner. Perhaps that's what has become of all the former parking lot attendants — they have become phone cleaners.

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The Third European Microcomputer Chess Tournament

The Third European Microcomputer chess tournament, held at the Barbican Centre during the PCW exhibition, September 9-12, 1982, proved once again that computer chess is a thriving force.

A seven round Swiss tournament is always an exciting affair with something of a lottery about it. The basic rule of such a tournament, for those who are unfamiliar with Swiss events, is that winners play winners and losers play losers. Each time the draw is made for a new round, the tournament director tries to pair opponents with the same scores against each other.

Because of this, the going gets easier for the weaker players (programs in this instance) and more and more difficult for those who are doing well. It is a sure way of finding the strongest player/program in the tournament. And it produces some marvellous final rounds.

This year's concluding round was in a class by itself, with the eventual overall winner, Mark Johnson and David Wilson's Advance 2.4, saving its unbeaten record at the last moment by a quirk of fate peculiar to computer chess.

But even at that final round later. Like all chess tournaments, even the human kind, this event began long before any processors found their way into the playing hall in the Barbican Centre.

This year there was an added complication to the usual organisational difficulties that surround such an event. Six months before the tournament was due to

Anthony Harrington

begin PCW changed hands. Burch Binks, the former owner of PCW, who staged the first European tournament back in 1979, sold the magazine to VNU Publications, a Dutch publishing group.



The prototype chessboard for the German machine Angel (foreground) was built by an excellent craftsman who knew making chess boards (note the white squares in the bottom left corner). Here it is, playing against the Regence from David Levy's Intelligent Software Company, the eventual commercial victor.

On top of this change, David Levy, the international chess master, and the man responsible for organising the tournament in previous years, decided, quite rightly, that his commercial interests in computer chess programs made it impossible for him to continue to organize the event.

The upshot of all this was that invitations and entry forms went out on short notice, a month before the tournament was due to start. Nevertheless, the tournament attracted a very strong field, totalling 14 entries in all. This was two more than last year, though program failure in the case of two entrants meant that the numbers actually contesting the tournament turned out to be identical.

Commercial Entries

The final line-up included four commercial entries (programs or dedicated chess computers actually on sale to the public or which would be available before the end of the year) and four experimental entries from commercial companies.

It might have been even stronger had Fidelity, of Miami, FL, whose Seneca Chess Challenger 9 is one of the strongest chess computers around, decided against entering a week before the start. (According to John Reschke, Fidelity's marketing manager they were considering entering either a commercial model or an experimental entry or both.)

The West German company Degener and Glaser, who make the Meghisto, also almost entered, but decided at the

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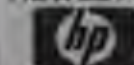


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Chess, continued...

last moment that they didn't like Swiss tournaments and would concentrate instead on the US World Championships in March 1984.

One has to sympathize with commercial companies. They have a lot at stake as far as potential sales are concerned. And if their machine, for some reason, fails to win one of the top three placings in a tournament it is tempting for their managing directors to feel that the public will take the hint, and buy the machine which did better.

My own feeling here is that they would do better to compete. If they do feel their commercial model is a little delicate, there's no harm in entering an experimental version. It would give these programmers a chance to test their ideas, and the results wouldn't affect their market share, provided the name given to the experimental entry bore no relation to the market model.

Still, if one remembers that this commercial class in the World Championships, held at Lübeck-Travemünde, West Germany, in September last year, consisted of only four entries, one of which withdrew after a few rounds, the commercial line up wasn't bad. And the amateur entries were excellent.

Amateur Entries

It is the amateur entries that make these events. Unburdened by the financial anxieties of the commercial entrants, the amateurs give the tournament its enthusiastic, convivial atmosphere. Whereas commercial competitors have a tendency to get a little grim at the board and to be sharp and short with opponents, the amateurs tone down the seriousness of it all—and are just as willing to laugh at the odd strange move generated by their own program as they are at their opponent's.

In all there were five amateur entries. From Hamburg, Dieter Steinwender, a computer science student, led a team of four German students with an entry

called *Microturks*, running on an Apple II.

Also on an Apple II was *White Knight* (MK III), written by Mark Bryant. This, like Richard Lang's *Cyrus II*, running on an Osborne, was an improved version of a program entered into last year's PCW tournament. Mark Johnson and Dore Wilkins, with *Advance 2.4* and Jeff Cooper with *Chess '86*, also teamed PCW tournament campaigners, completed the amateur turnout.

In passing, one should probably say that the "amateur status" of several of these programmers simply means that they are not selling or about to sell their entry programs, (though they might, if an offer came along). Johnson, Bryant, and Lang are all employed by Intelligent Software, a company set up by David Levy and Kevin O'Connell to write and market chess programs (and other intelligent games).



Spectrum Chess from Arctic for the Sinclair ZX81 held its own against much more powerful competitors such as Sci Sys' MK 5.01 experimental entry (foreground).

Experimental Entries

In the experimental commercial class (programs which won't go before the public in their present form), there were two entries by SciSys, one Hong Kong based company whose machine, Mark V, won the Travemünde world championships. These were the Mark 5.01 Experimental and the President Turbo Experimental. The Austrian chess programmer Wim Rens, sponsored by the UK firm Microtrend entered a program

called *Gambit '86*, and Intelligent Software put in an entry called *Philide*.

The commercial section proper, consisted of *La Regece*, a "sensory-board" chess computer designed by Intelligent Software; another sensory-board machine, called *Bogol*, by the Hamburg company Omikron (a newcomer to the commercial chess machine market); *Spectrum Chess*, which runs on the ZX Spectrum, designed by Arctic Computers; and an Irish entry, *Conchess*, another sensory-board machine.

On the morning of September 4 the competitors assembled in the playing area in the Barbiican Centre, set up their machines and programs and promptly experienced the first (and, thankfully, the last) major delay of the event. Someone had wired up a plug incorrectly and blew the fuse for that entire floor sector of the Barbiican exhibition hall.

Bear in mind the fact that the tournament was part of the PCW micro exhibition and hundreds of micro suppliers were putting the finishing touches to their stands while we were hunting for an electrician and you will get a fair picture of the start conditions.

Round One

Finally, after a half-hour delay an electrician was found to fix the fault and uncover the culprit, who shall be nameless, and the first round began. The draw and results for the first round are shown in Figure 1.

Play for the whole of this tournament was at the rate of two minutes a move, with the first time control at 30 moves in the first hour and then 23 moves in 46 minutes. This is a somewhat faster rate than is usual in tournament play, but it was forced on us by the tight closing hours of the exhibition.

Doors opened for the players and exhibitors at 9:30 a.m., (10:00 a.m. for the public), and closed at 7:00 p.m. In order to get through two games a day, we had to limit each round to approximately 3½ hours.

Players were allowed a maximum of 30 minutes down time to rectify any program crashes, as the possible duration of each round was 4½ hours. Since the theoretical starting time for the morning



Figure 1. Draw and results, Round One.

Advance 2.4	½	Philide	½
Spectrum Chess	0	Cyrus II	1
La Regece	1	Chess '86	0
Gambit '82	0	President Turbo	1
Conchess	1	Mk. 5.01 Exp.	0
Microturks	0	White Knight	1
Bogol	0	(Default)	

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Chess, continued...

Figure 2. Draw and results, Round Two.

Cyrus II	(1)	1/2	Conchess	(1)	0
President Turbo	(1)	0	La Regence	(1)	1
White Knight	(1)	0	Advance 2.4	(1/2)	1
Philidor	(1/2)	0	Bogol	(0)	1
Mk 5.01 Exp.	(0)	1/2	Micromarks	(0)	1/2
Chess '86	(0)	0	Gambit '82	(0)	1
A.N. Other	—	1/2	Spectrum Chess	(0)	1/2

Figure 3. Draw and results, Round Three.

La Regence	(2)	1	Cyrus II	(2)	0
Bogol	(1)	0	Advance 2.4	(1 1/2)	1
Conchess	(1)	0	President Turbo	(1)	1
Gambit '82	(1)	0	White Knight	(1)	1
Spectrum Chess	(1/2)	0	Mk 5.01 Exp.	(1/2)	1
Micromarks	(1/2)	0	Philidor	(1/2)	1

Figure 4. Draw and results, Round Four.

Advance 2.4	(2 1/2)	1	La Regence	(3)	0
Cyrus II	(2)	1	President Turbo	(2)	0
White Knight	(2)	1/2	Mk 5.01 Exp.	(1 1/2)	1/2
Philidor	(1 1/2)	1	Conchess	(1)	0
Bogol	(1)	1	Gambit '82	(1)	0
Spectrum Chess	(1/2)	1	Micromarks	(1/2)	0

round was 10:00 a.m., and for the afternoon round, 2:30 p.m., a little mental arithmetic will tell you it was a close squeeze fitting both rounds in.

Because of the time pressure, it was decided to adjudicate all unfinished games at move 33. This set the tournament director, Stuart Reuben, some complicated adjudication problems in the course of the four days.

This first round was characterized by two events that looked more like accidents than things that would shape the outcome of the tournament. Advance 2.4, running on a home constructed 16-bit machine found itself playing the white side of what must be one of the most boring Benoni defenses of all time.

Philidor, the opposing program constructed a blocked middle game in which the best either computer could think of doing was to shuffle rooks back and forth. The programmers read the papers while waiting for the inevitable draw by repetition. Fortunately Advance 2.4 went on to win the next five games in a row, in more aggressive fashion.

While this was going on, the Danish team of Martin Suhl and Gerd Krey were busy missing the first round. Unfamiliar with London traffic, they'd made the mistake of taking a taxi from Oxford Street instead of a tube. Their program, Bogol went on to win four out of the remaining six games, and who knows, was in this opening round might have seen them draw level for top commercial entry with La Regence on 5 points.

The Second Round draw and results are shown in Figure 2.



Along with the 3rd Microcomputer Chess Tournament at the PCW Show, the Computer Scrabble Tournament proved popular with participants and spectators alike.

Figure 5. Draw and results, Round Five.

Advance 2.4	(3 1/2)	1	Cyrus II	(3)	0
La Regence	(3)	1	White Knight	(2 1/2)	0
President Turbo	(2)	1	Philidor	(2 1/2)	0
Mk 5.01 Exp.	(2)	0	Bogol	(2)	1
Gambit '82	(1)	1	Spectrum Chess	(1 1/2)	0
Micromarks	(1 1/2)	1/2	Conchess	(1/2)	1/2

Figure 6. Draw and results, Round Six.

President Turbo	(3)	0	Advance 2.4	(4 1/2)	1
Bogol	(3)	0	La Regence	(4)	1
Cyrus II	(3)	0	Mk 5.01 Exp.	(2)	1
Conchess	(1 1/2)	1	White Knight	(2 1/2)	0
Philidor	(2 1/2)	1	Spectrum Chess	(1 1/2)	0
Micromarks	(1)	1	Gambit '82	(2)	0

As the keen-eyed will have noted, the tournament had 13 entrants at this stage, though this was soon reduced to even figures for most of the tournament. Chess '86 collapsed during its game against Gambit '82 and Jeff Cooper only managed to rectify it in time for the final round.

The day was exceptionally warm and the Barbican Centre was attracting record crowds. Computers don't like heat and several of them began to show their dislike. One of the SciSys entries, President Turbo overheated in a complex middle game against La Regence. It was a miracle that the President Turbo started the tournament at all, as Andrew Page, the SciSys UK general manager only received the module late the previous evening by airmail from Hong Kong.

Ideally, he would have liked a few weeks to test the program before the tournament, and we had to admire the competitive spirit that chose to enter rather than withdraw under such circumstances.

Later Rounds

Round Three draw and results are shown in Figure 3.

Richard Lang won last year's tournament and his program, Cyrus II had looked good up to this point. But La Regence proved too strong. Dieter Stitzwender and the German team were becoming very disappointed with their program, which was showing definite flaws.

Round Four produced one of the key games of the competition.

La Regence put up a close struggle against Advance 2.4, and the game went in the 53 move adjudication but Advance 2.4 was two clear connected passed pawns up in a rook ending and Stuart Reuben had no hesitation in awarding it a win.

Chess, continued...

Figure 1. Draw and results, Round Seven

Mk 5.01 (top)	(1)	1/2	Advance 2.4	(3 1/2)	0
La Regence	(5)	0	Philidor	(7 1/2)	1
Bogol	(3)	1	President Turbo	(3)	0
Cyrus II	(3)	0	Micromarks	(2)	1
White Knight	(2 1/2)	1	Spectrum Chess	(1 1/2)	0
Gambit '82	(2)	1	Cinchona	(2 1/2)	0

No one knew it at this stage, but Cyrus II had won its last game, beating President Turbo on adjudication. Keuben had his work cut out in this round, for White Knight and the Mk 5.01 also had to be adjudicated. This last was a very complex position, which either computer

could have muffed with ease. A draw seemed the fairest conclusion.

Round Five saw White Knight and Philidor falter and lost their way, though Mark Bryant with a final score of 5 1/2 was still to finish strongly enough to take the second amateur placing and a cheque

for £50, while Philidor, on 4 1/2, would take third place overall in the tournament.

The game against Bogol was a stiff test for David Levy's La Regence in Round Six, and it was not without its commercial appeal as well as its chess interest, for both these sensory-brain machines are due to be marketed before the end of this year.

After this loss, Martin Sald was undecided whether he was pleased or disappointed with the performance of his machine. No obvious flaws had been detected and in three wins very, very reasonable chess games. In retrospect, the two losses Bogol suffered turned out to be to the machines which came first and second overall, and after picking up another point in the final round, the German team went home smiling.

Philidor had an easy game against Spectrum, but Richard Turner, of Arctic Computing thought that the ZX program had held its own well against computers that were very much more powerful. It was the only cassette tape module program in the competition and this is one area where one can expect a greater number of entries next year. Advance 2.4 by this stage looked unstoppable, and it duly crushed President Turbo with a five-point attack.

The final round was full of surprises. The Mk 5.01 played a starvelous game against Advance 2.4, was material in the opening and looked set to force mate by move 26. But Advance 2.4 held its own although two moves down, managed to find a position where it could force perpetual check with its queen—the human equivalent of a "swindle".

On board two meanwhile, the Intelligent Software entries finally came up against each other, and much to everyone's surprise, Philidor, which hadn't done much of note till then, chose that moment to play a complex, crafty game against the fancied La Regence and stopped its stable mate from winning 6 out of 7 games.

So although the final round had started with the faint possibility of a tie for first place between La Regence and Advance 2.4 (if the former won while the latter lost), the gods decided otherwise and gave us a clean, clear winner.

Mike Johnson and Dave Wilson took away just about every prize on offer. They won the trophy for the overall winner of the Third Microcomputer Chess Tournament, the trophy for the best amateur entry and a cheque for £150. La Regence was named as the best commercial entry to the tournament and Mark Bryant, as we said, collected a cheque for £50 for the second highest placed amateur entrant.

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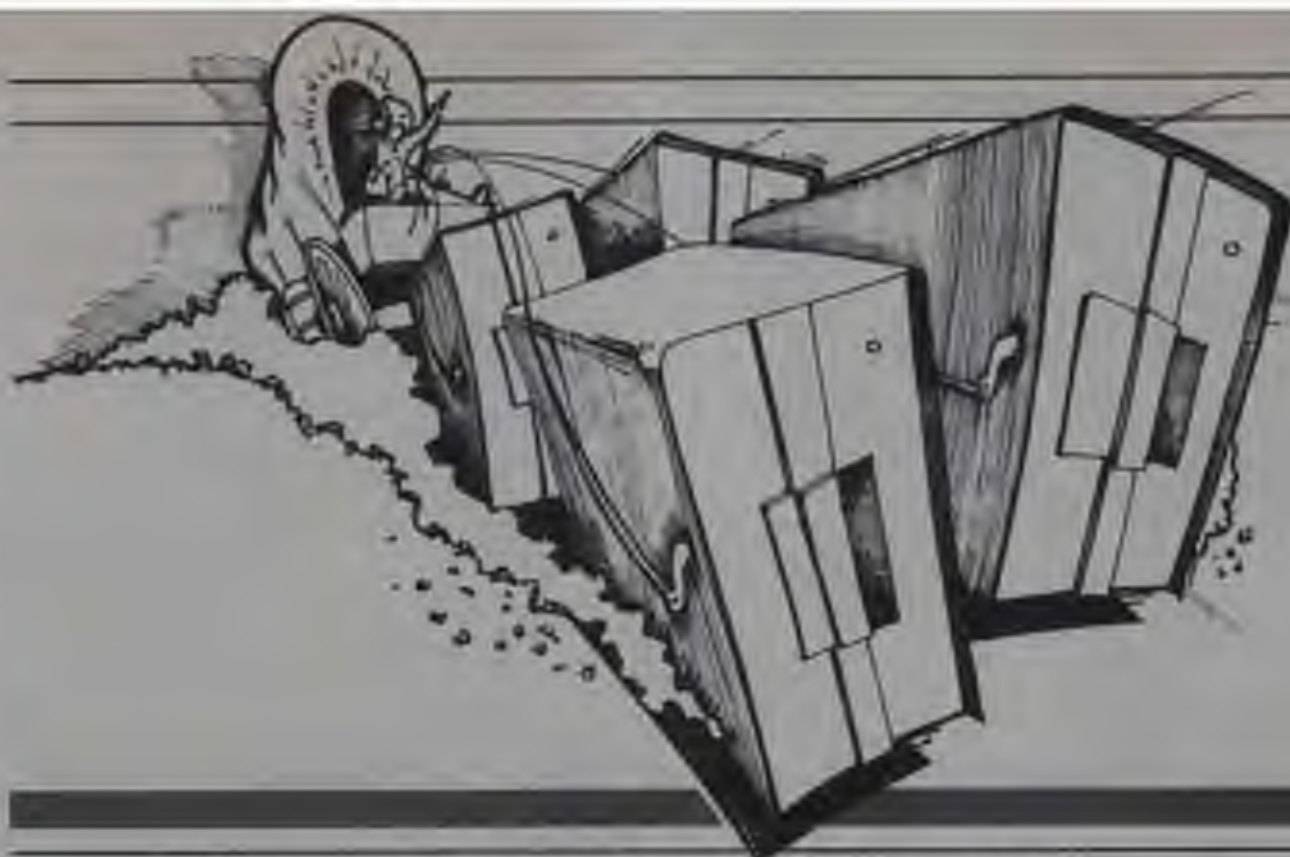
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Logo Ideas

Robert Lawler

Microworlds And Learning

The central problem of human education is how to nurture while respecting the self-constructive character of mind. Teachers face a terrible dilemma in motivating children to do schoolwork that is not intrinsically interesting. Either the child must be induced to undertake the work by promise of some reward or must be compelled to do the work under threat of punishment. In neither case does the child learn his attitudes on the material to be learned. The work is done as a bad thing because either it is an obstacle blocking the way to a reward or it is the cause of the threatened punishment.

Psychologists know that much of learning is a gradual process, one of familiarization, of stumbling into paradigms and resolving them by proposing simple hypotheses in which a new problem is seen as similar to others already understood, and of performing simple experiments to test the latest theory.

Microworlds can be seen as worlds designed for virtual, simulated experiences, worlds with agents and processes that can get to know and understand. Properly designed microworlds embody a local representation of the main entities and relations of some domain of experience — geometry and music are two examples — as understood by experts in the domain. This is where the knowledge of the culture is made available to the very world in which the microworld is defined.

The child's appropriation of that knowledge is made possible by the microworld not being focused on problems to be done, but on "near phenomena" — i.e., the primary manifestation of the power made available by knowledge about the domain. If there are near phenomena, then the challenge to the knowledgeable expert is to focus on so much a presentation of the elements of the domain that even a child can grasp its essence. The value of the computer is in building the complex model which an expert can imagine as an accessible entry point to his own richer knowledge.

If there are no near phenomena that a child can appreciate, there is no human that knowledge of the domain can serve him. He should not be exposed to learn about it until he is personally engaged with other tasks which will make the specific knowledge learnable as a supporting prerequisite to something desirable he knows.

Robert Lawler, Texas Machine Intelligence & Research Institute,
Dallas, Texas

The Idea Of A Formalism

A formalism is a set of symbolic objects that are related by the operations or manipulations that can be performed on them. Everyday arithmetic is an example of a formalism: the numbers are related to one another by addition, subtraction, and so forth. We often use formalisms, such as arithmetic, without asking what there is about them that really makes them useful in thinking.

The mathematician-philosopher Whitehead raised this question about the calculus, another formalism, and proposed an answer of the following sort. A formalism is useful because it gives you the best thing to worry about. You learn a set of rules of almost mechanical manipulation; then you can concentrate on how to apply them to a specific situation about which you want to know more. You judge the applicability of a mathematical formalism by whether or not its procedures correspond to what happens in the problem domain.

A programming language such as Logo is also a formalism — but, one whose focus is more on its structure, use than on its symbolic protection. In this sense, the Logo language is a kind of empirical mathematics, one whose value does not depend upon mechanically repeating perfectly a set of rules. One can begin with a fairly primitive and perfect it by debugging — trying the version held to produce the needed result — a better one is discovered along the way. Eventually, one may become sufficiently expert to compare perfect code, but it is not necessary that one ever do so.

A related requirement for perfection is one reason why that Logo programming compares with the child's other experienced formalism, arithmetic. This is important because in the world of exact geometry, the domain of design is so rich that intelligent words can often be more accurate than what the programmer first intended. This is a direct contrast with arithmetic — in which words are of positive value only to psychologists. There is a second sense, however, in which Logo programming requires perfection as much as any other formalism. When one is committed to a specific result, specific operations must be performed in the correct order to achieve that result. Because of the relative richness of the error points in little problems, Logo may be a more accessible formalism — and a more effective one — than children commonly met before the advent of computers.

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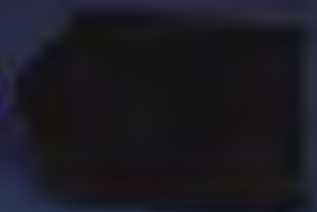
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CIRCLE 17 ON READER SERVICE CARD

When is Computer Art Art?

Art is a tricky subject. Everyone recognizes various kinds of objects they call art. Concentrating on the visual arts, what art is to most people usually limits itself to framed pictures hanging on walls. Obviously this may cover a very wide range of pictorial images, from pictures of flowers and landscapes, to abstract images and colorful designs.

The criterion for art most people apply is that a picture must be pleasing to them, and that it must be, at most, complex to the point that it does not quickly vanish in boredom. This means that when a person catches a picture in his eye, it should at least fascinate. But is it art?

Everyone realizes that there is a vast corpus of objects which some people call "art" that differs from what they call art. What is the difference — is it just a matter of snobbery? Are the serious art lovers, who embrace a dizzy succession of objects that sometimes seem to verge on the ridiculous, fooling themselves? To put it bluntly: is modern art and the avant-garde you read about sleepily, full of boredom?

To begin with, many art critics feel that there is no longer an authentic avant-garde. Take for example Hilary Kramer, who recently retired as critic for that most prestigious culture center, *The New York Times*. Kramer suggested in his own way that our eager appetite for innovation, our readiness to accept the arcane, the outrageous and the unfamiliar, has killed the very idea of an avant-garde. Regardless how shocking or radical the art form, powerful galleries, museums, and collectors instantly embrace anything that comes along, competing for the honor of discovering something new in art. And to make matters worse, government agencies, businesses, and private foundations stand ready to back them with as much money as they need.

Critics and concerned artists have been watching the march of art fashions over the past 50 years with horror. Realism disappeared, expressionists came



Robert E. Mueller

into being, realism was born, abstraction emerged, non-objective art exploded forth, followed by a stream of fads and fancies including Pop Art, minimalism, and field painting, only to return eventually to realism.

We must conclude that anything goes in modern art, because the norm seems to be that there is no norm. And if the major critics of aestheticians are confused, what about the rest of us? We must ask ourselves the same question Aristotle, Tolstoy, Kant, Susanne Langer asked: What, after all, is art?

Back in 1976 I wrote a little article published in *Art in America*, and reprinted in *Creative Computing* (May/June 1978), that attempted to apply my years of training as a visual artist to the efforts of computer specialists who dabbled in pictorial graphics. I took a look at the images which computer people were creating back then, from the standpoint of an art specialist, and tried to come to some critical conclusions which might help future "computer artists" in their efforts.

Since then I have read many criticisms of computer graphics, seen many shows, studied many books on the subject. I

have discovered very little to change my views on the subject — which means either that I am stagnant, or that my critique still holds up. (See here.)

If It Is Visual Must It Be Art?

In general, most theorizing about computer graphics as art is upbeat and measuring. Seldom is a question ever raised about the validity of computer art as art. The assumption is that since it is visual, it must *perforce* be art. This viewpoint is not only naive, it is sloppy thinking.

The word *art* is taken in its first level dictionary definition as a "skill acquired by experience, study or observation." This definition neglects the conscious use of the creative human imagination for the fabrication of valuable, human aesthetic objects, and never thinks of art as being something with a long history and tradition.

Those with some knowledge of art history frequently put on blinders, rationalizing that their attitude will permit a fresh start in a confused, stagnant field — which admittedly it is. But there is no use reinventing the wheel.

I wish to suggest that traditional art training has something to teach us as computer artists. My reasons are probably selfish: I am a visual artist with a vested interest in many tired old media. I

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Computer Art, continued...

paint in oils (abstract and expressionistic), do traditional woodcuts and drawings, and sculpt occasionally in wood and clay. But I have also dabbled about electric media for many years. See my article entitled "Electric Media," in an early issue of *Creative Computing*, and my book *The Science of Art: The Cybernetics of Creative Communication* (Dag, NYC, 1967).

I have been trying to apply my M.I.T. science background, and N.Y.U. aesthetic/philosophy training to the problem. My conclusions have been hopeful, but the practice I observe is discouraging. Where is there an art using the computer and video media that even vaguely transcends its inherent mathematics-design-feedback design qualities? Or where is one that does it, and succeeds in fascinating me?

Perhaps I am too immersed in the old media. But there are, after all, art schools. People spend many years studying art, learning about art, trying to discover the techniques of picture-making. The chances are that these people are not all kidding themselves. Out of the many academies of art must have come some expertise in the creation of visual images.

It may be true that this expertise is supplanted from time to time when another aesthetic comes along. This is what makes art evolve like an organic thing. But by and large, certain "rules" have emerged that seem to apply consistently to (most) art forms. I hedge because there are no absolutes in art (no more than in science, although admittedly less definitely so) — which is why people seem to be justified in saying that

anything goes in art. The feeling is that art judgment reduces to what you like and don't like. But this is far from the truth.

Fascinating The Critics

I do not believe that this non-creation for creating interesting visual images takes you very far in the direction of originality. Let us then agree, at least partially, that we would like our computer art to be original to the extent that it would fascinate a critic like Hilton Kramer. Assume, that is, that we must make

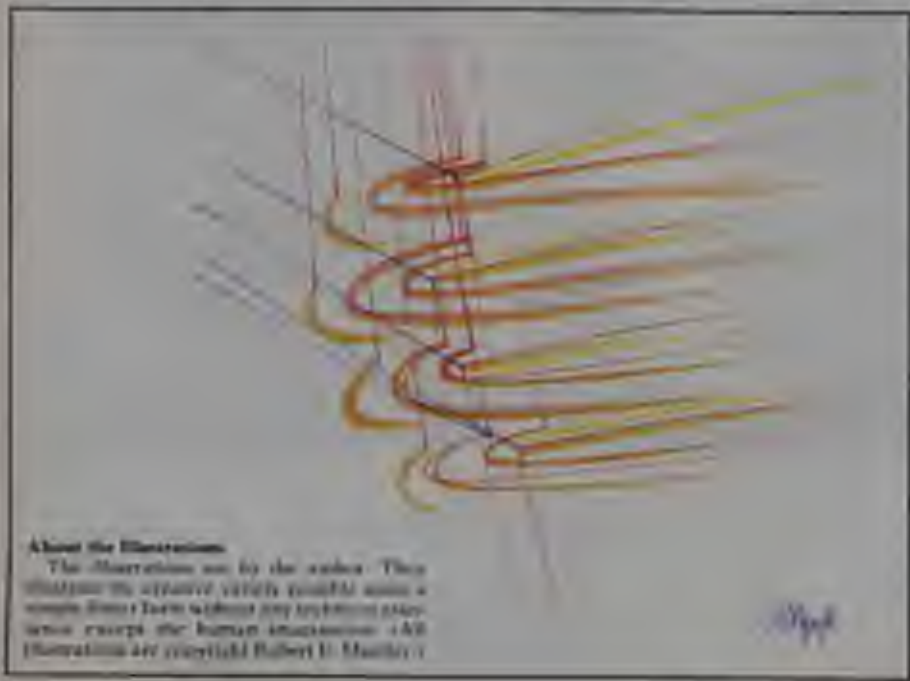
images at least as good as — as interesting as — the best in art which currently abounds in the non-computer world. How do we accomplish this? My answer is that we must apply the same criteria to computer products practicing artists use in their craft, regardless the medium.

We must be, first and foremost, cynical. We must not accept something which the eye in its naive state thinks is fun, exciting, bizarre, beautiful. The eye, so all know, can be fooled very easily — witness optical illusions. Is this art?

Also the mind can be fooled easily — particularly when it comes to what is called "beautiful" in this world. People, especially children and young people, lovely women, and sometimes men, are beautiful; sunsets are beautiful; flowers, nature, landscapes, seascapes and clouds are beautiful. Are images of them all automatically artistic?

We suffer from what the philosopher William Barret calls "the illusion of technique." It is easy to get carried away with technique because it can be so much fun, and so automatic. Especially if you have a powerful technical device like a computer or a holographic camera or a dye-laser to play with. These machines in and of themselves, entirely automatically, have an autonomous quality which, when made visually, comes great wonder.

We must therefore be highly critical of what we call art when it comes out of a computer, particularly if we advertise it as "fine art." Otherwise the cultured world with knowledge of art will think, and rightly so, that we are kidding ourselves.



About the Illustrations

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Ali Baba

AND THE FORTY THIEVES



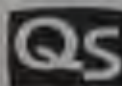
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I am sorry to say that a program like *Now* showing computer specialists turning out what they think is serious art, can appear ridiculous to a practicing artist — at least it did to me. The same applies to much computer music — it makes good background music for movies like *Star Wars*, with added visuals made up of the video feedback or lasajou variations, but that's about as far as it goes for the trained artistic observer. You tend to forget it easily, and have absolutely no desire to hear it again.

Constructive Criticism

Don't get me wrong. I think that the computer and all other electronic transducers are important for art. In fact, it is because I think that serious, fine art and music can be created using computer techniques, that I am so critical. It is a shame that so many productions fall so short of the media they try to imitate or transcend.

My optimism about the future of computerizing art is the reason for this article. I hope to snag a mind here and there, and convince them to read Rudolph Arnheim (*Art and Visual Perception*), Ernst Gombrich (*Art and Illusion or The Sense of Order*), R. G. Collingwood (*Principles of Art*), or Suzanne Langer (*Feeling and Form*).

There is much more to art than the fun of putting together images and being amazed at the stupendous results displayed on a color monitor.

Art is more than twists and turns of simple, kaleidoscopic digitized harmonies. Restrict yourself to the technique and you restrict your potential. We are more than our techniques; the ghosts in the machines are what count — all the more so when we try to computerize them.

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Idols Of Computer Art

In 1622 Francis Bacon wrote his *Novum Organum*, in which he suggested a broad approach to the scientific method that has influenced all scientists since then. Perhaps the most valuable aids he proposed were warnings about the idols or false appearances of the mind.

We know them as idols of the tribe, which describes how we are prone to suppose in nature a greater order and regularity than exists there; Idols of the Cave, in which we project errors unique to each of our personalities upon nature; Idols of the Market Place, in which errors arise because of the influence of words; and Idols of the Theater, in which fallacious thinking results from bad methods of philosophical demonstration.

I propose the following idols in the same spirit as Bacon's, not as impossible ways to make art, but rather as pitfalls that easily lead a person into thinking art has been created.

Idols	Fallacy
Idol Of Nature	Supposing that direct translations of natural forms into recognizable images makes art.
Idol Of The Formula	Taking the abstract orders of mathematical equations and turning them into images.
Idols Of The Kaleidoscope	Being fooled by the artistic look of images made from arbitrarily unleashing the combinatorial graphic powers of computers.
Idols Of The Game	Chasing orders or trapping oneself in chains to approximate what seems like artistic images.
Idols Of Disguise	Camouflaging or repackaging images by making transformations in the elements of design.
Idols Of The Eye	Tricking the eye into thinking that color illusions or optical novelties are artistic.

to make computers do fun visual things. I have said elsewhere that the computer is like a kaleidoscope. Add color to the equation and you can really go bananas with eye-appealing dazzlings. If you apply some of the more powerful graphic abilities of large computers, you can do some far-out visual things. The recent Walt Disney movie *Tron* proved that

computer graphics — especially unleashed in time — can be a successful visual accompaniment to a dramatic plot. To stand alone like music without an opera, however, is another matter.

Many groups are working to create wonderful tools and fabulous techniques for making images. Scientists at the New York Institute of Technology, for exam-



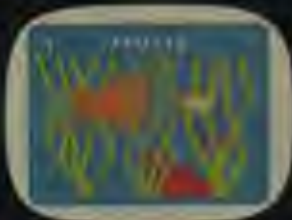
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ple, are at the forefront, taking out many patents on devices for improving our techniques for creating graphics and animation to control the color and contours of characters and scenes unendingly. I have a patent on a video graphic system myself.

The more the merrier — make them available to everyone. Color video pallets are the next thing we are going to see marching into our living rooms or capturing our hand-held calculators and other chip-embellished gadgets.

In general all of these devices are quite interesting, at least technically, even to an artist. But will they in themselves enable us to create valid, fine art? Since even the experts seem to be confused about what is or is not art, you might argue that they ought to be included in

this most ambiguous category of human production.

I am not saying that computer graphics, when produced by extremely sophisticated software, is not art. I am saying, however, that most of it appears very boring to an eye trained to recognize interesting visual images.

I am further arguing that we should exert caution when calling computer graphics "art." There is a vast world of simple reproduction or pure design which, is not art — although very interesting and original.

Realism is not enough. And design, unlike art, hinges on creating orders within orders, regularities that breed symmetries, proportions that are elegant and derived from magic squares, the perfect mean, and other natural

progressions.

I am making a plea for anyone truly interested in turning computer graphics into a more serious art form, to study art history and theory, to go back in the simpler art forms and learn what makes them artistic. Why is a line drawing, made with a pencil, the most elemental of human media, capable of becoming art? This question is not easily answered, but in my opinion it requires considerable study and exposure to great works of art.

We cannot let ourselves be carried away with dazzling new scientific techniques, believing that they are automatically art just because they overwhelm our untrained artistic eyes. We must look at Leonardo before we can consider ourselves Leonards. □





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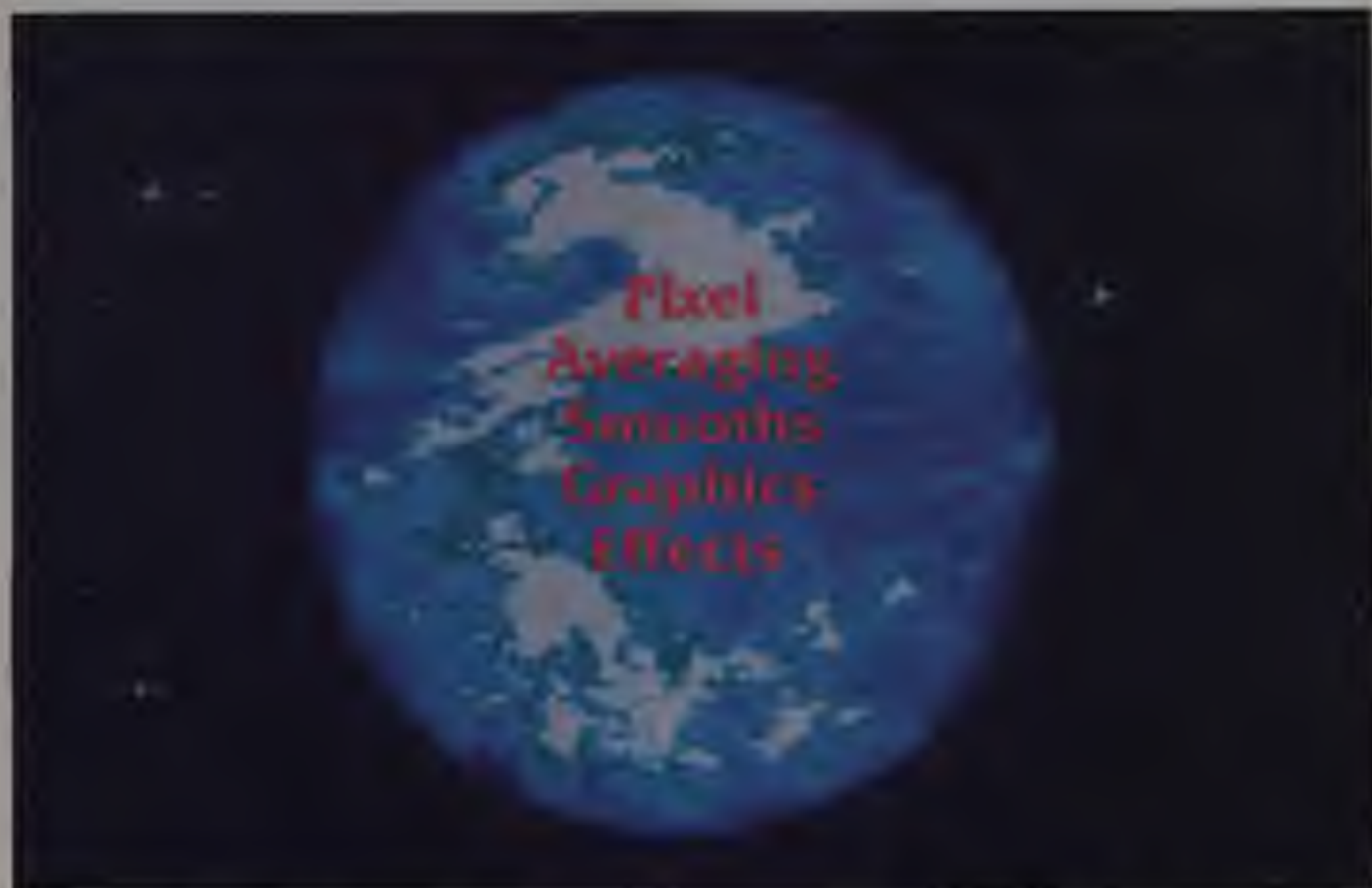
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Note: All photos were created by David Cook except the two marked with an asterisk () which were created by Bill Romanowski.*

David Cook, Digital Image Corporation, Grand Rapids, MI 49503.

David Cook

One of the problems we encountered has been resolution. For example, 35mm slide film has a resolution of about 4000 lines, while few inexpensive computers offer more than 512 lines. A second problem is the fact that 35mm slides are usually projected onto a large screen, increasing the resolution problem.

At Digital Image, we have designed software which produces very clean, full color graphics without matching the 4000 line film resolution requirement. This article attempts to explain just one of the many methods we employ to achieve even graphics.

The ideas presented here should give you a good start. Some of our techniques are not new. However, the ways in which we use some of them are completely new and have provided a great deal of insight into the secrets of computer graphics.

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The Basic Algorithm

Though everyone reading this article who currently owns a computer with graphics capabilities will benefit from these techniques, the basic algorithm is geared to computers with a color or

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Figure 1. This photo was made by taking the word **CREATIVE COMPUTING**, and **Replace** averaging it to the alternate page. After each average, all colors are converted to 15 (the brightest) and the result is again averaged. This is done in order to make the glow appear larger than the actual wording. After the desired glow size is obtained, the words **CREATIVE COMPUTING** were copied over the glow and then **Xor** copied, leaving the inside black. Then the outline of the word was copied into the glow using color 15 which was converted to orange while the glow was shaded between black and red.

black-to-white shaded map display, such as Atari, Cromemco, and Cromatics. The basic algorithm, and the one from which all other techniques



Figure 2. This photo was made by taking the word **GLOW** and **Replace** averaging it to the alternate page until the desired glow was obtained; this became the first exposure (in cyan). The second and third exposures were obtained by taking a sphere, inverting it (via **Xor**) and fuzzing it until the desired glow was obtained. These were then shot in red and green respectively.

described in this article are derived is called pixel averaging.

In pixel averaging, for any given pixel on the screen, an average can be calculated by adding the values of all neighboring pixels and then dividing by the number of neighbors and plotting the result. For example, below we see a pixel (center pixel with a color map value of 2 surrounded



Figure 3. This photo was made by taking a sphere, inverting it, **Replace** averaging it, and shading it between black and yellow. This became exposure one. The second exposure was created by taking the inside of the sphere and keying it onto the rest of the frame on color zero (background) which has the effect of placing the image behind the center sphere. This image was then shaded from black to red and then from red to blue and shot. Notice the outside edge of the center sphere is not smooth. This is because the outside edge does not sit next to a complementary color, thus jagged edges show up.

by pixels of different map values:

```

  3  4  15
  7  2  10 (2 is the center pixel)
  1  9  5
  
```

In calculating the average of the center pixel:

$$P' = (P_1 + P_2 + P_3 + P_4 + P_5 + P_6 + P_7 + P_8) / 8$$

or

$$P' = (3 + 4 + 15 + 7 + 10 + 1 + 9 + 5) / 8$$

or

$$P' = 6 \text{ (drop the fraction)}$$

To apply this algorithm correctly, scan the area containing the image and apply the algorithm to each pixel within that area. The result from each calculation may be immediately plotted back onto the display over the original pixel. However, much cleaner results are obtained if the averaged information is plotted somewhere other than on top of the original image—another image plane, disk, core, or even somewhere else on the same image plane.

If the results are plotted over the original, you will obtain a similar result, with a slowly accumulating degree of error. The error occurs because the pixel you just changed is a neighbor to pixels you are about to change. If you plot the new pixel on top of the old pixel, you will be changing future results for the neighboring pixels. (Later on however, I will explain how plotting the new pixel over the old one can be useful.)



*Figure 5. This photo was created by taking a straight two-dimensional grid, tilting it in the horizontal direction with a skew added (this makes it disappear to a horizon) and then tilting it in the vertical direction (this made the grid curve). The grid was then **Replace** fuzzed and shot as exposure one, the road. The next exposure was created by digitizing pieces of tissue paper and **REPLACE** fuzzing them to add softness. These became the clouds. The final exposure was created by taking the same tissue paper used for the clouds and repeatedly **Or** fuzzing it to create the rock and roadside images.

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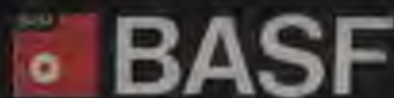


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Figure 4. This photo was created by taking three different versions of the background created in Figure 3 and shooting the first shaded between black and red, the second shaded between black and green, and the third shaded between black and blue. This causes much color interference on film which shows up as beautiful haze. All of the exposures were Replace fuzzed to enhance the interference.

Once an image has been averaged, the color map must be adjusted to provide the smoothest display possible. This is probably the most important and difficult (depending on your hardware) step in pixel averaging.

To explain how to arrange the color map, let me describe the way it is done on our system and then offer examples to make it work on other systems.

On the Cromemco, in low resolution mode (378 x 243) up to 16 colors out of a possible 4096 may exist on the screen at the same time. The colors are numbered 0-15, the actual numbers written when a pixel is placed on the screen, and thus the actual numbers being averaged.

Each color number (0-15) on the Cromemco may be assigned a red,



Figure 6. This photo was created by taking a two dimensional bar chart. Replace averaging it to the alternate page and tilting it to a horizon. The second and third exposure are composed of the word copy (the first in green, the second in white) and are done in high resolution (756 x 482 x 1 color). Figure 7 is Figure 6 without any averaging to show how averaging smoothed out the jaggies.



Figure 10. This photo is an example of our Odd language in action. The first two exposures were the red and green running and flipping stars. The last exposure was the center blue star which was Replace averaged.

green and blue gun value between 0 and 15. This allows any color (0-15) to be any one of the 4096 colors available (16 x 16 x 16). The map must be arranged so that the lower the color number, the darker the color. Therefore, if I want my image to glow a smooth blue, I shade my color map as shown in Table 1.

In effect what averaging together with proper color map manipulation does, is take a particular neighborhood and modify the color of the center pixel to make it "more like" its neighbors. If half of the neighbors of a center pixel are zeros (0) and half are fifteens (15), the center pixel will become a seven (7).

As the neighborhood moves through the area containing the image, each of the center pixels becomes more like the neighbors. (Remember, all neighbors get a chance to become center pixels.) This has the effect of fuzzing the image, or making it glow. Therefore, if the map is shaded from dark to light, the image will appear smooth.

This method should work on machines such as the Atari, but users of machines with fixed color maps such



Figure 11. This photo is identical to Figure 10 except that all components were Replace averaged.



Figure 9. This is a fun photo, and a good commercial effect. (Note that the text is from the article.) The photo was created by taking the text and Replace fuzzing only words existing outside of the glasses. This became exposure one in low resolution, shaded between black and red. The second exposure was the text existing inside the glasses which was shot while in high resolution. The third exposure was the glasses which were shot cyan in high resolution.

as the Apple and TRS-80 will find it more difficult to obtain smooth images. For these machines, assign a lookup table of colors arranged so the darkest color value is first and the brightest color last. When you read a pixel from the screen, average the index to the color in the table, not

Table 1.

Pixel Value	Red Gun Value	Green Gun Value	Blue Gun Value
0	0	0	0 - Black
1	0	0	1 - Darkest blue
2	0	0	2
3	0	0	3
4	0	0	4
5	0	0	5
6	0	0	6
7	0	0	7
8	0	0	8 - Medium blue
9	0	0	9
10	0	0	10
11	0	0	11
12	0	0	12
13	0	0	13
14	0	0	14
15	0	0	15 - Full blue

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Figure 12. This photo was created by taking a high-resolution sphere (the same one used to make the Earth slide) and manipulating it using Subtract, Replace, Or and And averaging until a somewhat smooth image resulted. Replace averaging is responsible for the three-dimensional look.

the actual color value. When writing the new pixel out, write the color at the index in the array corresponding to the result from the calculation. This method will pseudo-shade on fixed map machines. To understand this method better, try the following example:

Let us imagine that your computer only has the following eight colors:

- 0 = Black
- 1 = White
- 2 = Light blue
- 3 = Red
- 4 = Dark blue
- 5 = Yellow
- 6 = Dark green
- 7 = Dark purple

You would create an array, arranging the colors from darkest to lightest (you may have to experiment to see what order works best as follows):

- (1) = 0 (Black)
- (2) = 7 (Dark purple)
- (3) = 6 (Dark green)
- (4) = 4 (Dark blue)
- (5) = 3 (Red)
- (6) = 5 (Yellow)
- (7) = 2 (Light blue)
- (8) = 1 (White)

Let us then imagine that in reading a neighborhood, you find the following colors:

- | | | |
|---|---|---|
| 0 | 1 | 2 |
| 0 | 7 | 5 |
| 6 | 0 | 4 |

Before (or during) averaging, convert the colors using the table. The results will be:

- | | | |
|---|---|---|
| 1 | 8 | 7 |
| 1 | 2 | 6 |
| 3 | 1 | 4 |

At this point, the lower the number, the darker the color. The higher the number, the brighter the color.

Now average all pixels except the center pixel:



Figure 13. This photo is similar to Figure 12 in that the basic image was created in much the same way. However, the shading and three-dimensional look were added by many repeated Replace averages.

$(1 + 8 + 7 + 1 + 6 + 3 + 1 + 4) / 8$
The result is 3. Now determine which pixel is to be plotted:
NEW PIXEL = ARRAY (RESULT)
or
NEW PIXEL = ARRAY (3)
or
NEW PIXEL = 6

It is very important to note that when doing pixel averaging, the smoothest results are obtained if the

**Continued pixel
averaging causes the
image to glow more
and to become less
jagged with every pass.**

background is black. Bright backgrounds cause jaggies, so keep the background to the darker colors if not completely black.



*Figures 15 and 16. This photo was created in two steps. The first was to take shaded bars and to Or average them to create the effect of light shining from an angle. The second step was to take a picture of the Wag (Douglas Wagley) and Replace average out some of his facial features. Next, various objects in the background (such as a light switch on the wall) were edited out of the image. Finally, the bars were Copied over Doug and then Xored to create them. The bars were then shot as one exposure and Doug as the second exposure.



Figure 14. This photo is similar to Figures 12 and 13 in that the basic image was created from a high-resolution sphere. After the initial shape was created, it was And Copied onto bars which had been Or averaged to produce the effect of light shining from an angle. The bars were then And Copied onto another image which placed the dark and light shapes onto the bars. The result was then Replace Copy Averaged onto Replace averaged bars to give the edges a very smooth and three-dimensional look.

You may be wondering why we don't average the center pixel. The reason for this is that our routines are in assembly language which makes dividing by 8 much faster than dividing by 9. The center pixel does not weight the algorithm too much, but if you do decide to include it, make sure to divide by 9, not 8.

Uses Of Pixel Averaging

I call the type of pixel averaging mentioned above Replace Averaging as the result is replaced directly on the screen. Replace averaging is best used for one of the following functions:

Clean noise from a digitized image. Replace averaging reduces (by averaging) all noise inherent in digitizing. Continued averaging will slowly reduce



all random grey scale elements, causing the digitized image to appear compressed as opposed to digitized.

Clean up jagged lines in computer drawings. Replace averaging only once on a line drawing (or solid shape) has the effect of blurring all borders and edges. This reduces the jagged edges inherent in low resolution drawings. Continued pixel averaging causes the image to glow more and to become less jagged with every pass. You will obtain cleaner graphics if before averaging, every color except background in the image is converted to the lightest color. This places the entire image at the top of the color map with the background at the bottom. Averaging at this point slowly and smoothly pulls the color of the outer edges of the image toward the color of the background.

Variations On A Theme

Once you understand basic Replace averaging, variations are simple to implement. From here on we will deal with very simple variations on Replace averaging which provide many different results. Some of these variations are dependent on the color map being shaded; others are not. Therefore, some of them will be useful to anyone who has a computer with graphics capabilities whether it has color or color maps or not.

Edge Detection

Sometimes it is useful to be able to detect just the edges (boundaries between colors or grey shades) of images. Uses range from art, to being able to detect, identify and track a fast moving missile via computer (and I don't mean video games).

Normally, edge detection is accomplished by taking a copy of the image, shifting the copy one pixel up and one pixel to the right and then xoring the copy back over the original. This method leaves most edges with the exception of corners and overlapping lines.

A much faster and smoother algorithm is one I call Subtract averaging. Subtract averaging is identical to Replace averaging with the exception that when the result is obtained from averaging the neighbors, it is subtracted from the original center pixel before being plotted in another page or area on the screen.

Note that you must plot the result somewhere other than on top of the original image or the effect you get will not be edge detection.

If Subtract averaging is handled properly, what you should end up with

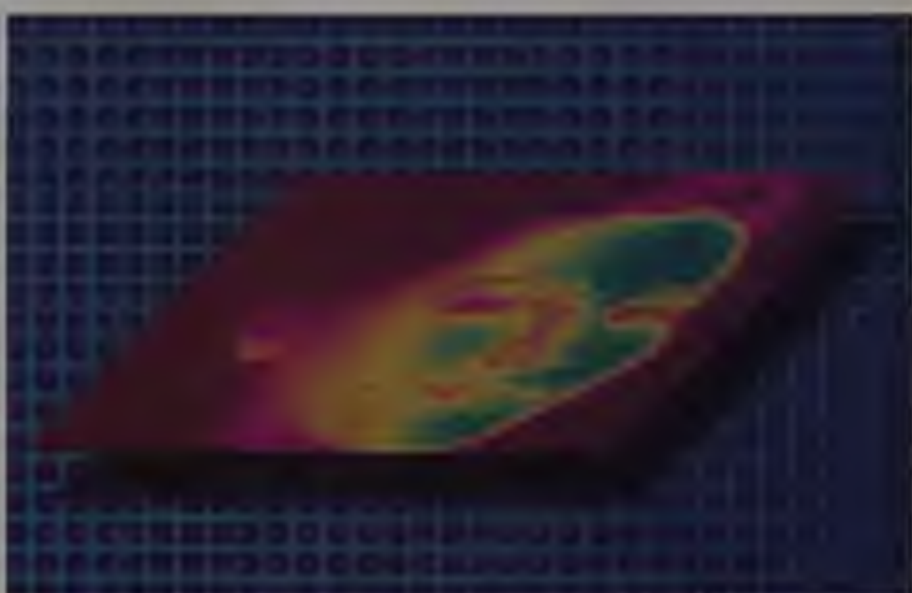


Figure 17. This photo was created by taking in a picture via the video camera and riling it through software. This was then Copied on top of the grids and then Xored to cut the picture out leaving the shadow. The picture was then moved up and Copied back in. Finally the picture was Replace averaged and randomly colored to provide linked shading.

is an image consisting of only borders and edges from the original image. Xoring the result and the original center pixel (Xor averaging) instead of subtracting also performs edge detection with the exception that the detected edge is not quite as clean as it is with Subtract averaging.

Other forms of pixel averaging fit themselves to unusual forms of texture and pattern generation.

The following is an example showing exactly where the subtract should appear (this holds true for all other types of fuzzing mentioned below):

P = Color assignment of original center pixel before averaging

P1 = Color assignment of new center pixel after averaging but before plotting.

Before plotting the pixel, perform this calculation:

$$P2 = P1 - P$$

And plot P2.

Edge detection is best to use on solid shapes or digitized images. If you are using it on a digitized image, it may help to reduce the noise in

the picture first by Replace averaging the image before Subtract averaging. Remember, all noise in an image will show up as edges during edge detection.

Texture And Pattern Generation

Other forms of pixel averaging fit themselves to unusual forms of texture and pattern generation. Two good examples of this are Subtract and Xor averaging on top of the existing image. If the user Subtract averages twice in succession, replacing each pixel on top of the original, and then applies a grey scale to the image, the image will appear pitted and very three dimensional (much like the surface of the moon). The image can then be Replace averaged to make the features blend in and soften the image.

Xor averaging on top of the existing image also causes unusual patterns to appear. Xor averaging again does not cause the picture to revert back to normal but instead modifies it further.

Intensity Modifications

And averaging on top of the original image causes only the brightest shades to remain and all darker shades to be lowered in intensity. This also provides more depth (encoded via shade) to an image and is useful in intensity control.

Color Map Wraparound

Add averaging on top of the original image or to another area of memory causes the shades to begin to wrap

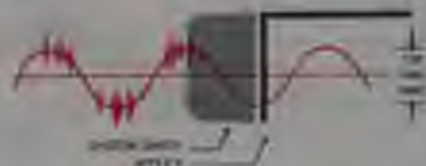
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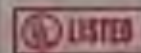
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Pixel Averaging, continued...

Figures 18-32 show how each type of averaging affects a digitized image.



Figure 18. This photo is the original. No averaging or manipulation was performed on the image. The image is shown as it came into the computer.



Figure 19. This photo shows Figure 18 Replace averaged on top of itself once. Notice that noise is slightly reduced. Continued averaging would reduce the noise more. Also notice the patchy coloring. This is due to the accumulating error caused by replacing the averaged information on top of the original.



Figure 20. This photo shows Figure 18 Replace averaged to the alternate page. Notice the noise is reduced and very clean. Continued averaging would reduce the noise more and begin to make the image glow. Notice that no patchy coloring is found as there is no accumulating error.



Figure 21. This photo shows Figure 18 Xor averaged to the alternate page. The effect performed is basically edge detection with shading added. This effect is almost identical to the results obtained if the image is shifted one pixel up and one pixel to the right and then Xor copied back on top of the original (as discussed in the article). This type of edge detection differs from Subtract averaging in the alternate page in that it is not as clean as Subtract averaging and produces a shaded output.



Figure 22. This photo shows Figure 18 Xor averaged on top of itself once. This manipulation is useful for introducing patterns into images.



Figure 23. This photo shows Figure 18 Or averaged to the alternate page. The effect here is to add highlights to edges at angles giving the effect of light shining from an angle (more apparent on computer images than on digitized images).



Figure 24. This photo shows Figure 18 Or averaged on top of itself once. The effect here is basically identical to Figure 23 with the added accumulating error which is greatly evident. This effect is nice for a "washed out" look.



Figure 25. This photo shows Figure 18 And averaged to the alternate page. The effect here is basically the opposite of Or averaging to the alternate page. Places where Or would highlight, And will darken.



Figure 26. This photo shows Figure 18 And averaged on top of itself once. This is very useful for non-linear intensity reduction. The intensity reduction is non-linear because of the accumulated error. This method may also be used to introduce shadows into an image.



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around the color map. This effect causes bright shades to become darker and darker shades to become lighter. It differs from simply inverting the color map (of the image) by keeping the association between the color scales the same.

High Lighting

A very useful feature is Or averaging to another area of memory. If applied to a computed image (words or shapes) it causes highlights (brightest color map values) to be added to edges and corners making the image appear to gleam as if from reflected light.

If several Or averages follow each other on the same image (each time reverting to another place), and the final result is Replace averaged, the very brightest highlights will be reduced to stars.

Conclusion

While there are many other techniques which must be employed to obtain the smoothest graphics possible, pixel averaging and all of its variations provide a good stepping stone into the world of smooth graphics. The following is a list of ideas to try once you have forms of pixel averaging working:

- Average larger neighborhoods than the ones I describe here. This results in various degrees of cleaner output.
- Try averaging the center pixel along with the neighbors (just remember to divide by 9 rather than 8).
- Try using all forms of averaging mentioned in this article to become familiar with the results of the variations listed in Figure 2.
- Try combining the different forms of averaging mentioned here.
- Add new types of averaging (formula averaging where a complex formula may be executed for each pixel).
- Add the types (Replace, Subtract, Add, Xor, Or, And) to other graphic tools such as loading images from disk. Try adding the image from disk onto the screen, or subtracting or XORing.

In conclusion, the basic ideas presented in this article do not deal as much with pixel averaging as they deal with modifying a basic algorithm over and over again to provide new and diversified effects. In graphics where memory is a consideration, if the same routine can be used in many different effects, the routine becomes a valuable tool and a basis for the design of other routines using the same concepts. □



Figure 27. This photo shows Figure 18 Subtract averaged to the alternate page. The effect here is Edge Detection. Because the image contains so much noise, there are many edges detected. To reduce the number of edges, Replace average first. Figure 32 is an example of Figure 18 which has been Replace averaged before Subtract averaging.



Figure 28. This photo shows Figure 18 Subtract averaged on top of itself once. This effect is useful in pattern generation and masking.



Figure 29. This photo shows Figure 18 Subtract averaged on top of itself twice. If Subtract averaging on top of the original is used an even number of times, it produces more and more three-dimensional textures. These textures appear as tiny bumps and valleys with shadows. This is a very good method of producing high-altitude type images of ground features.



Figure 30. This photo shows Figure 18 Add averaged to the alternate page. The effect here is to wrap the pixels around the color map without adjusting it.



Figure 31. This photo shows Figure 18 Add averaged on top of itself once. This effect is very beautiful due mostly to the accumulated error. It is a very good effect to combine with other forms of averaging.



Figure 32. This last photo is an example of Figure 18 Replace averaged to the alternate page to reduce noise, and then Subtract averaged to the alternate page to edge detect. The detection here is very clean and can be made cleaner by Replace averaging several times before Subtract averaging.

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STEREO GRAPHICS

Remember 3-D movies? I still remember sinking down in my seat at the local theater, hearing that if those bats floating out over the audience didn't get me, the falling rocks would. And then there were 3-D comics with the funny red and green glasses. The pictures seemed to stand out from the page. How did they work?

Our ability to perceive depth in the world around us stems primarily from two factors: perspective and the relative angle of view between the viewer's eyes. An example of the former is the apparent convergence of parallel lines which extend to the horizon. We are conditioned to believe that the lines really don't get closer together but rather are extending away from us in depth. This use of perspective is what allows pictures of objects projected onto a flat page or screen to give the illusion of depth.

But another and more convincing sense of depth comes from the positioning of the eyes. If you must cross your eyes to focus on something, then you know it must be very close. This is why there can be no doubt in your mind when you see a 3-D movie that it is different from a regular movie, even though both are projected onto a flat screen.

The difference between perspective and depth perception in pictures is that perspective requires only one

John D. Fowler, Jr.

image, but it takes two separate images to create a really convincing sense of depth. This is directly related to the fact that you have two eyes in the front of your head. This ability to perceive how far away an object was proved to be a great headache-preventer for our tree-dwelling ancestors.

If you want to create an image, a mirror if you will, out of flat paper, then you must do two things: draw two images in perspective, and assure that each eye sees only the appropriate image. In 3-D movies this is accomplished by projecting both images onto the same screen, in more or less the same place.

For color movies, two projectors are used. The images are sorted out by the use of polarizing filters over the projector lenses and similarly-oriented filters in the glasses you must wear. The light coming from the right projector, for example, is horizontally polarized and the light from the left is polarized vertically. Then the filter over your right eye, which is horizontally polarized, passes light only from the right projector and that eye sees only the image intended for it. The rest of the light on the screen shows up in your left eye and, voila, each eye receives the intended image. Your brain, working on those images,

notices the similarities (and vital differences) and forces you to duck when those bats come flustering out over the audience.

If you put the glasses on upside down, so that the images go to the wrong eyes, you can still see the picture, but the essential depth information no longer corresponds to experience. The picture looks strange in a way that is difficult to describe, and no longer gives the proper illusion of depth.

Non-color 3-D movies and comics work on the same principle, but use red and cyan (sort of greenish blue) colors and filters. Red and cyan are complementary colors. A red line can't be seen through a red filter (because it looks just like the red background), but a cyan line looks black. And vice-versa for the cyan filter. So one eye gets the red image and the other eye the cyan.

The real problem in making your own stereo pictures with a computer comes in getting the proper image to the proper eye. Several possible methods will be discussed.

If you have two slide projectors and the equipment to photograph your display, you can buy some polarizing filters and do it as in the movies: properly oriented filters over each lens with corresponding filters over the eyes. Or, if you are satisfied with red and cyan images and want to experiment with different colored pens and filters, you can do it that way. But beware: light blue pens are hard to find,

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Stereo Graphics, continued...

Colored and polarizing filters can be purchased at a photographic supply store.

Another approach is to use lenses. You have probably seen the stereo viewers on the market. They have two lenses through which you can view images from disks containing small pieces of film which are inserted into the viewer. You must make the center-to-center distance of the images less than the distance between your eyes. This means that the images must be rather small. A viewer can be made by placing a small magnifying glass in front of each eye.

There is another method which requires no extra equipment at all. The drawback to this method is that it takes a degree of voluntary control over the eye muscles which some people lack. If you can make your eyes diverge slightly (the opposite of crossing them), you can try pointing your left eye toward the left member of an image pair and the right eye towards the right image. If you can still focus on the images, you've got it made. You also have a rare talent because very few people can do this.

A variation of this method is to put out the images and reverse them, so that the image intended for the left eye

goes on the right. The trick now is to cross your eyes slightly so that the left eye sees the right image, and vice-versa. One aid in doing this is to cup your hands a few inches in front of your face and look through the hole. Or you can cut a rectangular hole in a piece of cardboard and view the images through it.

The real problem in making your own stereo pictures with a computer comes in getting the proper image to the proper eye.

The problem that most people encounter with these methods is that there exists a semi-voluntary coupling mechanism between the interocular muscles (the ones that control the relative angles of your eyes) and the muscles which focus the eyes. You must focus on an image (really two images) which are farther away than

your interocular muscles are telling your brain they should be. Some people can do this and some can't. If all this leaves you dizzy, then go on to the next method, which works for almost everyone.

Perhaps the best way to view stereo images is through an inexpensive viewer made from cardboard and mirrors. To construct the viewer, you will need four small rectangular mirrors (approximately 1 1/2" x 2"), some sturdy cardboard, double-stick tape, and glue. The pocketbook mirrors, which can be found at a variety store, will do nicely. You may have to remove the plastic cases by boiling them to loosen the glue. Heavy-duty photographic mounting-board works well for building the frame. In addition, you will need some small strips of wood or plastic for sturdiness and to form the necessary 90 degree angles. I used decorative molding strips for this.

Construct the viewer, as shown in Figure 1, by first cementing the rear short sides of two of the mirrors to a piece of molding-strip to form a right-angle V. Next glue a piece of molding strip to the back side along one of the long edges of each of the other two mirrors. While the glue is drying, you can cut two pieces of cardboard to the

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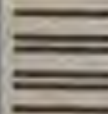
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Figure 1b. Photograph of partially assembled viewer.



Figure 1c. Fully assembled viewer with additional strips of cardboard on sides to exclude light.

dimensions shown in Figure 1(a). Transfer the lines, as shown in the figure, to one of the pieces, then put down a layer of double-stick tape.

After the glue has dried, take the middle pair of mirrors, and align them with the V you have drawn on the cardboard base. Place the outer two mirrors along the other two lines on the base, with the reflecting sides facing each other. The molding strips you glued to the bases of these outer mirrors should be against the tape, holding them in place.

Now you can pick up the viewer and look at the stereo figures which accompany this article. You will probably have to make slight adjustments in the mirror positions to get the images to line up and appear as one. This is the reason for using the double-stick tape. Take your time and get the mirrors just right, so that you comfortably see a single 3-D image. (You will also be able to see other images from unwanted reflections, but we will take care of them shortly.)

When everything is lined up, put on the top piece of cardboard and glue the mirrors in place. Finally, as shown in Figure 1(b), you should apply cardboard wherever possible to the four sides of the viewer to keep out extraneous light (without, of course, obstructing the view of the images you want to see).

In what follows, we will go through the steps required to write your own programs and make stereo images like those shown here. I will give you the subroutines and main programs you will need, except for the plotting routine.

The statement GOSUB PLOT probably won't work on your system. In place of PLOT you must insert the line number for your plotting subroutine. In most cases, the plotting subroutine will be quite simple: a command to draw a straight line from one point to another, followed by a RETURN

statement. Variables used in the listings are defined in Table 1.

We will be considering three objects: the viewer, the object to be displayed, and the display itself (monitor, plotter, or printer). To establish a frame of reference, we will create a coordinate system with its origin in the center of the display. The X and Y axes are in the plane of the display, with X increasing to the right and Y increasing upwards. The Z axis comes out of the display toward the viewer.

As shown in Figure 2, the axes are labeled with capital letters, while the coordinates of objects are lower-case letters. (Only capital letters will be used in the listings.) Viewer coordinates are (X, Y, Z), coordinates of points in the object to be plotted are (a, b, c), and points on the display surface are labeled (m, n, o) or just (m, n) since the Z coordinate always equals zero on the display surface.

For the time being, let's content ourselves with producing a single image on the display. (After this has been accomplished, it will be easy to produce two images, one for each eye.)

Pretend that you are holding a pencil in front of your display and that when you remove it, you want an exact image of the pencil as you saw it to remain on the display. To do so, we must draw an image on the display, corresponding to the original "real" image of the pencil, which was displayed on the backs of your eyeballs.

When the pencil is removed and only the display remains, we want the image on the back of your eye to remain unchanged.

This can be done by thinking of the pencil as being made up of a bunch of points each of which is transferred, one at a time. For each point on the pencil, we want to set the corresponding point which is directly behind it on the display. This point on the display can be found by extending a straight line from the viewer's eye, through the point on the pencil, to the display. Do this for each point on the pencil, and when you remove your eye will see the identical image on the display. (Note in what follows that the pencil could just as well be behind the display as in front of it.)

What we have to know to get the computer to do this, is a mathematical relation between the point at which the viewer exists, the points which make up the pencil, and the corresponding points on the display. Figure 2 shows a stereo view of just one point and the projection from the eye through the point to the screen. Looking down from above, as in Figure 3, we can see that for X coordinates the needed relation between viewer, object, and display is expressed by the equation:

$$(1a) \quad m/a + (n-x)/c = (z-c)$$

Likewise, if we were to view the figure from the side, it would be apparent that for Y coordinates the equation is:

$$(1b) \quad n/b + (m-y)/c = (z-c)$$

Figure 1a. Viewer template. Lines at 45° angles should be one mirror length.





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Stereo Graphics, continued...

And that's all there is to drawing perspective images. You put in a coordinate for the viewer (x_v, y_v, z_v) and a series of coordinates for the object (a, b, c) or let the computer calculate them, and then plot the resulting m and n (horizontal and vertical) numbers on the display.

That was so easy, let's try something else before getting to the stereo part. How about rotating the object before plotting it? Once again, since objects can be thought of as sets of points, we need only consider how to rotate a single point about each of the axes.

In Figure 4, we see the result of rotating a point about the Z axis. Using a little trigonometry, and calling the rotated point ($a1, b1, c1$) we get:

$$a1 = a \cdot \cos \theta - b \cdot \sin \theta, \\ b1 = a \cdot \sin \theta + b \cdot \cos \theta, \text{ and} \\ c1 = c.$$

If we now use $a1, b1$, and $c1$ in equations 1(a) and 1(b), instead of a, b , and c , the projection of the object onto the display will be rotated by the angle θ .

To rotate about the X and Y axes, you do the same things to the b and c coordinates or to a and c . Putting all of this together, we arrive at the Master Rotation-Perspective Subroutine which starts at line 1000 in Listing 1.

Since this subroutine will be executed a great many times, it is desirable to make it run as fast as possible. Thus, the sines and cosines of the rotational angles are calculated only once, near the beginning of the program.

There are several other neat things you can do with this subroutine. Notice the variables Q and W in Listing 1. These can be used to display the image on the display. For instance, if the origin of coordinates on your system is in a corner instead of the middle, you can insert appropriate values for Q and W to move the display point (0, 0) back to the center.

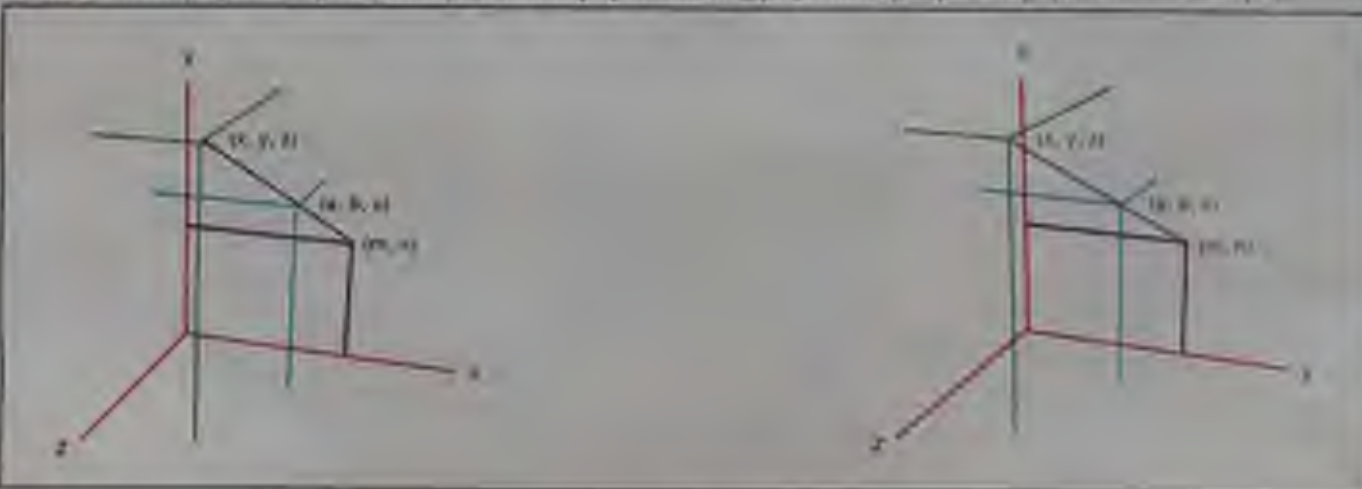
A	X coordinate of point in object to be displayed
A1	A after rotation about Z axis
AA	A1 after rotation about Y axis
B	Y coordinate of point in object to be displayed
B1	B after rotation about Z axis
BB	B1 after rotation about Y axis
C	Z coordinate of point in object to be displayed
C2	C after rotation about Y axis
CC	C2 after rotation about X axis
CF	Conversion factor for degrees to radians
CP	Cosine of rotational angle about Y axis
CS	Cosine of rotational angle about Z axis
CT	Cosine of rotational angle about X axis
FG	Toggle variable (alternates between 1 and -1)
I	Loop index
J	Loop index
K	Loop index
M	X coordinate of point on display
N	Y coordinate of point on display
PEN	Current penicil number
PH	Rotational angle about Y axis
PI	3.14159265
PLOT	User-supplied line number of plotting subroutine
PN	Temporary value of PEN
PS	Rotational angle about Z axis
Q	Display X coordinate of origin
R	Radius of a circle (distance between two points in Listing 1)
SP	Sine of rotational angle about Y axis
SS	Sine of rotational angle about Z axis
ST	Sine of rotational angle about X axis
TH	Rotational angle about X axis
W	Display Y coordinate of origin
X	X coordinate of viewer
XRES	Number of resolvable units on X axis of display
XX	X coordinate of polygon vertex
Y	Y coordinate of viewer
YRES	Number of resolvable units on Y axis of display
YY	Y coordinate of polygon vertex
Z	Z coordinate of viewer

Table 1. Index of variables used in program.

The TRS-80 Color Computer has the coordinate origin in the upper left corner of the display, with a range of m from 0 to 255 and n from 0 to 192 in

the highest resolution mode. Setting $Q=128$ and $W=96$ moves the point (0, 0) to be plotted at the center of the screen. So you can use Q and W to position the image on the display. On

Figure 2. Screen projection of viewer, object, and display, illustrating projection of object image from object to display.



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Stereo Graphics, continued...

some systems, the Y coordinate on the display is positive downward instead of upward. To keep things from coming out upside down, you can change line 1000 to:

```
1000 N = (BB + (BB - Y)) * CZ * W.
```

Another operation, similar to moving the projection of the object around the display, but not quite the same, is translation of the object itself before the projections (m, n) are computed. This corresponds to actually moving the object to a new position. To do this you must add the statement:

```
1055 RETURN
```

to Listing 1. Then a GOSUB 1000 will calculate the rotated coordinates of the object only. You can then add or subtract displacement coordinates to the rotated coordinates (ax, ay, az) and

```
GOSUB 1000
```

Now that you know how to plot images of points (a, b, c) in perspective, as seen from a view position (x, y, z), you are ready to make stereo pairs of images. The only thing left is to plot the same object from two view points, one for each eye.

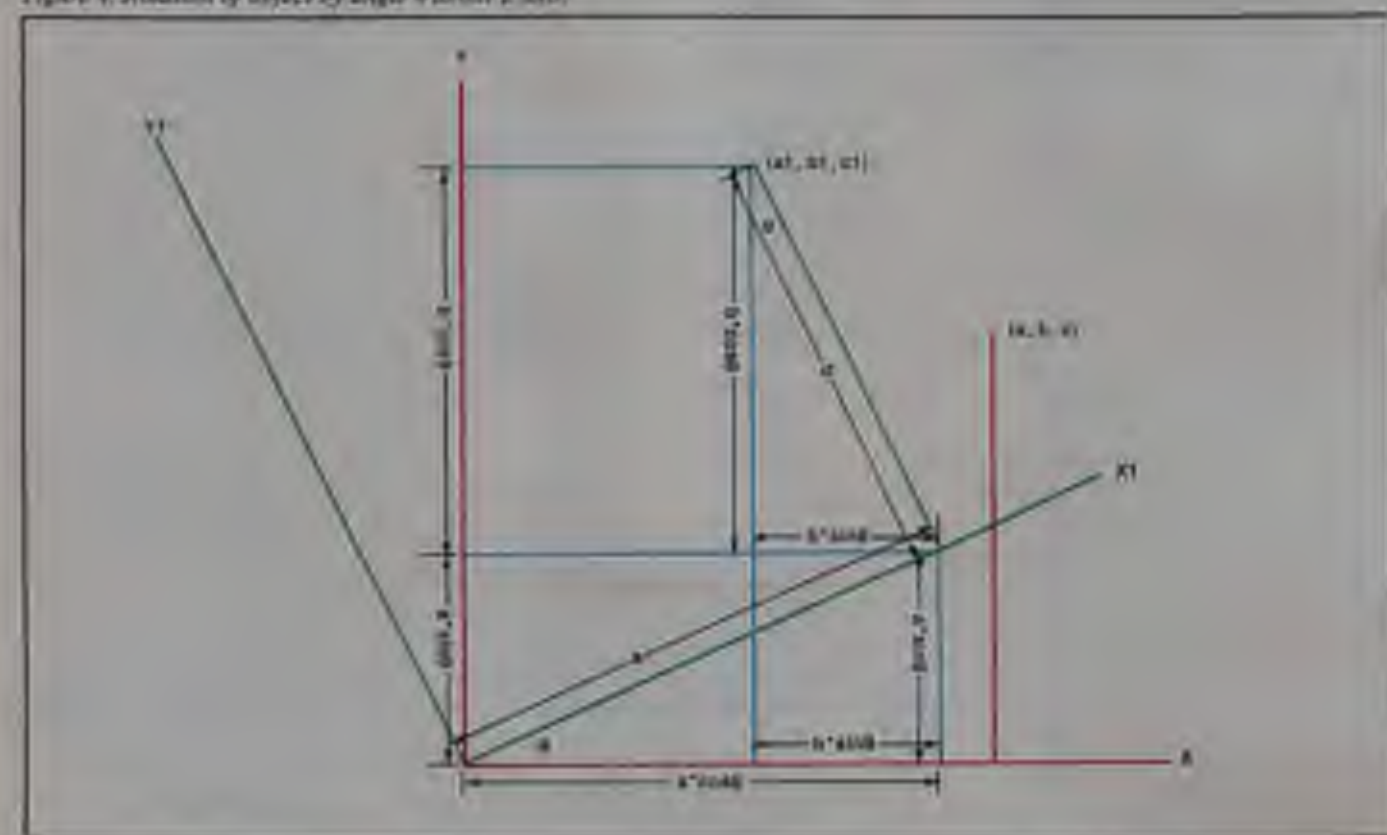
Usually, if you are positioned directly in front of the display, the (x, y, z) coordinates of each of your eyes will be given by (xs/2, 0, zd) for the right eye and (-xs/2, 0, zd) for the left. The variable xs is the distance

Figure 3. Top view of viewer-object-display relationship. Notice that the legs of the two triangles have the same ratio.

between your eyes, and zd is your distance from the display. The numerical values for these variables will depend on the plotting units you use. We define one plotting unit as the distance between two adjacent points (pixels)

on your display, separated by the minimum distance of resolution. As an example, my plotter has a resolution of 0.005 inch, so this is one plotting unit. Since I normally view these plots at a distance of about one foot,

Figure 4. Rotation of object by angle θ about Z axis.



Stereo Graphics, continued...

Listing 1. Rotation perspective subroutines begin at line 1000.

```

10  G3=3.14159/180
20  INPUT "PSI, PHI, THETA/(PI, PHI, TH)"; PSI, PHI, TH
30  C1=COS(C1*PI/180);S1=SIN(C1*PI/180)
40  C2=COS(C2*PI/180);S2=SIN(C2*PI/180)
50  C3=COS(C3*PI/180);S3=SIN(C3*PI/180)
60  (MAIN Body of program starts here.)
70  GOTO 1000
1000 X=X0+Q*cos P*cos W
1010 B=Y0+Q*sin P*cos W
1020 AA=Z0+Q*cos P*sin W
1030 Q2=AA*BB+CC*EE
1040 BB=BB*CC+GG*TT
1050 CC=BB*TT+GG*CC
1060 CC=CC/(1-Q2)
1070 M=AA+AA*BB*CC
1080 Z=BB*BB+TT*CC*W
1090 RETURN
    
```

Listing 2. Additional lines which should be added to Listing 1 to produce stereo pairs of images. Any variable which depends on XRES or YRES may need slight changes for different systems. In determining Q and W it is assumed that the display width is in the lower left corner.

```

1  INPUT "NUMBER OF PLOTTING UNITS IN X AND Y (ARCS, DEGS)"; XRES, YRES
11 Q=ARCS/200/YRES;W=ARCS/2
12 Q=ARCS/200/YRES/2
13 IF Q*ARCS/2 THEN YRES/2;C=Q*W
14 Q=Q*ARCS/2
15 X=X
16 GOTO 100
    
```

Listing 3. Add these lines to Listing 1 and 2 to draw the sphere of Figure 5.

```

30  PI=3.1415926
100  PEN=1
110  B=ARCS/5
120  FOR I=0 TO 3.1415926/PI
130  FOR J=0 TO 1.5707963/PI
140  A=ACOS((I+J)/2)
150  B=ACOS(J/2)
160  C=BSIN(B)*SIN(I)
170  P=PI*(1+I)/PI
180  GOON=1000
190  IF J=0 THEN PEN=0
200  GOSUB PLOT
210  NEXT J
    
```

```

220  NEXT I
230  FOR I=PI/5 TO 3.1415926/PI
240  PEN=1000/PI
250  FOR J=0 TO 1.5707963/PI
260  A=ACOS((I+J)/2)
270  B=ACOS(J/2)
    
```

```

280  C=BSIN(B)*SIN(I)
290  GOSUB PLOT
300  IF J=0 THEN PEN=0
310  GOSUB PLOT
320  NEXT J
330  NEXT I
    
```

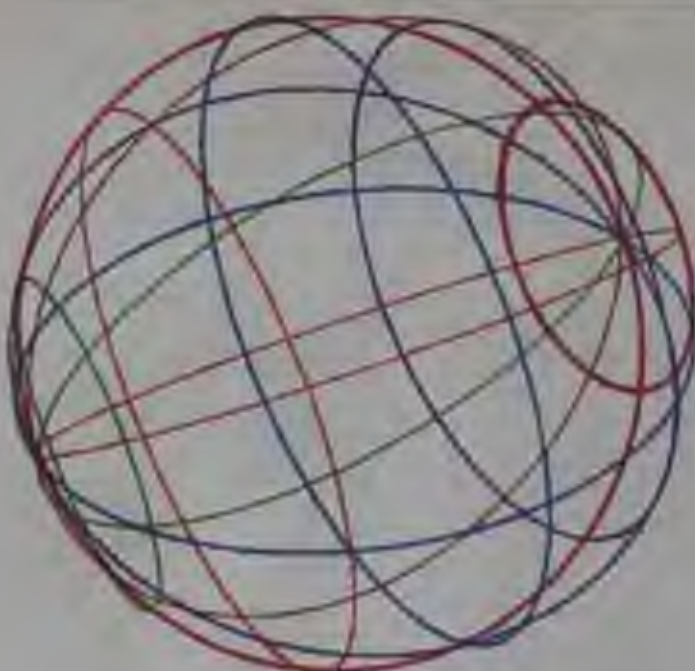


Figure 5. Sphere.

Listing 4. These lines should be added to Listings 1 and 2 to draw the mobius strip shown in Figure 5:

```

90 PEN=1:SB=30,05
95 RA=XRES/8:R1=XRES/
  8:RC=XRES/16
100 FOR I=0 TO 1080 STEP 36
110 A=RA+COS(CF*I)+RC*SIN(CF*I/2)
120 B=RB+SIN(CF*I)
130 C=RC+COS(CF*I/2)
140 GOSUB 1800
150 PN=PN+PEN*V
160 GOSUB PLOT:PEN=PN
170 A=RA+COS(CF*I)-RC*SIN(CF*I/2)
180 G=-RC+COS(CF*I/2)
190 PEN=PEN+1
200 IF PEN=2 THEN PEN=1
210 GOTO 100
220 GOSUB PLOT
230 NEXT I
240 PEN=2
250 FOR I=0 TO 120 STEP 4
260 A=RA+COS(CF*I)
  +RC*SIN(CF*I/2)
270 B=RB+SIN(CF*I)
280 C=RC+COS(CF*I/2)
290 GOSUB 1800
300 IF I=1 THEN PEN=2
310 GOSUB PLOT
320 NEXT I
330 PEN=1

```

I use:

sd=12/.005=2400

My eyes are about 2 1/2" apart, so:

ss=2.5/.005=500

In practice, I find a value of about 200 to be more pleasing. Making ss larger enhances the stereo effect, but if it gets too big, the illusion no longer looks real. Making sd smaller corresponds to getting closer to the display.

The lines in Listing 2 can be added to those of Listing 1 to make stereo pairs of images, the image for the left eye occupying the left half of the display. To reverse the images, change

line 15 to:

15 X=XRES/20:Y=0:

Z=1.5*XRES

The variables XRES and YRES are the number of plotting units in the X and Y directions, respectively. These will vary from system to system. I have used units appropriate to my system. Some of the other variables are defined in terms of these two and you

may have to experiment to get them just right for your system. In many systems, the X plotting unit is of a different size than the Y plotting unit. To make them the same, you will have to scale (multiply) one of them by the ratio of the two. Doing this will make circles come out round rather than like ellipses.

Listings 1 and 2 combined enable us



Figure 5. Möbius strip.

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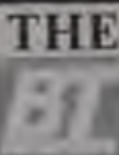
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Listing 5. These lines, along with Listings 1 and 2, create the pop-up figure shown in Figure 7.

```

100 PEN=1
110 R=ROTOR/7
120 FOR D=0 TO 40 STEP 1.5
130 A=RA*(D/2)*%
140 B=R*COS(D/2)*%
150 C=R*SIN(D/2)*COS(P)
160 Z=P/1.1
170 PEN=P/100
180 IF D=0 THEN PEN=1
190 GOSUB 1000
200 GOSUB PLOT
210 NEXT D

```



to plot stereo images of anything which can be described as a set of (x, y, z) points. These points can be calculated by the computer or input as data.

Now that we have both ends of a program, let's fill in the middle with some listings to make the drawings shown here. By the time we get through these, I am sure you will have some good ideas of your own.

If your plotting device is a video display, the resolution will probably be inadequate to show all the detail in these drawings. You may have to modify the listings to draw fewer lines. You can, of course, plot them from any viewpoint and rotation. With a video recorder, you could probably even make an animated sequence, one frame at a time.

Remember that GOSUB PLOT refers to your plotting subroutine, which simply draws a line from wherever it is now, to the point (m, n), using the color number of the PEN variable. PEN=0 means to move to the new point without drawing. The drawings shown here use up to seven different colors.

The listings which follow must be combined with Listings 1 and 2 to make an executable Basic program.



Figure 7. 3-D drawings.

Listing 4. These lines were used to create Figure 8. Values for loop indices I and J may have to be altered to fit your display.

```

20  P=0
140 PEN=1
148 FG=1
148 FOR I=0 TO 15 STEP 10
149 FOR J=0 TO J+25 STEP 1
149 A=1
149 B=0
148 C=FGM/34
149 PN=PEN/PEN#
149 GOSUB 199:GOSUB PLOT
149 PEN=PN
149 FOR K=0 TO 90
210 A=ACOS(CF+X*B)
220 B=1+25H(CF+X*B)
230 C=FGM/34*CONH(B)+2*X*B*FG+1
240 GOSUB 199:GOSUB PLOT
240 NEXT K
149 NEXT I
210 PEN=PEN+1
240 IF PEN=7 THEN PEN=1
240 FG=-FG
148 NEXT I
310 PS=PS+60
320 IF PS=360 THEN 940 CLEAR 30
925 PS=0
930 GOTO 30

```

Listing 3 contains the program lines to make a sphere (Figure 5). The listing is for the high resolution sphere of Drawing 1a. Lines of longitude (from pole to pole) are drawn by lines 120-220, and latitudes are made by lines 230-330. Increasing the STEP size in lines 130 and 250 causes the spheres to have coarser resolution. Eventually they don't look like spheres at all. If the high resolution sphere looks ellipsoidal on your display, you need to scale the plotting coordinates, as described previously.

A mobius strip is a figure with just one side and a single edge. You can make one by cutting out a strip of paper, rotating one end by 180°, and taping it to the other end. To demonstrate that it has just one side, draw a line down the middle of the strip. Keep drawing until you end up where you started. You will be able to see that the



Figure 8

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Authors note to players - I wrote this one with a confidence in hand. It is very serious - and a lot of fun. It was nice to work around the ship instead of watching it on T.V.

CIRCLE WORLD by Bob Anderson - The alien planet has built a huge world in the shape of a ring circling their sun. They left behind junk, strange customs and a lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

Authors note to players - In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is a very complex, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson - This one is for the kids. The house has ghosts, goblins, vampires and monsters and problems designed for the 8 to 12 year old. This is a real adventure and does make some thinking and problem solving - but only for kids.

Authors note to players - This one was fun to write. The vocabulary and characters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logical thought mapping skills, and possibly some learning about interest.

DERELICT by Rodger Olsen and Bob Anderson - For Wealth and Glory, you have to rescue a thousand year old space ship. You'll have to learn to speak their language and overcome the difficulties they left behind. The hardest problem of all is to live through it.

Authors note to players - This adventure is the new series in the "Toughest Adventure" or Aardvark's "Derelict". The most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational tricks and sudden unlikely 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.



NUCLEAR SUB by Bob Reville - You start at the bottom of the ocean in a wrecked Nuclear Sub. There is clearly no way to go but up. Save the ship, save her, or get out of her before she blows or starts WWII.

Authors note to players - This was actually plotted by Rodger Olsen, Bob Reville, and someone you don't know. This is the hardest work in adventure writing. It is tedious, wicked, and kills you often. The TRS-80 Color version has nice sound and graphic effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen - A second kind adventure. You are trapped in a floating center during an earthquake. There is a way out, but you need help. To save yourself, you have to be a hero and save others first.

Authors note to players - This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays more. Instead of killing, you have to save them to win this one. The player must help others first if he/she is to survive - I like that!

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Listing 7. Lines for dodecahedron of Figure 9.

```

10 DIM XS(4), YS(4)
20 PH=PI/180:PS=PI/2:CF=1.414/180
30 INPUT "XRES, YRES,XRES, YRES";XRES,YRES
40 Y=0:X=XRES/10:Z=1/3*XRES:Q=XRES/4:W=YRES/1
50 LL=XRES/180:AD=0:CD=0:(B=1:G=0)
60 PEN=1
70 CB=COS(CF*PS):SB=SB*(CF*PS)
80 CP=CD*(CF*PS):SP=SB*(CF*PS)
110 CT=CD*(CF*PS):ST=SB*(CF*PS)
110 J=0:LL=LL
120 FOR I=1 TO 5
130 XX(I)=X+XRES*CD*(CF*I)
140 YY(I)=Y+XRES*SB*(CF*I)
150 J=J+1
160 NEXT I
170 PEN=0
180 XX(5)=XX(1):YY(5)=YY(1)
190 A=XX(1):B=YY(1):C=0
200 GOSUB 1000:GOSUB 1000
210 PEN=5
220 A=XX(1):B=YY(1)
230 GOSUB 1000:GOSUB 1000
240 FOR I=1 TO 5
250 PEN=1
260 A=XX(I):B=YY(I)
270 GOSUB 1000:GOSUB 1000
280 R=|(XX(I)-XX(1))|*|YY(I)-YY(1)|/2
290 QQ=(XX(I)-XX(1))*L/R
300 WW=(YY(I)-YY(1))*L/R
310 XX(I)=XX(I)+QQ
320 YY(I)=YY(I)+WW
330 NEXT I
340 XX(5)=XX(1):YY(5)=YY(1)
350 L=L*1.97
360 IF B&120 THEN 380
370 GOTO 240
380 PH=PI/180
390 AP=1/5:SP=1/5:CD=1/5:SB=1/5
400 CO=-1/5:PS=PI/5:CF=1/5
410 IF IB=1 THEN PH=PI/12
420 IB=1
430 IF PS=PI/12 THEN 440
440 GOTO 360
450 IF Q/ARCS/4 THEN 460 ELSE END
460 Q=Q+ARCS/2
470 RETURN

```



Figure 9. This dodecahedron was created using rotation and translation of a single pentagon.

Stereo Graphics, continued...

line you have drawn covers both "sides" of the strip. Since you didn't go over an edge, the strip really must have only one side.

Listing 8 contains the lines for the mobius strip shown in Figure 6. Lines 100-250 draw in the colored bars which form the surface of the strip. The edge is drawn by lines 250-320. Notice that the rotation of the strip, generated by the second term of the variable *A* and by *C*, contains the factor 1/2. This causes the 180° twist in the strip.

"String Art" was part of the pop art lull of a couple of decades ago. A string art creation is made by nailing a set of pegs in a board along a predetermined set of lines and then running a length of string from peg to peg in a pattern. Listing 5 generates 3-D string art (Figure 7). These patterns are also known to electronics engineers as Lissajous figures, which are created by using harmonics of sine waves to generate the *x* and *y* object coordinates. Of course, we will throw in a component in the *Z* direction for depth.

To make different figures, try varying the STEP size in line 100 and the arguments of the trig functions in lines 110-130.

Figure 8 illustrates the possibility of creating symmetrical patterns by drawing a segment and then rotating it sufficient times about the *Z* axis to make a circular pattern. Listing 6 creates the figures shown in Figure 8. The original figure is drawn in a 60° angular segment. This is rotated by 60° five times to complete the drawing.

The dodecahedron of Figure 9 extends this concept to translation as well as rotation. It consists of a single pentagon which is rotated and translated five times to make the top half of the figure. The bottom six sides are not drawn, giving the illusion of hidden line removal. Part 2 of this series will include a detailed consideration of hidden line removal.

As with most string art, the object appears to contain curved lines, even though only straight lines are used in drawing it. Because the generation of the dodecahedron requires rotation, translation, and then another rotation, extensive modification of Listing 1 is necessary. Listing 7 contains the entire program for generating the dodecahedron.

Finally, I leave you with the blown dandelion of Figure 10. The RND (random) function was used in generating the coordinates for the fuzz, so this one comes out different each time it is drawn. The one you see here will probably never be duplicated. If you

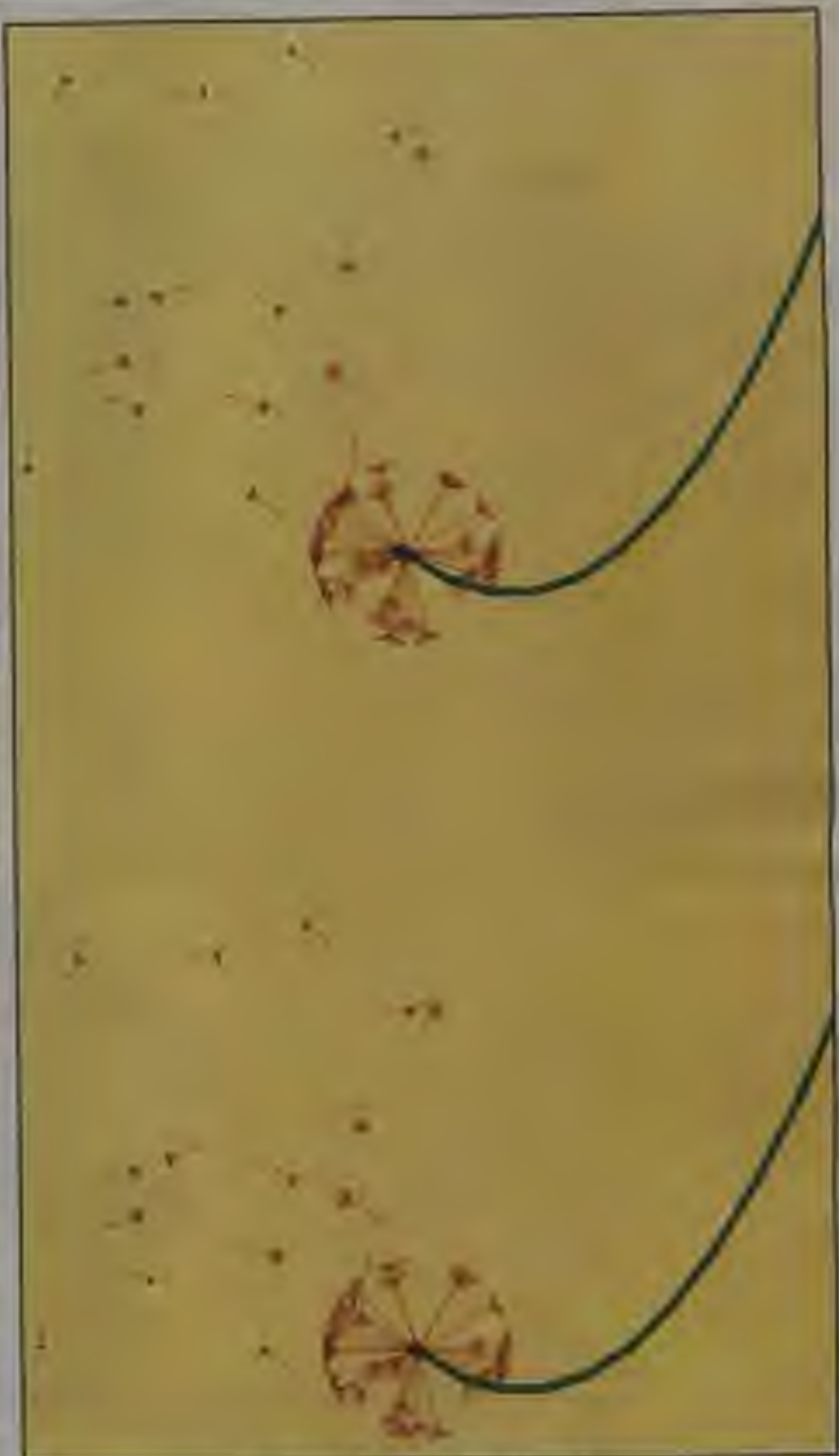


Figure 10. Dandelion with airborne fuzz.

want a listing for this program, you must first blow off the rest of the fuzz, then send me an SASE for the listing. So go ahead. Make a wish and blow. Then make some nice pictures of your

own. And watch out for those hats at the movies. See you next month when we will discuss the creation of mesh plots of functions of two variables and hidden line removal. □

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Computer Art for the Tektronix 4052



A common motif in analytical computer art is the polar coordinate curve. This has the form $R=f(A)$, where R is the radius, f is a mathematical function, and A is the angle. The angle parameter A is swept through some range of values, the radius R is calculated, and the computed polar coordinate points (R,A) are converted to rectangular coordinates and plotted.

The resulting curves frequently (but not always) exhibit angular symmetry; that is, they look the same after being rotated through a suitable angle.

Like many other computer artists, I had played with polar coordinate designs from time to time, but it seemed to me that the possibilities were limited with these curves. You generally ended up with designs like those in Figures 1 and 2, which are similar to the polar coordinate curves found in high school texts on analytic geometry.

Joe Jacobson

It was with considerable interest that I became aware of an innovation in polar curve plotting by a fellow computer artist and engineering co-worker, Woodrow Europa. Woodrow repeatedly swept simple polar coordinate curves through the interval from 0 to 360 degrees, and incremented the radius by a fixed amount between sweeps. The result was similar to the design in Figure 3, and seemed more aesthetic than the patterns based on a single angular sweep.

Woodrow's program was written for the Hewlett-Packard 9825B desktop computer, which uses a language (HPPL) that is somewhat different from standard Basic. I transcribed his algorithm into Tektronix 4052 Basic and used it to generate designs of the type shown in Figures 3 and 4.

Woodrow's algorithm used the

polar coordinate function $R = R_0(1 - \sin(L \cdot A))$, where L is a constant selected by the user, and R_0 is increased for each successive angular sweep. Curves of this type, which incorporate trigonometric functions, display a high degree of angular symmetry and consist of lobes that look somewhat like flower petals (as in Figure 4).

Traditionally, small integral values of L are used; $L = 3$ in Figure 3 and $L = 8$ in Figure 4. It was generally assumed that increasing L would just increase the number of petals in the daisy-like design. This is what would be expected on purely mathematical grounds.

After a short while I stopped using this algorithm, because the variety of different pictures that could be made still seemed very limited. It sat in a tape file for a couple of years before I realized that I could, after all, create some unusual effects by using larger values of L .

This is the case because computer science is a bit different from pure



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Figure 1

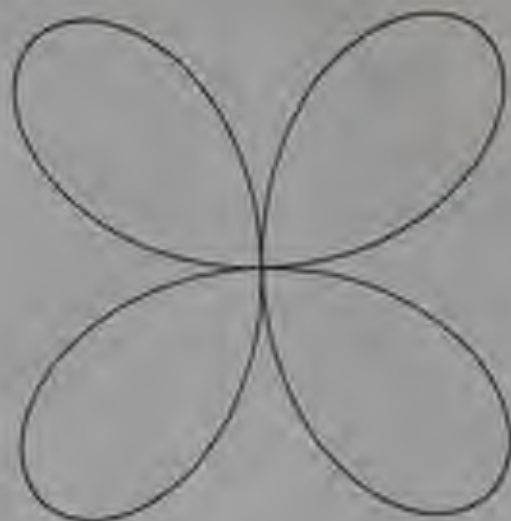


Figure 2

mathematics. In particular, computers use finite increments and intervals. If the increment in the angle A were made smaller and smaller as higher values of L were tried, a simple daisy pattern would indeed result.

But if the increment in A was fixed at some reasonably large value, such as 5 degrees, only selected points on the daisy pattern would be computed; when these points were connected by straight-line segments through use of vector graphics routines, new and novel patterns could be created. In fact, successive computed points could jump around on the background daisy

pattern in a rather wild fashion.

A sample pattern is shown in Figure 3. This design was made using $L = 16$ in Woodrow Europa's algorithm. The angular increment was 5 degrees.

I then generalized Woodrow's algorithm in two ways. First, I incorporated five additional, carefully chosen polar coordinate functions, which are embedded in subroutines and accessible by inputting a value for the parameter N from the keyboard.

Second, I made provision for inputting the amount (D) by which the radius R is increased for successive angular sweeps, and the amount (G)

by which the angle A is incremented during an angular sweep.

In addition, I installed an option, selectable through the parameter T , that enables the user to get a list of the values of parameters N , L , D , and G at the bottom of the picture; in this way a pleasing design can readily be re-created at a future date without straining one's memory.

I call the resulting program Sinusoidal Loop Program No. 1, and it can be used to create a large number of varied and striking patterns. Some of these are reproduced here (Figures 6-10).

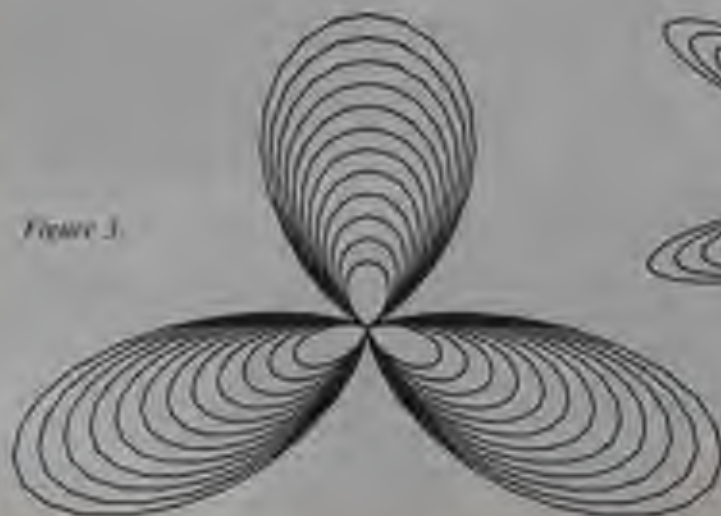


Figure 3

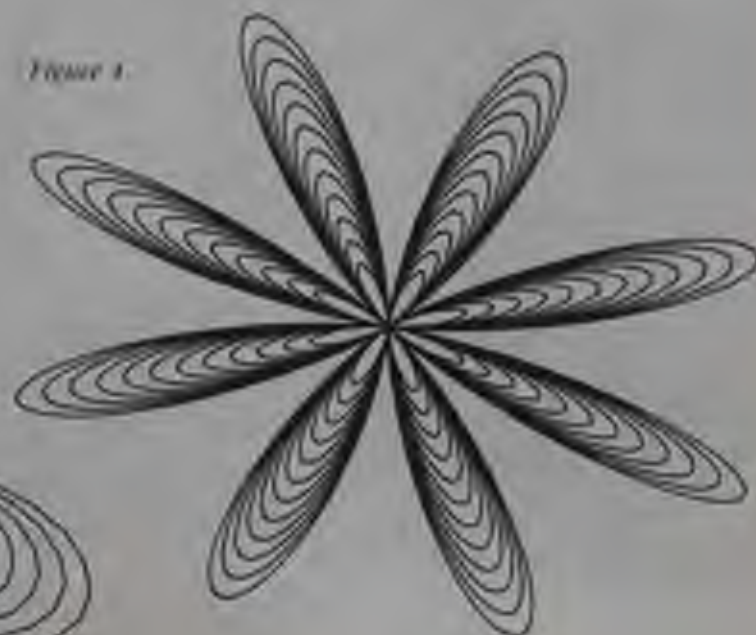


Figure 4

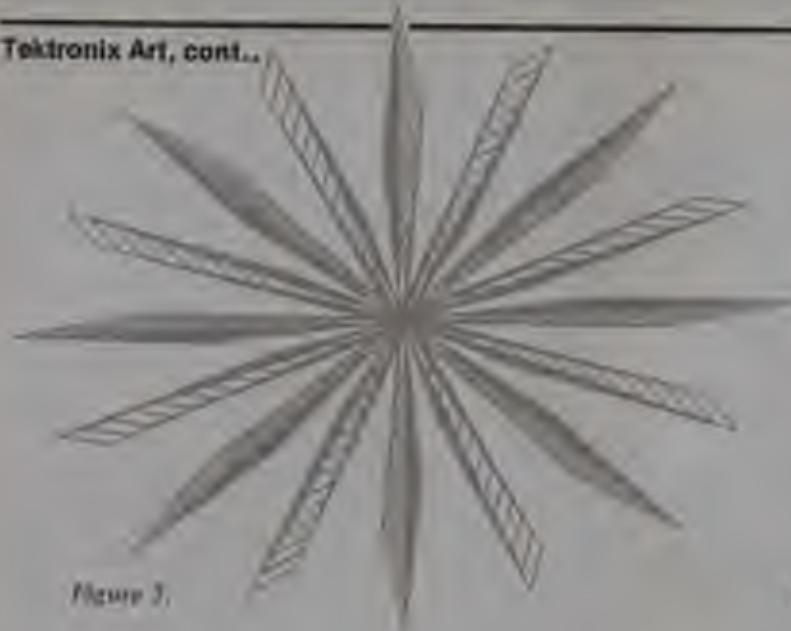


Figure 3.



Figure 4.

The Program

The program is easy to use. It prompts the user to enter values for N, L, D, and G from the keyboard. When it asks for a value for T1, enter a 1. The picture will then be plotted (it takes 10 to 20 seconds on a Tektronix 4052) and the parameter values listed at the bottom.

Then, press the HOME/PAGE button to clear the screen and hit the

RETURN key; the picture will be plotted again, but this time without the parameter values. (Alternatively, if you don't want a parameter value list at all, enter a 2 when the program asks for T1, and you will get a "clean" plot the first time.) Type R1/N to execute the program again for the next picture.

Table 1 lists the ranges of input parameter values that I have found to give good results with this program.

However, some values outside these intervals could conceivably make good pictures too. The patterns tend to repeat for L values larger than about 40 (with G = 5 degrees). The parameter values don't have to be integers; I have had good results with decimal functions like $L = 17.2$ and $L = 29.2$.

In fact, if you change the L value by as little as ± 0.1 , you may get an entirely different picture. This, again, is something that was not realized

```

100 REM SIMULATED LOOP PROGRAM NO. 1
110 PAGE
120 PRINT "ENTER N TO SELECT SUBROUTINE."
130 PRINT "N MUST BE 1,2,3,4,5 OR 6."
140 INPUT N
150 PRINT "ENTER L TO GENERATE A PARTICULAR PICTURE."
160 INPUT L
170 PRINT "ENTER D TO ADJUST SPACING"
180 PRINT "BETWEEN ANGULAR SWEEPS."
190 PRINT "SELECT A VALUE BETWEEN 10 AND 50 FOR D."
200 INPUT D
210 PRINT "ENTER G TO ADJUST ANGULAR INCREMENT."
220 INPUT G
230 PRINT "ENTER T1"
240 INPUT T1
250 PAGE
260 SET DEGREE
270 IF T1=2 THEN 300
280 VIEWPORT 22,100,14,100
290 GO TO 310
300 VIEWPORT 15,115,8,100
310 FOR B=0 TO 360 STEP 0
320 FOR A=0 TO 360 STEP G
330 IF B=0 THEN 370
340 IF B=1 THEN 370
350 COSB 540
360 GO TO 740
370 COSB 580
380 GO TO 740
390 IF B=4 THEN 450
400 IF B=5 THEN 450
410 COSB 620
420 GO TO 740
430 COSB 660
440 GO TO 740
450 IF B=5 THEN 480
460 COSB 700
470 GO TO 740
480 COSB 640
490 GO TO 740
500 REM FIRST SUBROUTINE (N=1)

```

```

510 WINDOW -500,500,-500,500
520 R=B*(SIN(L*A)+COS(L*B))
530 RETURN
540 REM SECOND SUBROUTINE (N=2)
550 WINDOW -750,750,-750,750
560 R=B*(COS(L*A)-ABS(SIN(L*B)))
570 RETURN
580 REM THIRD SUBROUTINE (N=3)
590 WINDOW -500,500,-500,500
600 R=B*ABS(SIN(L*A))
610 RETURN
620 REM FOURTH SUBROUTINE (N=4)
630 WINDOW -1000,1000,-1000,1000
640 R=B*(1-SIN(L*A))
650 RETURN
660 REM FIFTH SUBROUTINE (N=5)
670 WINDOW -500,500,-500,500
680 R=B*ABS(SIN(L*A)+COS(L*B))
690 RETURN
700 REM SIXTH SUBROUTINE (N=6)
710 WINDOW -500,500,-500,500
720 R=B*(1-ABS(SIN(L*A)))
730 RETURN
740 THREDCOS(A)
750 THREDCOS(B)
760 IF A=0 THEN 790
770 MOVE X,Y
780 GO TO 800
790 DRAW X,Y
800 NEXT A
810 NEXT B
820 IF T1=1 THEN 840
830 END
840 WINDOW 0,130,0,100
850 VIEWPORT 0,130,0,100
860 MOVE 0,10
870 PRINT "SIMULATED LOOP PROGRAM NO. 1 PARAMETERS"
880 MOVE 0,5
890 PRINT "N,L,D,G" = "1",10,"10","10","10"
900 INPUT J0
910 T1=2
920 GO TO 260

```




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Figure 7.



Figure 8.

Table 1. Suggested Parameter Values.

Parameter	Range of Values	
	From	To
N*	1	6
L	6	60
D	30	50
G	1	15
T1**	1	2

*N must be 1, 2, 3, 4, 5, or 6.

**T1 must be 1 or 2.

historically. Similarly, small changes in the angular increment, G, can have a big effect.

Sinusoidal Loop Program No. 1 is the first of several recent computer programs I have written using polar coordinate functions; some of the others are further generalizations of Woodrow Europa's algorithms and some are completely new. They will all appear in *Creative Computing* over the next few months.

In order to use these programs you will need access to a Tektronix 4050 series terminal, which is used here as a stand-alone microcomputer, or some other system having extremely high CRT screen resolution. (Unfortunately, the vast majority of home

computers do not have the necessary screen resolution. However, if you have a good mechanical X-Y plotter, that will do nicely.)

The programs generally take up about 6K of memory and use vector graphics. They are written in Basic, but the graphics commands (MOVE, DRAW, WINDOW and VIEWPOINT) are machine specific. You will have to adapt the programs to your own graphics system.

Even if you don't have access to a suitable computer, I hope you will find the algorithms interesting (a complete source listing will accompany each article) and that you enjoy the sample output designs that will be reproduced with each listing. □



Figure 9.

Figure 10.



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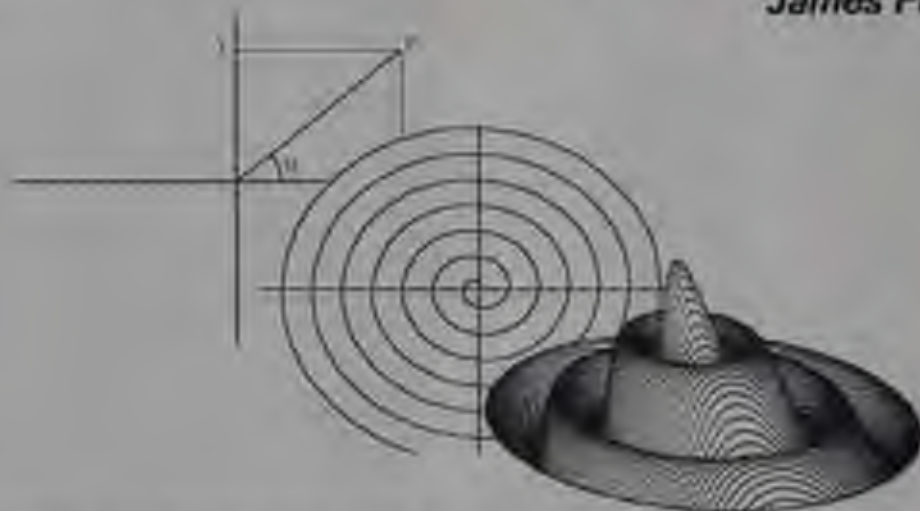
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Three Ways of Looking At A Function

James Fuller



Anyone with scientific or technical interests needs to have an intuitive feeling for the behavior of different kinds of mathematical functions, and the typical shapes of their plots. This is one of the barriers which keep many people from an enjoyment of science, preventing them from taking pleasure in what is, when you think about it, the art of our time.

It used to be that the only way to acquire such an easy familiarity was to sit down with a pencil and graph paper, heave a sigh, and start plotting points.

Even with a calculator this is slave labor. So while most people (the ones who paid attention in high school, anyway) can recognize simple linear, exponential, and quadratic plots and the garden-variety trigonometric functions, if they encounter an unlovely object such as

$$f(x) = \cos(4x) + (20/(x^2 + 3))$$

it's back to graph paper.

For anyone with a personal computer, however, this is no longer true. The computer will take over the dull, repetitive task of plotting points, and the user is free to pay attention only to what the function actually does. He is also encouraged to experiment with the effects of making minor or major changes in the formula, and to plot it in different coordinate systems.

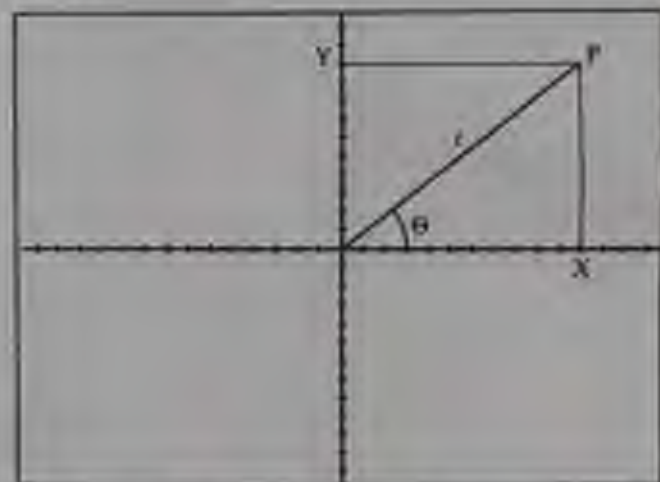
The Applesoft Basic program in Listing 1 can create three kinds of high-resolution plot of a given function. It can plot points in Cartesian or polar coordinates, or it can create a solid of revolution in three simulated dimensions.

Cartesian coordinates need no introduction and little discussion. They are used daily to plot everything from the third world balthaze to the speed with which Brand X aspirin enters the bloodstream.

When Descartes warped the future of Western thought by inventing the graph, this is what he invented. In this system a point is uniquely located in two dimensions by giving its coordinates on a horizontal and a vertical axis.

There is another way to locate a point uniquely in a plane, though this method is not in such common use. In the polar coordinate system we draw a line between the point of origin of the system and some other point of interest, and specify where that point is by giving its distance from the origin and the angle the line forms with the horizontal axis. Thus point P in Figure 1 can be located either by giving values for X and Y or by giving length r

Figure 1.



and angle θ (theta). The translation between the two systems involves the elementary trigonometric relations

$$\sin \theta = Y/r \quad \text{and} \quad \cos \theta = X/r$$

or, rearranged,

$$X = r \cos \theta \quad \text{and} \quad Y = r \sin \theta$$

Polar coordinates are especially appropriate for graphing periodic functions such as sines and cosines. Complex combinations of simple periodic functions can result in

some remarkably beautiful plots. Figure 2 is the polar plot of

$$f(X) = \sin(7 + \sin(2X))$$

A solid of revolution is created by rotating a two-dimensional figure about an axis to create a three-dimensional surface. A circle rotated about a line passing

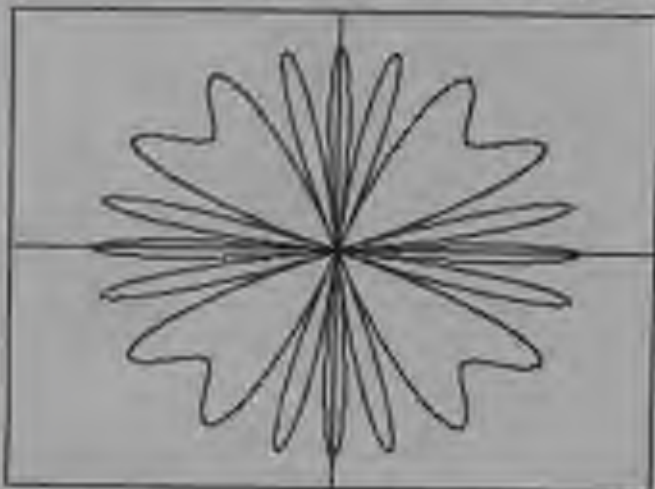


Figure 2

through its center creates a sphere, a right triangle rotated about one of its legs creates a cone, and so forth.

The program presented here takes a function plotted in Cartesian coordinates and creates a solid of revolution by rotating it about the Y-axis. The program then displays the result on the screen in a way that gives a convincing illusion of a three-dimensional object. The viewer seems to be looking at it from above and somewhat to one side. Portions which he would not be able to see from this vantage point are eliminated.

Running The Program

To run the program, the user must first translate the function he wants to examine into Basic and type it into line 170.

170 DEF FN R(Q) = (user's formula, in terms of Q)



Figure 3

The plotting routines can call it from this point whenever it is needed.

After the equation is entered and the program is started,

a self-explanatory series of prompts appears, asking the user to choose a Cartesian, polar, or three-dimensional plot. If one of the first two is chosen, further questions appear asking about the function increment (how much distance between plotted points), whether the axes should be expanded or compressed, and whether the origin should be moved.

It is worth mentioning that whole number increments are not always best. For example, the function $f(X) = 1/(X-5)$ will give a divide-by-zero error where $X = 5$ if increment 1 is chosen. If increment 1.1 is chosen instead, X never lands precisely on 5 and the error is avoided.

Other prompts appear if the user asks for a three-dimensional plot. These plots have a habit of running off the top or bottom of the screen. If the user finds this is happening, he can enter a value which moves the plot up or down the screen, and another which expands or compresses it in the vertical direction.

Once all the questions are answered, the program assumes control and produces the desired plot in accordance with the instructions the user has given it.

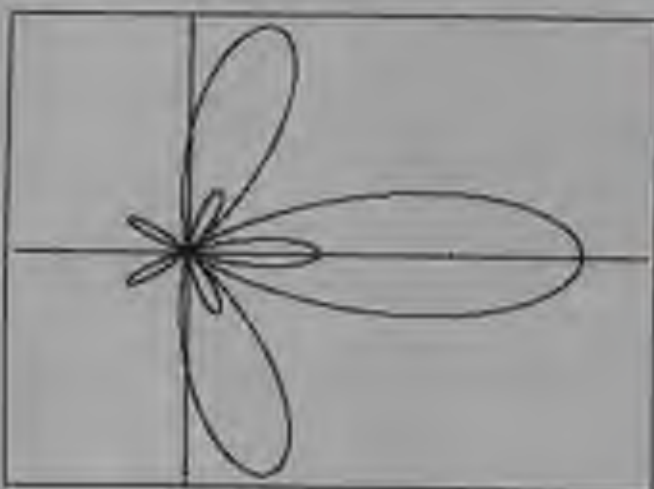


Figure 4

Figures 3, 4, and 5 show the three types of plots the program can create of the function

$$f(X) = \cos(X) + \cos(2X) + \sin(3X)$$

Altering The Program

The program has another use besides examining the graphs of complicated equations. It can also create some very elegant graphics, which may be appreciated for their own sake. The slight alterations

```
660 FOR G = 0 TO 3600 STEP 1
    DEL 750, 760
    770 IF G = 0 THEN H$ = "X", "Y"
    775 H$ = "X", "Y"
```

will cause the computer to draw a line between each two consecutive points plotted in polar coordinates. This will have little effect if the points are close together (that is, if the function increment is small.) On the other hand, large increments often produce remarkable results. With an increment of 1, the function $f(X) = X/\pi$ (one version of Archimedes' spiral) produces the plot shown in Figure 6. The plots in Figures 7, 8, and 9 were produced by increments of 122, 145, and 88.5 respectively.



Figure 5.

As the program is printed here, the equation $f(X) = .25 - \sin(2X)$ gives the plot shown in Figure 10 (increment = 1, scale X = scale Y = 6). If line 660 is changed to read `FOR G = 0 TO 3960 STEP 1` and the increment is set at 55, the result (Figure 11) resembles the calcium skeleton of some delicate, microscopic sea creature. The effect is particularly striking on a color monitor or TV.

Many other equations yield similarly beautiful results. (Try equations like $f(X) = .5 - \sin(X)$, with G stepping to 10700 by increment 143, or $f(X) = \cos(4X)$, with G stepping to 1800 by increment 25.) The knowledge that such rewards are waiting to be stumbled upon is enough to encourage endless experimentation.

The 3-D Plotting Module

The 3-D plotting module of the program also yields graphic rewards to the persistent heaver-topper of equation factors. Pleasing examples are shown in Figure 12

$$f(X) = \sqrt{.5(16 - X^2)} + 1/(X + 4)$$

and Figure 13

$$f(X) = \cos(4X) + (20/(X^2 + 3))$$

— the ugly-duckling equation with which we began.



Figure 8.



Figure 7.



Figure 8.



Figure 9.



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Three Ways, continued...

In addition, "wrong" variables can be pulled out of their proper positions and plugged in to produce plots which clearly are not solids of revolution, figure 14.

$$f(X) = \sin(2X) + \cos((X + BB)/16)$$

is such a plot.

The 3-D plotting module is slower than the others, simply because of the very much greater number of points which must be plotted to give a finished display. If the user is just searching for neat graphics, a cruder but faster trial version can be created by changing line 1430 to read `FOR BB = -AA TO AA STEP 5`.

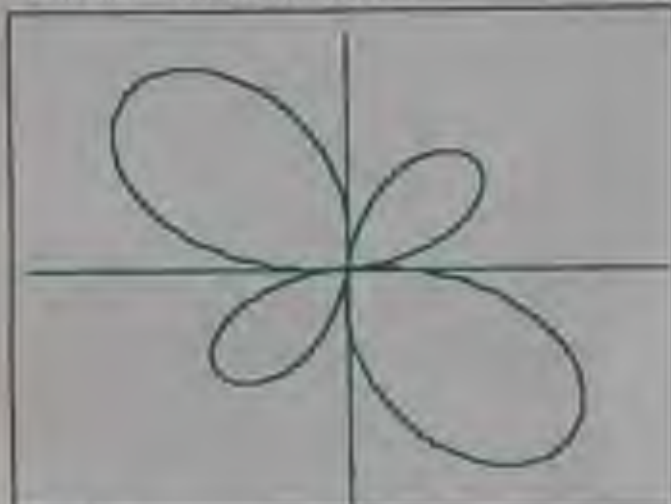


Figure 10

The two short programs in Listings 2 and 3 are provided so that interesting plots can be saved and retrieved later rather than having to be recreated from scratch every time. After a plot is complete and the program has ended, clear the screen by typing `TENT` and a carriage return. (Don't be alarmed—the picture has not been destroyed. It is still in memory although it no longer appears on the screen.) Then load and run the program `SAVE PICTURE`, which will save the plot on disk as a binary file under a name of

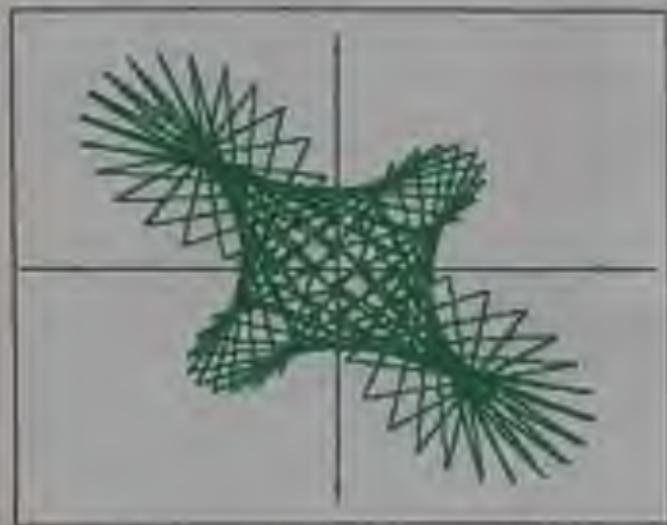


Figure 11

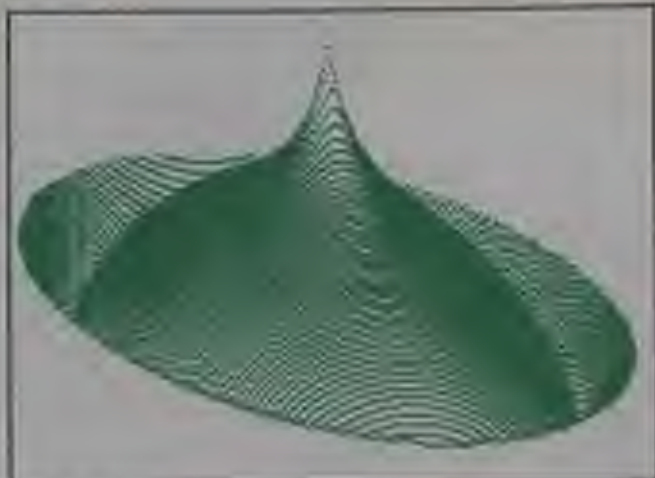


Figure 12

your choice. The program `DISPLAY PICTURE`, similarly, will retrieve a saved plot from the disk and display it on the monitor screen.

The program needs only a few detailed comments. For the polar plot routine, the value `G` in line 690 is 0; `r` may be found using the Pythagorean theorem by taking `X` and `Y`, defined in lines 710 and 720, and setting `r = sqrt(X^2 + Y^2)`. The result will be that `r = 0(T) = 0(G/57.296)`, where `f` is the function the user has defined. (Note that `T` is in radian measure, this is accomplished in line 700. The Apple and many other small computers do their trigonometry in radians, not degrees.)

For the Cartesian plot module, the values of `X` and `Y` are found in lines 910 and 920. Other manipulations merely square these values onto the Apple screen. "Invisible" points in three-dimensional plots are removed by lines 1610-1650, which change the plotting color to black, drop a black line from each plotted point to the bottom of the screen (thus erasing any previously plotted white points directly beneath it), and restore the plotting color to white again.

The program has been written for legibility and clarity, at a slight sacrifice in speed. Most lines contain only one

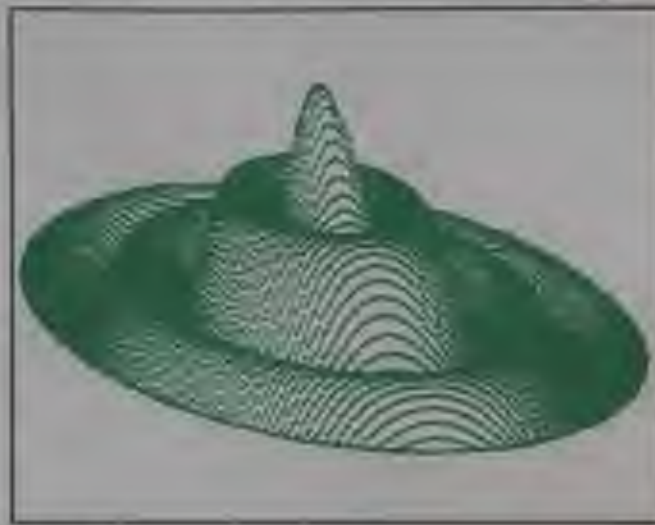


Figure 13

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Three Ways, continued...

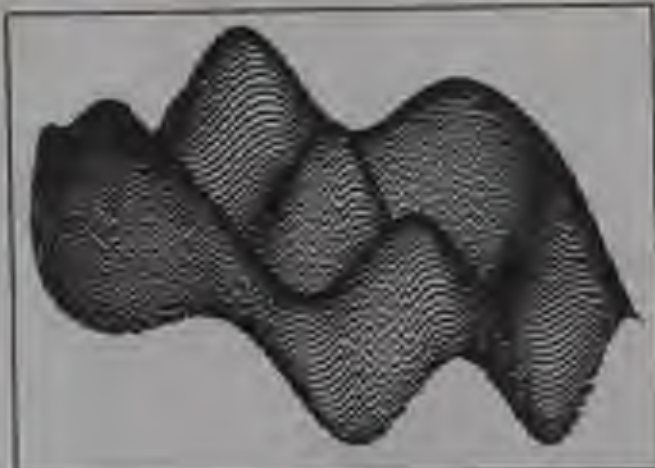


Figure 1A

program command. The FOR-NEXT loops which do the actual plotting have been indented to make their operation as understandable as possible, and to make it easy to translate them into other flavors of Basic. Of course, if you have an Applesoft compiler, you can compile the program into machine language, which will run much faster.

The program could be developed in several ways. It would be interesting and not difficult to include scaling routines which would allow plotting on logarithmic and semilog axes as well as on linear ones.

Using shape-table methods, a graphic character set could be defined and used to label the axes.

Finally, I have seen published explanations of ways to enter a function from the keyboard in response to a prompt, while the program is running—something Applesoft does not ordinarily allow. Inclusion of such a routine would make it unnecessary to change line 170 whenever you want to plot a new function. □

```

10: TEXT = HOME
20: PRINT : PRINT : PRINT
30: PRINT "THE CURRENT FUNCTION IS DEFINED AS:"
40: PRINT : LIST 170
50: PRINT
60: PRINT "DO YOU WANT TO:"
70: PRINT "  1) A CARTESIAN PLOT"
80: PRINT "  2) A POLAR PLOT"
90: PRINT "  3) A THREE-DIMENSIONAL PLOT"
100: PRINT
110: PRINT
120: PRINT : INPUT "ENTER 1, 2, OR 3, *PL"
130: PRINT
140: GOTO 1
150: GOTO 1
160: GOTO 1
170: DEF FN W(X) = COS(X) + COS(X) + SIN(X) + SIN(X) + 1
180: GOTO 1
190: GOTO 1
200: GOTO 1
210: GOTO 1
220: GOTO 1
230: GOTO 1
240: GOTO 1
250: GOTO 1
260: GOTO 1
270: GOTO 1
280: GOTO 1
290: GOTO 1
300: GOTO 1
310: GOTO 1
320: GOTO 1
330: GOTO 1
340: GOTO 1
350: GOTO 1
360: GOTO 1
370: GOTO 1
380: GOTO 1
390: GOTO 1
400: GOTO 1
410: GOTO 1
420: GOTO 1
430: GOTO 1
440: GOTO 1
450: GOTO 1
460: GOTO 1
470: GOTO 1
480: GOTO 1
490: GOTO 1
500: GOTO 1
510: GOTO 1
520: GOTO 1
530: GOTO 1
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630: GOTO 1
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690: GOTO 1
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720: GOTO 1
730: GOTO 1
740: GOTO 1
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760: GOTO 1
770: GOTO 1
780: GOTO 1
790: GOTO 1
800: GOTO 1
810: GOTO 1
820: GOTO 1
830: GOTO 1
840: GOTO 1
850: GOTO 1
860: GOTO 1
870: GOTO 1
880: GOTO 1
890: GOTO 1
900: GOTO 1
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920: GOTO 1
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950: GOTO 1
960: GOTO 1
970: GOTO 1
980: GOTO 1
990: GOTO 1

```


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570 PRINT "TO MOVE THE DESIGN LEFT OR RIGHT,
580 INPUT "ENTER A NUMBER FROM -100 TO 100." : G
590 PRINT
600 PRINT "TO MOVE THE DESIGN UP OR DOWN,
610 INPUT "ENTER A NUMBER FROM -40 TO 40." : G
620 G
630 HSB = POKE -16302, 0
640 HSBOR = 3
650 C = 96 * 2
660 F = 128 - C
670 HSBOR = 0 TO 255, 15
680 HSBOR = 0 TO 255, 15
690 FOR X = 0 TO 255 STEP 15 : G
700 HSBOR = 0 TO 255, 15 : G
710 FOR Y = 0 TO 255 STEP 15 : G
720 HSBOR = 0 TO 255, 15 : G
730 FOR Z = 0 TO 255 STEP 15 : G
740 HSBOR = 0 TO 255, 15 : G
750 FOR W = 0 TO 255 STEP 15 : G
760 HSBOR = 0 TO 255, 15 : G
770 HSBOR = 0 TO 255, 15 : G
780 HSBOR = 0 TO 255, 15 : G
790 HSBOR = 0 TO 255, 15 : G
800 STOP
810 G
820 REM *****
830 REM *****
840 REM *****
850 REM *****
860 REM *****
870 REM *****
880 REM *****
890 G
900 FOR X = 0 TO 255 STEP 1
910 Y = (X * 15) / 255 : G
920 Y = (X * 15) / 255 : G
930 Y = (X * 15) / 255 : G
940 Y = (X * 15) / 255 : G
950 Y = (X * 15) / 255 : G
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1080 Y = (X * 15) / 255 : G
1090 Y = (X * 15) / 255 : G
1100 Y = (X * 15) / 255 : G
1110 Y = (X * 15) / 255 : G
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1260 Y = (X * 15) / 255 : G
1270 Y = (X * 15) / 255 : G
1280 Y = (X * 15) / 255 : G
1290 Y = (X * 15) / 255 : G
1300 Y = (X * 15) / 255 : G
1310 Y = (X * 15) / 255 : G
1320 Y = (X * 15) / 255 : G

```

```

1203      Y = YB
1204      Z = ZB
1205  1
1206  BEGIN
1207  2
1208  FOR X = 1 TO 1000 STEP 10
1209  3
1210  4
1211  FOR Y = 1 TO 10 STEP 1
1212  5
1213  6
1214  FOR Z = 1 TO 10 STEP 1
1215  7
1216  8
1217  9
1218  10
1219  11
1220  12
1221  13
1222  14
1223  15
1224  16
1225  17
1226  18
1227  19
1228  20
1229  21
1230  22
1231  23
1232  24
1233  25
1234  26
1235  27
1236  28
1237  29
1238  30
1239  31
1240  32
1241  33
1242  34
1243  35
1244  36
1245  37
1246  38
1247  39
1248  40
1249  41
1250  42
1251  43
1252  44
1253  45
1254  46
1255  47
1256  48
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```

105 REM --- SAVE PICTURE ---
110 A
120 PRINT;PRINT;PRINT
130 INPUT "NAME OF PICTURE: ";A$
140 PRINT CHR$(4); "SAVE ";A$;"$2000;L$FFFF"
150 END

```

```

100 REM --- DISPLAY PICTURE ---
110 G
120 PRINT;PRINT;PRINT
130 PRINT CHR$(147);"LOAD ";A$;" ,ADDRESS"
140 POKE -16383, 0
150 POKE -16384, 0
160 POKE -16387, 0
170 POKE -16389, 0
180 END

```



Revised and updated!
Stereo Review's SRT14-A
STEREO
TEST RECORD

This latest version contains everything you need to get the fullest, most realistic reproduction from your stereo equipment. Whether you're spending thousands on your stereo system or have a more modest setup, the SRT10 is an indispensable tool for helping you realize the full potential of your equipment. Best of all, you don't have to be an electronics engineer to use it. You can actually perform a complete stereo system checkup by ear alone. A head line is a musical touch.

Employing the most advanced receiving, measuring, and printing techniques, the SAMS RDS-505A-A is produced to strict laboratory standards. Engaged at its optimum are a series of precisely recorded test tones, frequency sweeps, and peak noise signals that enable you to accurately detect and check your alarm system's

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- Stereo Enhancement
- Cartridge Tracking Error
- Channel Separation
- Hum and Noise: Reducing
- Automatic Reversal
- Wow and Flutter
- Electronic Speed Stabilizer
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- Musical Instrument Tuning Standards and more... much more!

Step-by-step instructions

Included with L2718-2 is a detailed instruction manual, complete with photos, tables, and diagrams. This makes you step by step through the tuning process. It indicates the significance of each test. It tells you what is right for: it clearly describes any corrections in system response. And it shows targeted problems.

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The usefulness of the DTF-1-A is well confirmed by the manyfold use, made, included on the record are a series of tests that call for the use of sophisticated measuring instruments, such as accelerometers, clip-on sensors and distortion analyzers. These tests permit the obtained amplitude and phase data to make precise measurements of transient response, recorded signal velocity, anti-skating compensation, IM distortion, and a host of other performance characteristics.

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- FREQUENCY RESPONSE, 20 HZ TO 20 KHZ
- SEPARATION, LEFT-TO-RIGHT
- SEPARATION, RIGHT-TO-LEFT
- CARTRIDGE TRACKING, LOW FREQUENCY
- CHANNEL BALANCE
- CARTRIDGE AND SPEAKER PHASING
- LOW FREQUENCY NOISE
- TUNABLE FLUTTER
- FREQUENCY-RESPONSE SWEEP, 500 TO 20,000 HZ, LEFT CHANNEL
- FREQUENCY-RESPONSE SWEEP, 500 TO 20,000 HZ, RIGHT CHANNEL
- TONE SCALE
- INTERMODULATION DISTORTION
- ANTI-DARTING ADJUSTMENT
- 1000-HZ REFERENCE TONES
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Linked Lists Are Alive And Well In Computer Graphics

Mark Coleman

What in the world is a linked list? *Linked list* is a fancy buzz phrase that means each position in the list contains, among other things, a map showing how to get to the next position in the list, much like a treasure hunt.

Lists that are not linked are called sequential lists. In a sequential list, the next element in the list must be in the next storage location. However, in a linked list the next element value may be stored anywhere, since each element has a pointer to the location of the next element. Figure 1 shows the list (A, B, D, E, F) in both forms.

There are many advantages and disadvantages to linked lists. One disadvantage is that they take up more memory since links must be stored along with element values. One advantage is the ease of inserting or deleting elements. Say we want to insert C between B and D.

Figure 2 shows that in the sequential list all elements after B must move one storage location in the list to make room for C. This can take a great deal of time if the list is very long. But in a linked list all that need be done is change the value of the link at B so it points at the storage position of C and make the link of C point to D.

In a doubly linked list, each element has two links, one pointing to the next element and one pointing to the previous element as shown in Figure 3.

In the example above, the links are actually the values of the next storage

		Storage position	1	2	3	4	5
Sequential	Element value		A	B	D	E	F
Linked	Storage position		1	150	25	300	83
	Element Value		A	B	D	E	F
	Link		150	25	300	83	—

Figure 1.

		Storage position	1	2	3	4	5	6
Sequential	Element value		A	B	C	D	E	F
Linked	Storage position		1	150	25	300	83	
	Element Value		A	B	D	E	F	
	Link		150	200	300	83	—	
				200				
				C				
				25				

Figure 2.



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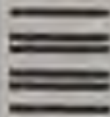
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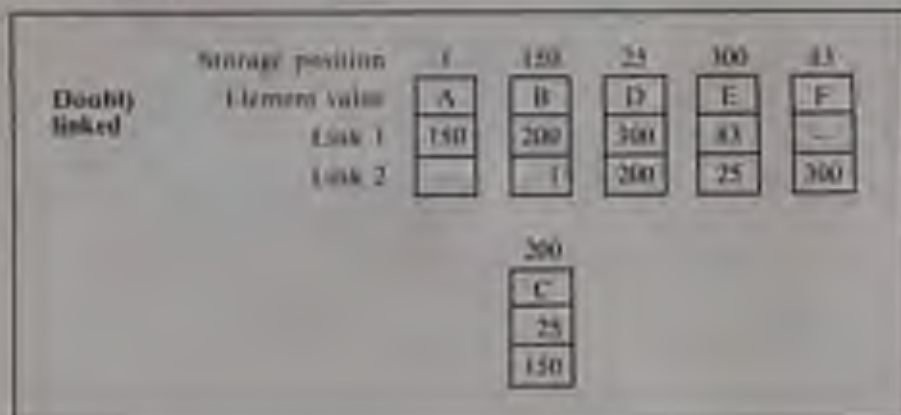


Figure 3



Figure 4

A(1, 5)=22	A(2, 5)=3	A(3, 5)=37	A(4, 5)=148	A(5, 5)=117
A(1, 4)=9	A(2, 4)=16	A(3, 4)=7	A(4, 4)=216	A(5, 4)=93
A(1, 3)=83	A(2, 3)=12	A(3, 3)=91	A(4, 3)=609	A(5, 3)=125
A(1, 2)=282	A(2, 2)=37	A(3, 2)=32	A(4, 2)=462	A(5, 2)=78
A(1, 1)=179	A(2, 1)=47	A(3, 1)=56	A(4, 1)=367	A(5, 1)=1

Figure 5

location. In general, links are any pieces of information which point to the location of the next value. This article shows how linked lists can be useful in solving a game known as Magic Path.

The Game

The game goes like this: Given the 5x5 matrix in Figure 4, draw a line which starts at START and ends at END. The line may not cross the same square twice, it may not go diagonally or out of the matrix, and the sum of the numbers crossed by the line must be 1958. Sounds easy.

I spent a few minutes trying to figure out a short cut solution, but soon decided that a systematic trial and error approach would be faster. All I had to do was try each possible path. Figuring out how to do this

systematically is where the fun comes in.

The Algorithm

Since the matrix is a two-dimensional array, I decided to store the data in the same form. For a given square, the first subscript of the array corresponds to the column and the second subscript corresponds to the row as shown in Figure 5.

But how do I decide which direction to go from any given square? There are only four directions that are legal so I numbered them 1 to 4 as in Figure 6.



Figure 6

When I first enter a square I will try to exit from it in direction 1. If for some reason I cannot exit in the desired direction — if I run into an edge or the new total will exceed 1958 — then I simply increment my direction pointer and try the next direction. If that direction doesn't work, I increment it again and again until I find a direction I can go or until I exhaust all four possible directions. For example, in Figure 7, directions 1



Figure 7

and 2 from square 11 go off the matrix, so direction 3 is chosen making 1 the next square.

To generate the Row (x), Column (y) coordinates of the next square, I wrote a "direction decoder" routine which relates the direction number 1 to 4 to the required change in subscripts.

```

IF D=1 THEN Y=Y+1
IF D=2 THEN X=X+1
IF D=3 THEN X=X-1
IF D=4 THEN Y=Y-1
    
```

But what if I exhaust all possible directions from a given square, the classic "You can't get there from here" problem? I must then go back to the previous square on the path and try the next direction from that square. For example, trying to select the next square from square "216" in Figure 8 results in: direction 1 crosses a square twice; direction 2 crosses a square twice; direction 3 crosses a square twice; direction 4 causes sum to be greater than 1958.



Figure 8

In this case square 216 must be eliminated from the path and the next direction must be selected from square 7.

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A(1, 1, 1)=value of square (1, 1)
 A(1, 1, 2)=direction to go to find the next square: Forward Link
 A(1, 1, 3)=direction to go to find the previous square: Backward Link
 A(1, 2, 1)=value of square (1, 2)
 A(1, 2, 2)=direction to go to find the next square: Forward Link
 A(1, 2, 3)=direction to go to find the previous square: Backward Link
 etc.

Figure 9.



Figure 10.

A(2, 1, 1)=47 value
 A(2, 1, 2)=1 up
 A(2, 1, 3)=0
 A(2, 2, 1)=57 value
 A(2, 2, 2)=2 right
 A(2, 2, 3)=4 down
 A(3, 2, 1)=32 value
 A(3, 2, 2)=4 down
 A(3, 2, 3)=3 left
 A(3, 3, 1)=56 value
 A(3, 3, 2)=0
 A(3, 3, 3)=1 up

Now I realized I had a problem. I needed two pieces of information that I didn't have yet. First of all, square 216 needs to know how to find square 7 and then square 7 needs to know which direction it tried last so it knows which direction to try next, or in other words it needs to know how it got to square 216. I needed "links" forward and backward in the lot of squares on the path.

I decided to expand my two-dimensional array, which was storing the values of the squares, into a three-dimensional array as in Figure 9.

The values for the links are the numbers 1 through 4 corresponding to the directions shown in Figure 6. In addition, when a square is not yet on the path, I set the links to zero. This makes it easy to tell whether or not a given square is available or has already been used. Remember that you can't cross a square twice.

To illustrate this scheme consider the path shown in Figure 10.

The zeros arise from the fact that square (2, 1) is the start square so it has no previous square and square (3, 1) is the last square shown so it has no next square.

Once I figured out the linking scheme all I had to do was check for a total of 1958 and current coordinates equal to the END square.

Graphics

To keep myself from feeling completely neglected as my computer solved this problem, I added a few lines to the program to draw the matrix on my screen and to draw and erase the different paths as they were tried. Having the different paths drawn on my CRT not only made the program more fun to watch, but it also made debugging much easier since I already had a mental picture of how the search should proceed.

The machine I used was a Hewlett-

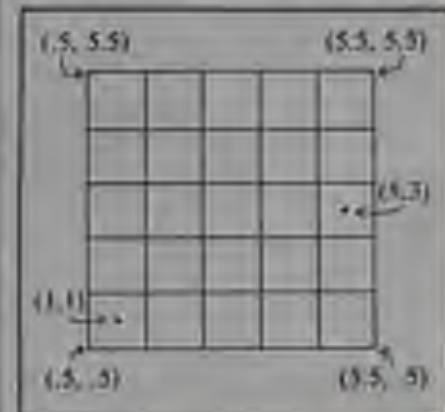


Figure 11.

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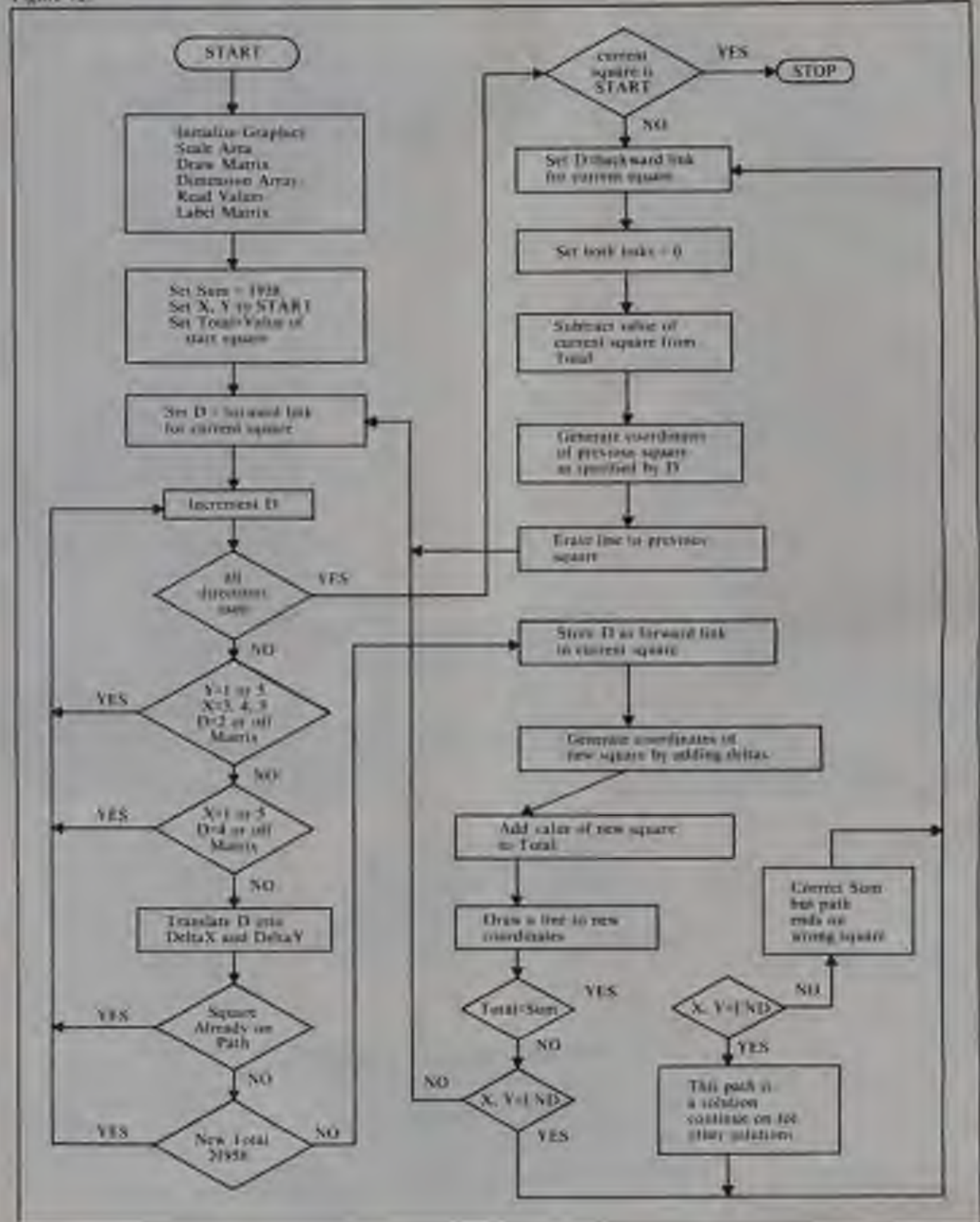
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Figure 12





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Packard 8645B which has really super graphics, but you don't need anything too super to perform most of the operations I discuss below.

By scaling my graphics area (5, 5, 5, 5) and drawing the matrix with corners at (5, 5), (5, 5.5), (5.5, 5.5), and (5.5, 5), the centers of the squares occur at integer coordinates corresponding to the subscripts of my A array. (Figure 1.)

Initially, I do a MOVE to the center of the START square. Then, after I decide which square to move to next, I do a DRAW to the new coordinates. If I arrive at a dead end and have to back up, I erase lines by doing a PEN -1 and a DRAW to the coordinates of the previous square. On my HP 9845B, PEN -1 means erase.

If your machine doesn't have a SCALE statement just MOVE and DRAW to 3*X,3*Y or 5*X,5*Y — whatever scale factor is necessary to get a reasonable size matrix and gallery.

Also if you don't have MOVE, DRAW commands you will want to write a little subroutine which lets you draw horizontal and vertical lines. The program in Listing 1, or some modification of it, might work on your machine. As shown it will run on a TRS-80 or the like. It only draws vertical and horizontal lines, but that's all you need for this application.

To do a MOVE, simply set XS equal to the x-coordinate of the starting point and YS equal to the y-coordinate.

To do a DRAW set XE equal to the x-coordinate of the end point and YE equal to the y-coordinate. Then do a GOSUB 1000.

The routine draws a line from XE, YE to XS, YS. Then it sets XS=XE and YS=YE so you can draw a line starting at the end of the last line without redefining the startpoint.

P determines whether the line is to be drawn or erased (-1 means erase, any other value means draw).

Faster Solutions

After I got the program running, I noticed that the search spent a great deal of time on paths that I knew wouldn't work. For example, since a square in column 1 or 5 is entered (unless there is no way to get to the END square by going down (direction 4). Also when Row 1 or 5 is entered (top and bottom) and I'm in column 3, 4 or 5, there is no way to get to the END square by going right (direction 2). Also the END square should be treated as a dead end.

I was able to avoid searching three

paths by modifying a few lines of code in the runtime which checks to see if the proposed direction is legal. By eliminating these paths I was able to speed up the search considerably.

Conclusion

Figure 1.2 and Listing 2 show my flowchart and program. If you rewrite

Outline 1.

```

1000  IF I=0 THEN GOTO 1100
1010  IF I=0 OR I=1 THEN GOTO 1100
1020  PRINT "MODIFIED AND C ERROR FOR CONTROL AND VERTICES: 10000"
1030  RETURN
1100  FOR I=0 TO N-1 STEP 1
1110  IF NOT THEN SET (X(I),Y(I)) ELSE BASE1 (X(I),Y(I))
1120  GOTO 1100
1130  GOTO 1100
1140  GOTO 1100

```

London 2

[illegible]

It is for your own machine be careful to undo all your steps completely as you travel backward from a dead end. It is very easy to forget something. It took me a while to figure out that I was forgetting to subtract the values of the sources as I left them.

There are several solutions which result in a total of 19%, but only four

MX-80 Graphics from Pascal



The Epson MX-80 printer comes with a limited graphics capability. It has 64 graphics characters as shown in Figure 1. Better resolution graphics are available, but the cost for the hardware approaches \$100.

I would like to have the ability to do graphics, but my need doesn't justify this expenditure. Fortunately, the graphics character set can be easily used from Apple Pascal to produce graphics that are adequate for my applications.

The Pascal graphics screen has a 192 (down) by 280 (across) resolution. Each MX-80 graphics character has a three (down) by two (across) resolution. Thus,

R. A. Dousette, 8283 Woodbine Dr., Apt. 1, Woodland, MD 21781.

R. A. Dousette

If 66 lines of 80 graphics characters are printed on each page, the printed page will have a resolution of 198 by 160 dots.

In one dimension, the MX-80 will accommodate the graphics page. Going across, however, there isn't enough room to accommodate the graphics page.

The MX-80 accommodates four print sizes. They are normal size (80 characters per line), double-wide (40 characters per line), compressed (132 characters per line), and compressed double-wide (66 characters per line). By using these dif-

ferent print sizes, the page resolution can be changed. Double-width characters give a 198 x 80 display, compressed characters give a 198 x 264 display, and double-width compressed characters give a 198 x 132 display.

Assignment Of ASCII Codes	
1	0
4	0
16	00
Example: 185	185 = 160 + 25

Figure 2.

Use of any of the resolutions causes some distortion of the image. The distortion is least if 80 graphics characters per line are used, in which case, the horizontal dimension is shrunk by about 10%.

Figure 1 shows the ASCII codes and the corresponding graphics characters. The graphics characters have ASCII codes 160 through 223. The appropriate code is determined by adding to 160 the appropriate power of two for each of the pixels to be printed. The example in Figure 2 shows how the ASCII code of 185 is assigned to one character.

Figure 1.

ASCII Codes Of Graphics Characters							
160	161	162	163	164	165	166	167
168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183
184	185	186	187	188	189	190	191
192	193	194	195	196	197	198	199
200	201	202	203	204	205	206	207
208	209	210	211	212	213	214	215
216	217	218	219	220	221	222	223

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CIRCLE 274 ON READER SERVICE CARD

I have written a Pascal procedure named DRAW that transfers a portion of the graphics screen to the printer. The procedure accepts four integer arguments, XMIN, XMAX, YMIN, and YMAX, that define a window into the graphics screen. This procedure has an internal procedure, SETCODE, that assigns the ASCII code for each block of six dots from the graphics screen by use of the Boolean function SCREENBIT.

SCREENBIT is contained in the TURTLEGRAPHICS unit. The reference SCREENBIT(I,J) looks at the graphics screen pixel with coordinates I and J and then returns a value of TRUE if the location on the screen isn't black. Otherwise, it returns the value FALSE.

By examining a 2 x 3 matrix of screen pixels, it is possible to determine the ASCII code of the graphics character that reproduces the pattern on the graphics screen.

Procedure DRAW initially sets a Boolean variable GRAFEROR as FALSE. Then, it tests the coordinates of the screen window for consistency. If the coordinates aren't correct, GRAFEROR is set as TRUE and the procedure is exited.

Some editing is also done on XMIN and XMAX. For CHARSIT to work correctly on the rightmost edge of the picture, XMAX-XMIN must be an odd integer. If not odd, the procedure expands the window by half a character.

The procedure assumes normal width characters. No provision for double-width characters is made. Possible changes in the procedure include adding double-width characters and rotating the image through 90 degrees before printing it.

The program Printdemo demonstrates the use of this procedure. I borrowed the butterfly from the APPLE3:GRAFDEMO program that comes with the Language System. The program prints the butterfly in both normal (Figure 3) and compressed (Figure 4) formats.

I also drew two geometric figures by rotating a square (Figure 5) and, in the last case, expanding the square (Figure 6) as it rotates.

The GRAFRANDOM procedure illu-

Figure 3



Figure 5

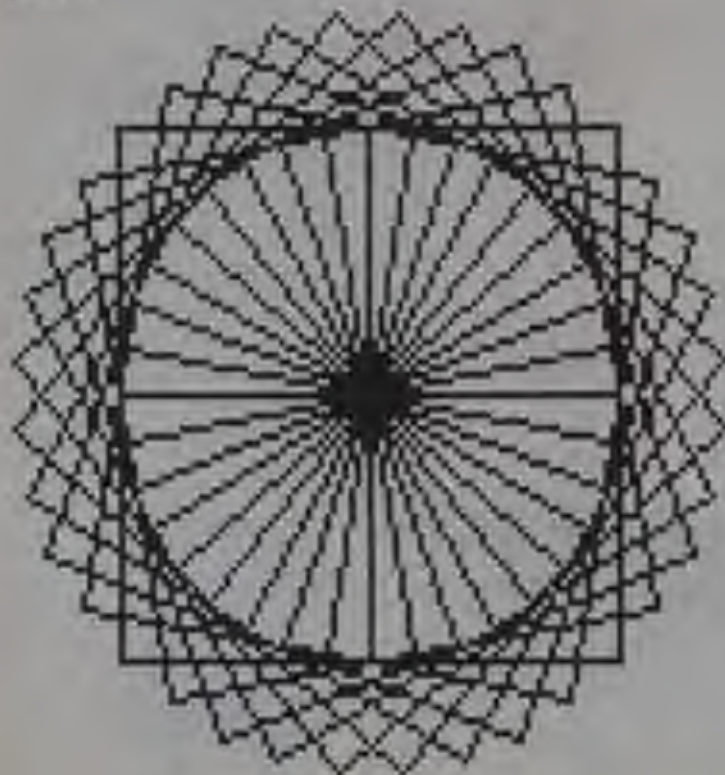
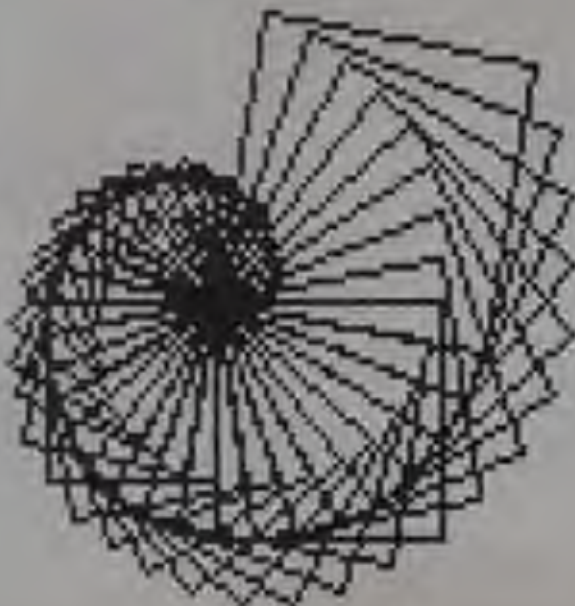


Figure 4



Figure 6



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MX-80 Graphics, continued...

states a random walk (Figure 7). It can be interpreted as the result of a coin toss experiment; with each successive toss of the coin, the total count of heads is divided by the number of tosses and the resulting ratio is plotted. The horizontal line through the graph is the 50% level. As the number of coin tosses increases,

the ratio tends towards 50% (Figure 8).

The resulting graphics aren't as pretty as those from Grafman-80, and they lose all shading because colors other than black are treated the same. They are, however, adequate for what I want, and they have the enormous consolation of being free. □

Figure 7

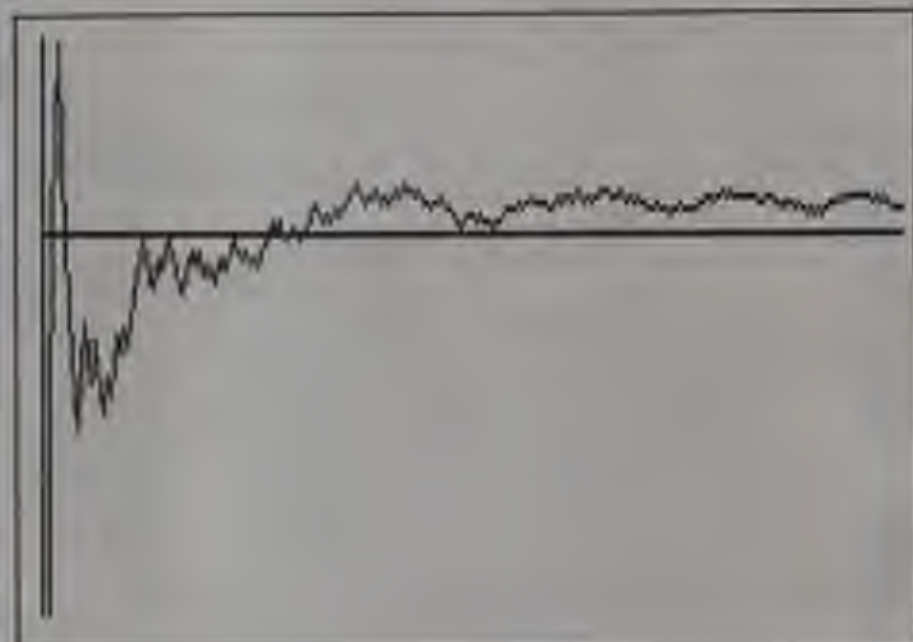
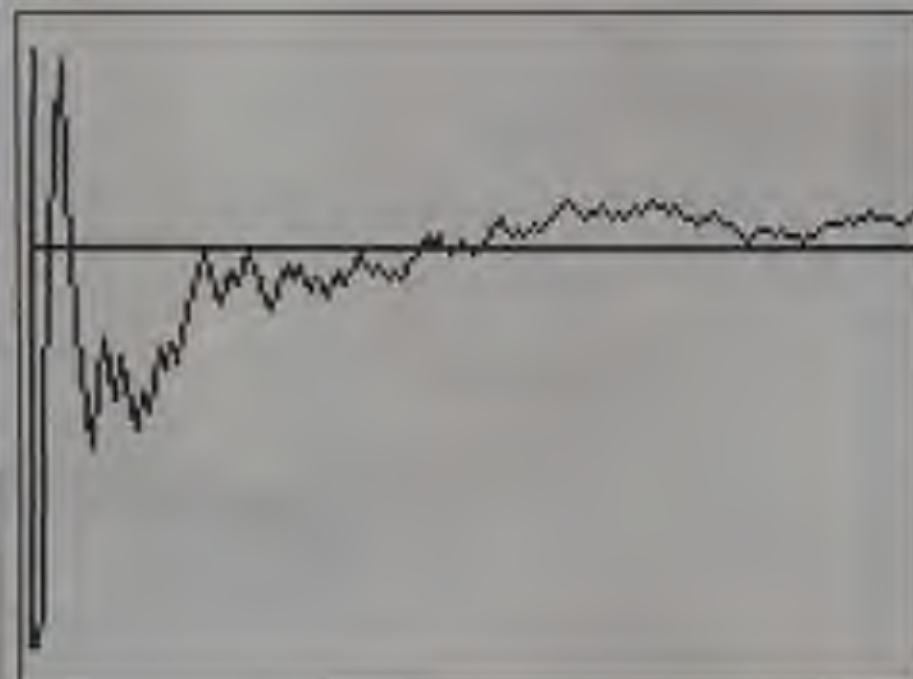


Figure 8



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MX-80 Graphics, continued...

```

PROGRAM PRINTING;
(*****XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX*)
18
19 THIS IS A PROGRAM TO DEMONSTRATE THE USE OF THE          21
19 EPSON MX-80 GRAPHICS CHARACTERS AND THE GRAPHICS        21
19 PAGE.                                                    21
19
19
19*****XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX*)

USED: TURTLEGRAPHICS,APPLESTUFF;
CONST XMAX=279;
      YMAX=191;
      XMD=140;
      YMD=96;

TYPE PICTURE=PACKED ARRAY(0..55,0..128) OF BOOLEAN;

VAR I,J,X,SKIP,HOM: INTEGER;
    CH: CHAR;
    PRINTER:TEXT;
    BUFFER: PICTURE;
    BUFFERON,BITS: BOOLEAN;

PROCEDURE WAITTIME;INTEGER;
VAR DELAY: INTEGER;
BEGIN
  FOR DELAY=1 TO TIME DO;
  END;

PROCEDURE DRAWPIXEL(XMAX,XMIN,YMIN,YMAX;INTEGER); { Transfer a portion of }
                                                    { the graphics screen to the printer. Use }
LEAVE; NEXTFORM=140; { Coordinates XMIN, YMIN, XMAX, YMAX to set }
COMPCHAR=12; { the window to the screen. }
NORCHAR=166;

VAR XMAX2,XORD,YORD: INTEGER;

PROCEDURE SETCODE(XPOS,YPOS;INTEGER); { Determine ASCII code of }
VAR I,J,STOP,YBOT,CHARSET;INTEGER; { six positions from the }
BEGIN { graphics screen. }
  CHARSET:=1;
  DRAWCODE:=160;
  STOP:=YPOS+1;
  IF STOP>XMAX THEN STOP:=XMAX;
  YBOT:=YPOS-2;
  IF YBOT<YMIN THEN YBOT:=YMIN;
  FOR J:=YBOT DOWNTO YBOT DO
    FOR I:=STOP TO STOP DO
      BEGIN
        IF (ORD(CHARSET(I,J)) THEN DRAWCODE:=DRAWCODE+CHARSET;
        CHARSET:=2*CHARSET;
      END;
    END;
  END;
  BEGIN
    BUFFERON:=FALSE;
    IF NOT (XMAX=XMIN) THEN { Procedure SETCODE needs an even }
      IF XMAX<279 THEN XMAX:=XMAX+1 { number of a character to copy }
      ELSE XMIN:=XMIN-1; { set the character }
    IF (XMAX=XMIN) OR (YMAX=263) OR (XMAX=279) OR (XMIN=0) OR (XMAX=XMAX)
    OR (YMIN=0) OR (YMAX=191) OR (YMIN=YMIN) THEN
      BEGIN
        BUFFERON:=TRUE;
        EXIT (PRAM);
      END;
    IF XMAX-XMIN<129 THEN WRITE (PRINTER,CHR (COMPCHAR));
    ELSE WRITE (PRINTER,CHR (NORCHAR));

    XORD:=XMAX;
    REPEAT
      XORD:=XMIN;
    REPEAT
      SETCODE (XORD,YORD);
      WRITE (PRINTER,CHR (DRAWCODE));
      XORD:=XORD+2;
    UNTIL XORD=YMAX;
    WRITE (PRINTER,CHR (10));
    YORD:=YORD-2;
    UNTIL YORD=YMIN;
    WRITE (PRINTER,CHR (NEXTFORM));
  END;

PROCEDURE FRAME;
BEGIN
  PENCOLOR (HOME); HOME:=10,0;
  PENCOLOR (NEXTFORM);
  HOME:=10,YMAX;
  HOME:=XMAX,YMAX;
  HOME:=XMAX,0; HOME:=10,0;
  PENCOLOR (HOME);
END;
  
```


PROCEDURE: DRAWING

BEGIN

VIEWPORT (0, 0, 256, 0, 256, 1)
FRAME
VIEWPORT (1, 0, 256, 1, 256, 1)
FILL SCREEN (BLACK)
PENCOLOR (HOME)
MOVE TO (0, 0)
PENCOLOR (WHITE)
END

PROCEDURE: DRAWING

VAR: YVAL: 0..255
XVAL: 0..255
RNDCOUNT: 0..255

BEGIN

DRAWING
PENCOLOR (HOME)
MOVE TO (XVAL, YVAL)
PENCOLOR (WHITE)
MOVE TO (X, Y)
RNDCOUNT := 0
FOR YVAL = 0 TO 255 DO
BEGIN
IF RNDCOUNT / 256 THEN RNDCOUNT := RNDCOUNT + 1
YVAL := RNDCOUNT * 255 / 256
MOVE TO (XVAL, YVAL)
END
END

END

PROCEDURE: DRAWING

VAR: Z: 1..4

BEGIN

FOR Z = 1 TO 4 DO
BEGIN
DRAWING
MOVE (Z)
TURN (Z)
END

END

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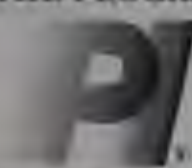
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CIRCLE 152 ON READER SERVICE CARD

MX-80 Graphics, continued...

PROCEDURE DRAWING

VAR: 1+1...344

BEGIN

IMAGE

FOR I=1 TO 34 OR

BEGIN

DRAWDRAW(1411)

TURN(10)

END

WAIT(1000)

END

PROCEDURE DRAWDRAW

VAR: 1+1...344

VAR: 1+1...344

BEGIN

IMAGE

FOR I=1 TO 34 OR

BEGIN

I=1+0

DRAWDRAW(21)

TURN(10)

END

WAIT(1000)

END

PROCEDURE STUFF(VAR RETURN; PICTURE; \$+STRING)

IF NAME BUTTERFLY RETURN FORM STRING \$1

VAR: 01 INTEGER

BEGIN

FOR J=1 TO LENGTH(PICTURE)

BEGIN

BIT=ASC(PICTURE(J))

BITMAPFROM(J+0)=BIT

BITMAPFROM(J+2)=BIT IF SYMMETRIC \$1

END

FORM=FORM+1

END

PROCEDURE BUTTER

BEGIN

FORM=0

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

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STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

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STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")

STUFF(BUTTER, "X")


```

PROCEDURE BUTTER3;
BEGIN
  STUFF (BUTTER, '  2 2 111 111XXX  AAA  XX
  STUFF (BUTTER, '  8 8 1 1 1 11 XXX  XX
  STUFF (BUTTER, ' AAAA 8 111 1 11 XXX  XX
  STUFF (BUTTER, ' XX 8 1 1 1 0 1 XXXXXXX
  STUFF (BUTTER, ' 88 8 11 1 00 1 8 XXX
  STUFF (BUTTER, ' XX X 1 1 11 000 1 8
  STUFF (BUTTER, ' XXXXX 8 1 111 111 0 1 8
  STUFF (BUTTER, ' 8 8 8 11 111 11 0 1 8
  STUFF (BUTTER, ' 3 8 8 11 1 1 00 11 0 1 8
  STUFF (BUTTER, ' XXX 8 8 1 1 1 00 1 1X
  STUFF (BUTTER, ' 3 88 1 1 0 1 00 1 1 8
END;

PROCEDURE BUTTER4;
BEGIN
  STUFF (BUTTER, ' 432 8 1 1 000 1 11 X
  STUFF (BUTTER, ' 8 8 1 0 1 00 1 00 1 8
  STUFF (BUTTER, ' 8 8 0 0 1 1 1 X
  STUFF (BUTTER, ' 8 3 1 1 0 1 1 1
  STUFF (BUTTER, ' 8 1 1 00 11 8
  STUFF (BUTTER, ' 8 111 1 8
  STUFF (BUTTER, ' 8 1 1 AAA
  STUFF (BUTTER, ' XXXX111 8
  STUFF (BUTTER, ' 8 X
  STUFF (BUTTER, ' XX
END;

PROCEDURE INITBUTTERFLY;
BEGIN
  BUTTER1;
  BUTTER2;
  BUTTER3;
  BUTTER4;
END;

PROCEDURE FLUTTER;
BEGIN
  IN DRAW SIZE BUTTERFLIES N1
  DRAWLOCK (BUTTER, 16, 0, 0, 120, 54, 10, 0, 14);
  DRAWLOCK (BUTTER, 16, 0, 0, 120, 54, 150, 64, 14);
  DRAWLOCK (BUTTER, 16, 0, 0, 120, 54, 10, 128, 14);
  DRAWLOCK (BUTTER, 16, 0, 0, 120, 54, 150, 128, 14);
  DRAWLOCK (BUTTER, 16, 0, 0, 120, 54, 10, 64, 14);
  DRAWLOCK (BUTTER, 16, 0, 0, 120, 54, 150, 0, 14);
  WAIT (1000);
END;

PROCEDURE ERRORMESSAGE (ERRPOINT: INTEGER);
BEGIN
  IF ERRPOINT THEN
    CASE ERRPOINT OF
      1: WRITELN ('SORRY- NO BUTTERFLIES');
      2: WRITELN ('SORRY- NO COMPRESSED BUTTERFLIES');
      3: WRITELN ('SORRY- NO FAY');
      4: WRITELN ('SORRY- NO SPINAL');
      5: WRITELN ('SORRY- NO RANDOM MILK');
      6: WRITELN ('SORRY- NO COMPRESSED RANDOM MILK');
    END;
  END;
END;

BEGIN
  RANDOM123;
  WRITE (PRINTER, 'PRINTER');
  INITBUTTERFLY;
  INITTURTLE;
  FRAME;
  FLUTTER;
  DRAW (0, 159, 0, 191);
  ERRORMESSAGE (1);
  DRAW (0, 263, 0, 191);
  ERRORMESSAGE (2);
  DRAW (0);
  DRAW (150, 209, 0, 191);
  ERRORMESSAGE (3);
  DRAWSP (DRAW);
  DRAW (160, 219, 0, 191);
  ERRORMESSAGE (4);
  DRAWRANDOM;
  DRAW (0, 159, 0, 191);
  ERRORMESSAGE (5);
  DRAW (0, 263, 0, 191);
  ERRORMESSAGE (6);
END;

```



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An IBM PC Character Generator

The IBM PC character generator is a program for making your own characters. You can make up any number of characters, in sets of 127, and use them within your other programs. It allows you to make customized characters for special purposes, such as letters of the Greek or Cyrillic alphabets, and cursive or underlined characters.

You can also use it to make pictures that are one character in size or composites made up of many characters. There are as many applications as your imagination will allow.

You need an IBM Personal Computer, with preferably 96K or more RAM, a color graphics monitor adapter, and Basic-A.

Character Structure and Location

The programmable character set is possible because the IBM PC defines only the first 128 (0-127) characters in graphics mode. The rest of the characters are left to be designed by the user. The addresses of these characters are given at the locations 7C-7F hex.

Each character is formed in an area of 8 x 8 pixels. Each row of eight pixels (bits) forms one byte, so that every character is defined by eight bytes.

Figure 1 shows one example of a character and the bytes that define it. After its formation, the definition of the character is stored sequentially, as demonstrated in Figure 2.

Note that even though each character definition is eight bytes long, once it is located properly, it can be recalled by

C. Kenneth Fan

its assigned ASCII code (128-254), which is only one byte long.

Making Characters

The screen display for the character generator shows four major sections. The second line of text displays the current memory location of the character set you are making or revising (in the format of segment: offset). The large 8 x 8 grid is where characters are actually designed. It represents the 8 x 8 pixels that make up the character space.

To its right, a box displays the ASCII codes of the characters in hexadecimal. The first digit of the code is given by the column heading, and the second digit by the row heading. The last section is the command table at the bottom of the screen.

There is a total of 14 commands to help you design shapes. To use a command, simply type the first letter of that

command. For example, if you wish to execute the command MEMORY, type the letter M. This first letter of the current command is shown to the lower left of the grid and remains until you change your command.

Before you begin to create shapes, be sure to indicate the memory location for the character set you want to make. To do this, use the MEMORY command, specifying the Segment and the Offset.

Be careful in using this command because doing so carelessly can "hang" the machine. (The CTRL-ALT-DELETE sequence may be inactivated.) Bad places to assign this location would be in the Basic work area (which could destroy the program), the system work area or Basic-A program (both of which could "hang" the system), and the ROM (which would simply not let you create a character set). This is why it is recommended that you have 96K or more RAM.

With less than 96K, you must find a safe place in the Basic work area that does not interfere with program variables, the program, or system variables.

Figure 1.

Graphic		Binary	Hex	Byte
		00011000	= 18	1
		00111100	= 3C	2
		01100110	= 66	3
		11000011	= C3	4
		11000011	= C3	5
		01100110	= 66	6
		00111100	= 3C	7
		00011000	= 18	8

1. Kenneth Fan, 8018 Kenner Dr., Honolulu, HI 96816.

PC Characters, continued...

The last command, QUIT, simply ends the program. To prevent loss of your character set accidentally, the QUIT command asks if you are sure you want to quit.

Using the Characters in Other Programs

To use the characters made by the IBM PC Character Generator in your own program, type the instructions in Listing 1, either directly into RAM or as part of your program. This example assumes that your special character set will be loaded at memory location 17000, and is named GREEN CHR.

Remember that the characters can be used only in a graphics mode. For 80 columns, use screen two (640 x 200); for 40 columns, use screen one (320 x 200).

200). The characters will be displayed in the foreground color. If you wish to change this color, you can always use the **BASICA PAINT** command to fill the character. In 80 column mode you are stuck with black and white.

To type one of your characters,

simply hold down the CTRL and ALT keys and type the three digit ASCII number in decimal of the desired character. For example, to get character 143, use this sequence: CTRL-ALT-1-4-3

You can now use your custom made character set. ☐

Limburg, L.

10 DEF SEG=0	'Set the segment to 0'
20 POKE &H7F,&H17	'High byte of segment of characters'
30 POKE &H7E,&H00	'Low byte of segment of characters'
40 POKE &H7D,&H00	'High byte of offset of characters'
50 POKE &H7C,&H00	'Low byte of offset of characters'
60 DEF SEG=&H1700	'Set segment of desired character segment location'
70 BLOAD "GREEK.CHR",0	'Load character set with offset'

Lesson 2

```

100 SCREEN (CLC:OUT 990,2:OUT 991,99
110 KEY OFF:LOCATE 1,2:DEF SEG=0
120 G4M CLC:ON
130 LINE (100,100)-(100,100):LINE (100,90)-(100,100)
140 SET (100,90)-(100,100),15
150 CLC:POKE=9:POKE=9
160 PRINT "Character Generator: By E. Ramon Fan"
200 SEG=10000
210 SEG=10000
220 SEG=10000
230 PUT (POKE25+22,POKE25+22),25
235 B=PEEK(1547F+325A+PEEK(1547E)+D-PEEK(1547E))
235A=PEEK(1547E)
240 B=1547E+1:IF B=1547E THEN 240
245 LOCATE 16,1:PRINT B
250 PUT (POKE25+22,POKE25+22),25
260 IF B=1547E OR B=1547F THEN 1000
270 IF B=1547D OR B=1547C THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
280 IF B=1547B OR B=1547A THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
290 IF B=15479 OR B=15478 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
300 IF B=15477 OR B=15476 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
310 IF B=15475 OR B=15474 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
320 IF B=15473 OR B=15472 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
330 IF B=15471 OR B=15470 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
340 IF B=1547F OR B=1547E THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
350 IF B=1547D OR B=1547C THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
360 IF B=1547B OR B=1547A THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
370 IF B=15479 OR B=15478 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
380 IF B=15477 OR B=15476 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
390 IF B=15475 OR B=15474 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
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THEN 1547E+1
410 IF B=15471 OR B=15470 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
420 IF B=1547F OR B=1547E THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
430 IF B=1547D OR B=1547C THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
440 IF B=1547B OR B=1547A THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
450 IF B=15479 OR B=15478 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
460 IF B=15477 OR B=15476 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
470 IF B=15475 OR B=15474 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
480 IF B=15473 OR B=15472 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
490 IF B=15471 OR B=15470 THEN 1505+1547E+1:IF 1547E+1
THEN 1547E+1
500 GOTO 230
510 LOCATE 21,1:INPUT "Segment: ",A
520 IF A=0 THEN A=15475:ELSE A=1547
530 LOCATE 21,1:SEG=10000
540 INPUT "Offset: ",B
550 IF B=0 THEN B=15475:ELSE B=1547
560 POKE 1547F,A:POKE 1547E,B:POKE 1547D,A:POKE 1547C,B
570 POKE 1547B,A:POKE 1547A,B:POKE 15479,B:POKE 15478,B
580 LOCATE 21,1:SEG=10000:SEG=10000:GOTO 230
590 LOCATE 21,1:PRINT "Quit (Y/N)?"
600 SEG=15000
610 IF B=1547F OR B=1547E THEN CLC:PRINT "Y/N:":END
620 LOCATE 21,1:SEG=10000:GOTO 230
630 LOCATE 21,1:INPUT "ASCII Code (128-255): ",A
640 IF A=128 OR A=255 THEN B=15475:GOTO 230
650 LOCATE 21,1:SEG=10000
660 DEF SEG=0
670 FOR Y=0 TO 7
680 B=PEEK(1547F+128+Y)
690 FOR X=0 TO 7
700 IF B AND 2^(7-X) THEN CIRCLE (1547+32,Y+15+27)
+4,...,1/5:PRINT (1547+32,Y+15+27) ELSE IF B=1547F
AND B=1547E THEN PRINT (1547+32,Y+15+27),0,0
710 NEXT X
720 NEXT Y
730 DEF SEG=0:GOTO 230
740 LOCATE 21,1:PRINT "Press any key to start (Y/N)?"
750 SEG=15000:LOCATE 21,1:SEG=10000
760 IF B=1547F OR B=1547E THEN DEF SEG=0:FOR I=0
TO 15475:POKE I,0:NEXT I:DEF SEG=
0:GOTO 100
770 GOTO 230
780 LOCATE 2,1:PRINT "SPACE"
790 B=0:123456789ABCDEF
800 FOR V=4 TO 19
810 LOCATE V+1,1:PRINT MID$(B,V+5,1)
820 LOCATE V+1,1:PRINT MID$(B,V+5,1)
830 NEXT V
840 LOCATE 2,1:PRINT "TAB"
850 FOR I=128 TO 255
860 LOCATE 1:1547+1,1:1547+1:1547+1:1547+1:1547+1
870 NEXT I
880 LOCATE 2,1:PRINT "Character set location"
890 IF B=1547F+128+PEEK(1547E)
+1547E+1:PEEK(1547F+128+PEEK(1547E))
900 RETURN
910 LOCATE 2,1
920 PRINT "M: Move L: Left R: Right P: Print
C: Change I: Input S: Set A: Character
B: Set A: Set A: Memory C: Clear M: Move B: Set"
930 RETURN
940 FOR I=0 TO 15475:1547+1:1547+1:1547+1:1547+1:1547+1
950 NEXT I
960 RETURN
970 B=1547F+128+PEEK(1547E) THEN 1547E+1:ELSE RETURN
980 PRINT SPACE(10):LOCATE 1:1:RETURN

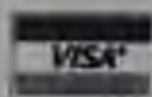
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TRS-80 Graphics Made Almost Painless

Part 1

John Crew

This is the first of a three-part series on graphics creation for purposes such as doodling, making limited resolution artwork, and designing graphics for your own programs.

The programs are intended to simplify graphics creation for the above purposes, and should be of interest to novice and expert computer users.

This article describes an on-the-fly sketch program that I call Sketch/Print. The second article describes a program, called Vector Plotter, which draws lines between any two points on the screen that you specify. The last article describes a program, Graphics Manager, which stores whatever is on the screen. Graphics Manager can store up to nine pictures, which I call frames, that can have either standard or double width characters. Using Graphics Manager, frames can be saved on tape, loaded from tape, compressed, printed on paper, combined, and have the ASCII number of every byte in them listed.

Sketch/Print and Vector Plotter can be used independently, or you can add Graphics Manager to either. I recommend that you type them as shown alone, test them individually, and correct your typographical errors, and then if you desire, follow the instructions in Part 2 of this series to add Graphics Manager to one or both of the others.

Programmers who have more than 16K of free RAM may want to combine all three programs. That is a fairly simple task if you know Basic well, have about 18K of free RAM, and have an excellent line renumbering program.

System Requirements

All of the programs in this series are written in Level II Basic for an unmodified Model I, 16K, cassette system. All programs except Graphics Manager will easily fit into 4K of free RAM. Using Graphics Manager with one of the other programs requires at least 16K of free RAM, and it is a tight fit so there probably is not enough room for anything else except a very short program such as a simple key debounce program.

To print frames on paper using Graphics Manager you need an MX-80 printer (the basic model without the new features is adequate), or you will have to modify the program. The article on Graphics Manager will describe how frames are stored, which should be very helpful to those who want to modify the program.

Because I used POKE statements and some other tricks which are unique to the previously described system, the programs in this series will probably require modifications to work on a Model III, a differently configured Model I, or other computer.

I spent many hours developing and debugging the programs in this series so I do not think they contain any errors. The programs have many tests to reject clearly erroneous commands. The only problem I am aware of is that some parts of the programs are not written in the most efficient and neat manner. There are no syntax errors, so do not change any statements which look

wrong to you. If you find statements which you think are unnecessary, please leave them alone; there is probably a good reason for their inclusion.

One good book which helped me gain the skills and knowledge which I needed to write these programs was William Barden's *Programming Techniques for Level II Basic* which is sold by Radio Shack. I highly recommend that book to intermediate Basic programmers who want to become more versatile.

Program Modification

The three main programs are written very compactly to save memory space and execution time. To this end I willingly sacrificed some legibility and ease of comprehension. For Basic programs they are rather fast. They could be made even faster if you rewrote them so the subroutines were put as close to the beginning as possible with the most frequently used subroutines first.

Another way to make the programs run faster if you have memory in the expansion interface is to set the memory size to 32769 so Basic will use the faster RAM in the keyboard. When you type them, omit all REM statements.

I strongly urge you to learn about the EDIT mode of Level II Basic before typing any program which has long lines since that knowledge will probably save you much frustration. Where you see what appears to be a long string of blanks, in the program I have used the L key to start a new line on the screen; there are no long strings of blanks in my programs because they waste space and formatted output is better produced with STRING\$ or TAB in a PRINT statement, or, of course, PRINT USING.

I used many tricks to save memory, some of which I have rarely or never seen used before. For example, there are only two cases in which a semicolon is needed in a PRINT statement: at the end of a PRINT statement to suppress a line advance, and to indicate the separation of two variable names. Many people use unnecessary semicolons in PRINT statements.

Figure 1 gives examples of compact PRINT statements which are designed to print the current values of two variables named A and B. Notice in particular that the first example will not work as intended; it will print a single value which is the value of a variable named AB if such a variable is used in the hypothetical main program. If AB is not used elsewhere, Level II will set aside space for AB and set its value to zero. Also notice that putting a space between the A and the B will not affect that PRINT statement, because Level II Basic almost always ignores spaces in statements. The other examples will properly print two values.

About Sketch Print

Most of the sketch-a-sketch programs which I have seen range in quality from mediocre to dreadful. I decided to

write a better program which would use a small graphics block instead of a large graphics character, which was compact and efficient, and which did not behave oddly when the edge of the screen was reached.

Sketch/Print can work in two different ways (modes): graphics mode and alphanumeric mode. When you run it, you will first see the instructions. Next you will see a small graphics block at the lower left-hand corner of the screen. When that block appears, you are in the graphics mode.

The Graphics Mode

In the graphics mode you can move the cursor using the keys 1-9 on the

numeric keypad (or the numeric keys on the main keyboard) in a pseudo-joystick fashion. The 8 key moves the cursor straight up, the 9 moves it diagonally upward to the right, the 6 moves it to the right, etc.

Using the 5 key, you can turn on a graphics block at the current cursor location. The other keys (1-3, 4, 6, 7-9) first move the cursor and then turn on a graphics block. The keys in the numeric keypad will repeat as long as you hold them down. If you find the rate of repetition too fast, increase the value assigned in line 380 to the variable named T and insert this at the beginning of line 350:

T=#:GOSUB410:
(using a digit in place of #).

Figure 1. Examples of Compact PRINT Statements

Compact Form	Functionally Equivalent Form	Separator of Variable Names
PRINTAB	PRINTA B	none
PRINTA:B	PRINT A; B	:
PRINTA%B	PRINTA% B	%, type declaration character
PRINT" AND "B	PRINT A " AND " B	literal character string
PRINTASIN(C)B	PRINT A SIN(C) B	function name
PRINTATAB(10)B	PRINT A TAB(10) B	Basic keyword

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By Fred Huntington

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Our collection of Atari games continues to grow. My personal favorite now is Frogger. Until Jan. 30 you can have the \$24.95 game for only \$19.99 when you purchase any other item. Please specify cassette or disk. The graphics and sound on this program are superb.

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Thank you to the many well-wishers on the birth of our son, Dave. He's very healthy and doing best. He's learning the computer business from the ground up. He's by Barb's side every day. I'm sure many of you have heard him in the background when you call. You should see Barb trying to take an order over the telephone, punch numbers into the computer and nurse Dave, all at the same time.

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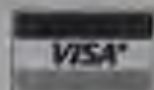
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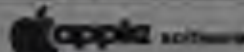
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 CRUISE: 040000, 040000, 040000
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Line 3. SKETCH/PRINT

```

100 CLEAR:DEFN(LMTG=2:GORG=1)
101 DEF 84 LINES 110-130:PROVIDE (INSTRUCTIONS)
110 CLR:PRINTTAB(13)TAB(0):PRINT BY JOHN GEM 12/24/81
120 TAB(24)TAB(15)DEF
130 USE NUMERIC KEYPAD TO MOVE CURSOR AS SHOWN IN DIAGRAM.
140 USE THESE KEYS WITH THE SHIFT KEY TO ERASE.
150 PRESS "." TO SWITCH TO NONDESTRUCTIVE FLASHING CURSOR."TAB"=ALPHANUMERIC MODE
160 ON=ALPHANUMERIC MODE:PRINTPRESS (SHIFT "." TO RETURN TO NORMAL
170 CURSOR.
180 PRESS (SHIFT DOWN)"/" TO SWITCH TO
190 "ON".
200 PRESS "B" TO STORE CURSOR LOCATION.
210 PRESS "C" TO AUTOMATICALLY DRAW A
220 LINE FROM THE STORED LOCATION TO THE
230 PRESENT LOCATION.
240 PRINTPRESS "C" TO DO SAME NO "C" BUT ERASE."PRINTPRESS TAB(15)TAB(15)P
250 RINTGORG,KTAB(15)TAB(15)FORV=1TO255SETLLOC,V)NEXTV:FORANBTO1TO88,37TO39KX=38+
260 KX+V)SETX=X,251SETY,Y,N+Y)NEXTY:PRINTTAB(25)TAB(37)TAB(38),TAB(39)TAB(37)
270 TAB(38)TAB(39)TAB(37)TAB(38)
280 END

```

ALL PRINTABLE KEYBOARD CHARACTERS BUT LINEAR LARG MAY BE USED.
150 PRINT PAGES (100000) 1/2 THE BACKSPACE AND ERASE LAST CHARACTER.
PRESS "RESET" (100000) TO RETURN TO GRAPHICS MODE.

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```

PUSH "SHIFT CLEAR" TO ERASE THE SCREEN.
PRESS "ENTER" TO GO TO GRAPHICS MODE. (IF IT HAS BEEN ADOPTED)
235 REM IF END OF INSTRUCTIONS, THE MAIN PART OF THE PROGRAM FOLLOWS. LINE# 400-
440 SET VARIABLES TO INITIAL VALUES, CLEAR THE SCREEN, AND SET A GRAPHICS BLOCK
  IN THE LOWER LEFT-CORNER
FOR CLS
240 DRAW-BOX-Y=472:Y1=312:Y2=512:Y3=512:Y4=512:Y5=512:Y6=512:Y7=512:Y8=512
AND REM XX LINE 270 ERASES PART OF THE KEYBOARD MAPPER SO THE COMPUTER KNOWS
HOW CERTAIN KEYS WERE PRESSED BEFORE
270 FOROD=0:DOV=0:DOZE=0:ANZ=0:DOX=0
275 REM IF THE "PUSH" STATEMENT IN LINE 160 RETURNS A 1 IF THE "SHIFT" KEY IS
PRESSED, OTHERWISE IT RETURNS 0
280 IFDOD=1:444:1:DOH=DOV:Y6=IFDOD=1:THEN:SL=SL+N:Y6=512:Y7=512:Y8=512
285 REM XX LINE 320 CONTAINS TESTS TO ACCEPT KEYBOARD INPUT IN THE GRAPHICS AND
ALPHABETIC MODES. MOST OF THAT LINE IS USED FOR ONLY THE ALPHABETIC MODE
285 IFN=1:444:1:Y6=512:Y7=512:Y8=512:Y9=512:Y10=512:Y11=512:Y12=512:Y13=512:Y14=512:Y15=512:Y16=512:Y17=512:Y18=512:Y19=512:Y20=512:Y21=512:Y22=512:Y23=512:Y24=512:Y25=512:Y26=512:Y27=512:Y28=512:Y29=512:Y30=512:Y31=512:Y32=512:Y33=512:Y34=512:Y35=512:Y36=512:Y37=512:Y38=512:Y39=512:Y40=512:Y41=512:Y42=512:Y43=512:Y44=512:Y45=512:Y46=512:Y47=512:Y48=512:Y49=512:Y50=512:Y51=512:Y52=512:Y53=512:Y54=512:Y55=512:Y56=512:Y57=512:Y58=512:Y59=512:Y60=512:Y61=512:Y62=512:Y63=512:Y64=512:Y65=512:Y66=512:Y67=512:Y68=512:Y69=512:Y70=512:Y71=512:Y72=512:Y73=512:Y74=512:Y75=512:Y76=512:Y77=512:Y78=512:Y79=512:Y80=512:Y81=512:Y82=512:Y83=512:Y84=512:Y85=512:Y86=512:Y87=512:Y88=512:Y89=512:Y90=512:Y91=512:Y92=512:Y93=512:Y94=512:Y95=512:Y96=512:Y97=512:Y98=512:Y99=512:Y100=512:Y101=512:Y102=512:Y103=512:Y104=512:Y105=512:Y106=512:Y107=512:Y108=512:Y109=512:Y110=512:Y111=512:Y112=512:Y113=512:Y114=512:Y115=512:Y116=512:Y117=512:Y118=512:Y119=512:Y120=512:Y121=512:Y122=512:Y123=512:Y124=512:Y125=512:Y126=512:Y127=512:Y128=512:Y129=512:Y130=512:Y131=512:Y132=512:Y133=512:Y134=512:Y135=512:Y136=512:Y137=512:Y138=512:Y139=512:Y140=512:Y141=512:Y142=512:Y143=512:Y144=512:Y145=512:Y146=512:Y147=512:Y148=512:Y149=512:Y150=512:Y151=512:Y152=512:Y153=512:Y154=512:Y155=512:Y156=512:Y157=512:Y158=512:Y159=512:Y160=512:Y161=512:Y162=512:Y163=512:Y164=512:Y165=512:Y166=512:Y167=512:Y168=512:Y169=512:Y170=512:Y171=512:Y172=512:Y173=512:Y174=512:Y175=512:Y176=512:Y177=512:Y178=512:Y179=512:Y180=512:Y181=512:Y182=512:Y183=512:Y184=512:Y185=512:Y186=512:Y187=512:Y188=512:Y189=512:Y190=512:Y191=512:Y192=512:Y193=512:Y194=512:Y195=512:Y196=512:Y197=512:Y198=512:Y199=512:Y200=512:Y201=512:Y202=512:Y203=512:Y204=512:Y205=512:Y206=512:Y207=512:Y208=512:Y209=512:Y210=512:Y211=512:Y212=512:Y213=512:Y214=512:Y215=512:Y216=512:Y217=512:Y218=512:Y219=512:Y220=512:Y221=512:Y222=512:Y223=512:Y224=512:Y225=512:Y226=512:Y227=512:Y228=512:Y229=512:Y230=512:Y231=512:Y232=512:Y233=512:Y234=512:Y235=512:Y236=512:Y237=512:Y238=512:Y239=512:Y240=512:Y241=512:Y242=512:Y243=512:Y244=512:Y245=512:Y246=512:Y247=512:Y248=512:Y249=512:Y250=512:Y251=512:Y252=512:Y253=512:Y254=512:Y255=512:Y256=512:Y257=512:Y258=512:Y259=512:Y260=512:Y261=512:Y262=512:Y263=512:Y264=512:Y265=512:Y266=512:Y267=512:Y268=512:Y269=512:Y270=512:Y271=512:Y272=512:Y273=512:Y274=512:Y275=512:Y276=512:Y277=512:Y278=512:Y279=512:Y280=512:Y281=512:Y282=512:Y283=512:Y284=512:Y285=512:Y286=512:Y287=512:Y288=512:Y289=512:Y290=512:Y291=512:Y292=512:Y293=512:Y294=512:Y295=512:Y296=512:Y297=512:Y298=512:Y299=512:Y300=512:Y301=512:Y302=512:Y303=512:Y304=512:Y305=512:Y306=512:Y307=512:Y308=512:Y309=512:Y310=512:Y311=512:Y312=512:Y313=512:Y314=512:Y315=512:Y316=512:Y317=512:Y318=512:Y319=512:Y320=512:Y321=512:Y322=512:Y323=512:Y324=512:Y325=512:Y326=512:Y327=512:Y328=512:Y329=512:Y330=512:Y331=512:Y332=512:Y333=512:Y334=512:Y335=512:Y336=512:Y337=512:Y338=512:Y339=512:Y340=512:Y341=512:Y342=512:Y343=512:Y344=512:Y345=512:Y346=512:Y347=512:Y348=512:Y349=512:Y350=512:Y351=512:Y352=512:Y353=512:Y354=512:Y355=512:Y356=512:Y357=512:Y358=512:Y359=512:Y360=512:Y361=512:Y362=512:Y363=512:Y364=512:Y365=512:Y366=512:Y367=512:Y368=512:Y369=512:Y370=512:Y371=512:Y372=512:Y373=512:Y374=512:Y375=512:Y376=512:Y377=512:Y378=512:Y379=512:Y380=512:Y381=512:Y382=512:Y383=512:Y384=512:Y385=512:Y386=512:Y387=512:Y388=512:Y389=512:Y390=512:Y391=512:Y392=512:Y393=512:Y394=512:Y395=512:Y396=512:Y397=512:Y398=512:Y399=512:Y400=512:Y401=512:Y402=512:Y403=512:Y404=512:Y405=512:Y406=512:Y407=512:Y408=512:Y409=512:Y410=512:Y411=512:Y412=512:Y413=512:Y414=512:Y415=512:Y416=512:Y417=512:Y418=512:Y419=512:Y420=512:Y421=512:Y422=512:Y423=512:Y424=512:Y425=512:Y426=512:Y427=512:Y428=
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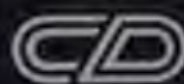
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Each time you press a key which moves the cursor, the direction is checked to be sure that it will not move the cursor off the edge of the screen. If the direction is illegal, then the cursor movement command is ignored.

Holding the SHIFT key down while a numeric key is depressed will erase instead of turn on a block.

To move the cursor to a different position without erasing or drawing over existing graphics, press the decimal point key. This will switch to a flashing cursor which will not disturb your graphics characters, but you will have to be careful not to move through or under an alphanumeric character (which will be mentioned later in detail). To return to the normal cursor for the graphics mode, press the decimal point and the SHIFT keys simultaneously.

You can also draw and erase lines automatically while in graphics mode. Press the S key to store the current cursor location for later reference when automatically drawing lines. To draw a line from the last stored location to the present location, press the D key.

To erase a line from the last stored location to the present cursor location, press the E key. The stored location is initially set to the coordinates of the lower left-hand corner of the screen.

Switching Modes

To switch to the alphanumeric mode, press the SHIFT key and the - key. To return to graphics mode, press the SHIFT key and the = key.

The Alphanumeric Mode

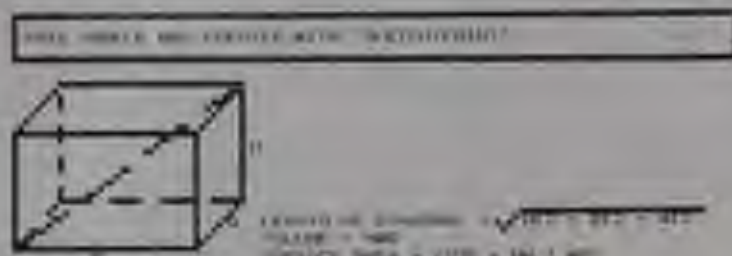
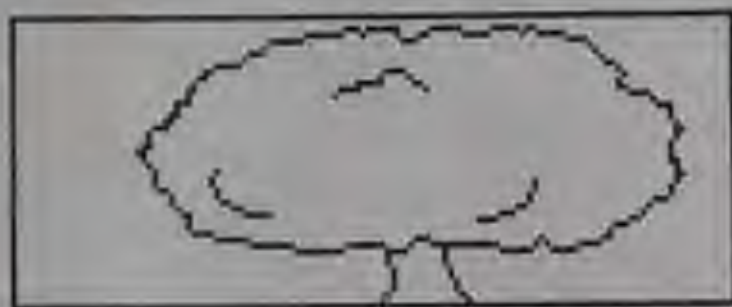
In the alphanumeric mode you may type on the screen any displayable character which is accessible from the keyboard except the lower case letters. Listing 1 displays the characters which may be used. Any lower case letter which you use will be converted to upper case. The left arrow key may be used to backspace and erase the last character. You cannot go beyond the top or bottom of the screen.

Restrictions

There are two restrictions imposed on the program by the design of the Model I.

The first restriction is that, as noted above, lower case letters can't be used in the alphanumeric mode. This is because the unmodified Model I has only seven instead of eight bits for each location in the video memory (bit 6 is not stored). You will see a character with an ASCII number 64 less than the one you POKEd if you POKE a character with an ASCII code of 96-127 or 192-255. If you POKE an ASCII value

Two Sample Pictures Made with SKETCH/PRINT.



less than 32, you will see a character with an ASCII number 64 greater than the POKEd code.

Line 192 contains the POKE statement which puts an alphanumeric character into video memory and also converts lower case letters to upper case. If you have a working lower case modification, you may want to modify this program to allow lower case letters. I believe that the only change needed is to use the EDIT mode of Level II to delete +32*(N>95) from the second POKE statement in line 192.

The second restriction is that you can't move through or immediately under an alphanumeric character while you are in the graphics mode of Sketch/Print. This is because the Model I has character graphics instead of a separate display mode for graphics such as the Color Computer has.

On the Color Computer you could write a program to draw alphanumeric characters while in one of the high resolution graphics modes, so you could freely draw over the alphanumeric characters. But, alas, on the Model I you are restricted to the characters listed in the C appendix of the Level II reference manual.

The only way to make two characters on the screen appear to overlap is to flash them alternately at high speed, a trick which this program cannot accomplish.

There are 1624 character positions on the Model I screen. Each position can hold either an alphanumeric character or a graphics character. Alphanumeric characters have a blank space below them while graphics characters may fill a character position. The blank space under an alphanumeric character is part of that character.

If you try to SET a point in a position which is occupied by an alphanumeric character, that alphanumeric character will be replaced by a graphics character. Because each alphanumeric character has a blank space below it which is associated with that character, you can't set a point in the blank space below the alphanumeric character.

Program Notes

I wanted the keys which move the cursor in the graphics mode to repeat. This can be accomplished in two ways: by writing a keyboard scan subroutine either in Basic using PEEK statements or in machine language, or by erasing the keyboard buffer used by Level II and using the INKEYS function to scan the keyboard. I used the second method.

Level II maintains a buffer which contains a record of the last keys pressed. It occupies positions 16438-16444 in memory. This buffer is referred to after the keyboard has been scanned so the computer can determine which new key has been pressed. This provides key-

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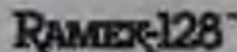
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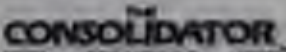
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Figure 2. Variables Used By Sketch/Print

Type	Name	Primary Use(s)
Integer	X	x-coordinate of cursor (0-127)
	Y	y-coordinate of cursor (0-47)
	QA	Alphanumeric mode flag
	F	Flashing cursor submode flag
	S	Shift key flag, temporary storage
	T	Temporary storage. Used as parameter to set length of time delay and to hold address of cursor in alphanumeric mode
	QE	Loop counter
	QF	Loop counter in delay subroutine
	N	VAL(QAS). A number, 1-9, indicating the direction of movement.
	X1	x-coordinate of stored location used as initial point in line-drawing submode.
Single precision	Y1	y-coordinate of stored location used as initial point in line-drawing submode.
	ID(0-8)	Illegal direction flags. Position 4 is always zero.
Character string	A	Used in line-drawing calculations
	B	Used in line-drawing calculations
	QA	Used for INKEYS loop. It holds the character obtained from the keyboard.

board rollover without elaborate hardware.

If zeroes are POKEd into the keyboard buffer, the computer does not know which keys were previously pressed and recognized. For a more complete description of how the keyboard is used by Level II see the book by William Barden which I mentioned earlier.

You may wonder why I used POKE instead of PRINT to put a character on the screen. I used POKE because even if you put a semicolon at the end of a PRINT statement the screen will scroll when you put a character at position 1023 (the lower right-hand corner of the screen).

The multiple IF-THEN-ELSE statements in Sketch/Print are used to avoid using many GOTO statements to jump past the long list of tests. Using lines which have multiple IF-THEN-ELSE statements saves memory and makes the program run fast. Also, a program written that way will appeal more to programmers who like structured programs.

When you write multiple IF-THEN-ELSE statements on one program line, remember to put the highest priority IF-THEN tests first, and, if the logic is complex, make a flowchart.

One of the biggest problems I encountered in writing Sketch/Print was finding an efficient way of testing which directions of motion in the graphics mode were illegal. There are eight different illegal cases. Four of them occur when

the cursor is in a corner of the screen. The other four occur when the cursor is at one edge of the screen but not in a corner.

At first I thought eight IF-THEN statements would be needed, but later I thought of a clever method that required only three IF-THEN-ELSE statements. An array with nine elements named ID

is used to hold flags which indicate which directions are illegal. Each position in the ID array corresponds to a key in the numeric keypad. The fifth position in the array corresponds to the 5 key which does not move the cursor so it is never an illegal direction.

The IF-THEN-ELSE statement in line 210 checks to see if the cursor is at the left or right edge of the screen and if one of those situations exists, sets appropriate flags indicating which horizontal directions are illegal.

The IF-THEN-ELSE statement in line 220 checks to see if the cursor is at the top or bottom of the screen, and, if one of those situations exists, sets appropriate flags indicating illegal vertical directions.

In line 250, the direction of motion you request is compared with the list of illegal directions. If the direction is illegal, the computer goes back (to line 170) and awaits your next command. When the cursor is in a corner one illegal direction flag is set by both the test for illegal horizontal directions and the test for illegal vertical directions. This is a minor inefficiency.

If you plan to modify Sketch/Print or want to learn how it works, look at Figure 2 which lists the variables used in the program.

You might want to modify Sketch/Print so it would do one, several, or all of the following functions on command: reverse graphics; draw a border; scroll the screen left, right, up, or down; or automatically draw a triangle, rectangle, ellipse, circle, or other figure. □



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CIRCLE 311 ON READER SERVICE CARD

Colorful Circles

Alan Foxx

Circle Fill is a program designed to allow the Apple II to fill in circles. See Listing 1. The program first draws a circle, saving each point into two arrays. The x-coordinate of each point is saved in the array AX. The y-coordinate of each point is saved in the array AY.

For example, the x-coordinate of the first point is saved in AX(1). The y-coordinate of the first point is saved in AY(1). The x-coordinate of the second point is saved in AX(2). The y-coordinate of the second point is saved in AY(2) and so on.

The outer perimeter of the circle is composed of 100 dots (see Figure 1), therefore AX(100) and AY(100) contain the value of the coordinates of the 100th and last dot.

After drawing the circle, the program fills the circle in. It accomplishes this by connecting each dot on the outer perimeter of the circle to all the others. Lines are drawn connecting the first dot to the second dot, the first dot to the third dot, the first dot to the fourth dot and so on. This routine occurs in lines 230 thru 260. To speed up this process you may change line 230 to read:

```
230 FOR J = 1 TO 100 STEP 10
```

Alan Foxx, 2000 Teahawk Trail, Southold, NY 09486

You may want to make some changes in the program. For example, to change the color of the circle, change line 120. To change the diameter of the circle change the value of



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Colorful Circles, continued...

DIAM in line 130. To move the circle to another position on the screen, change the variables XP and YP in line 130.

One word of caution: the entire circle must be on the screen. Therefore do not make the circle too big or you will get an illegal quantity error in line 200.

To make an ellipse change line 180 to read:

180 AX(C) = R * SIN (J) / 3 + XP

or change line 190 to read:

190 AY(C) = R * COS (J) / 3 + YP

Figure 1. Circle before fill-in.

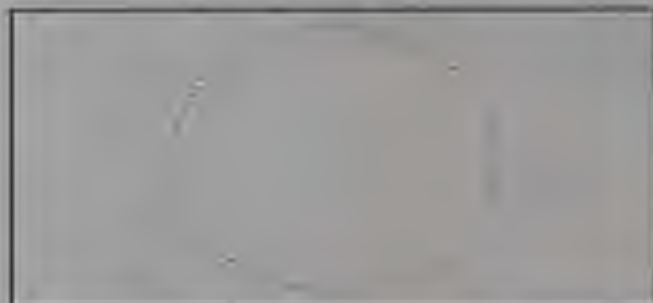
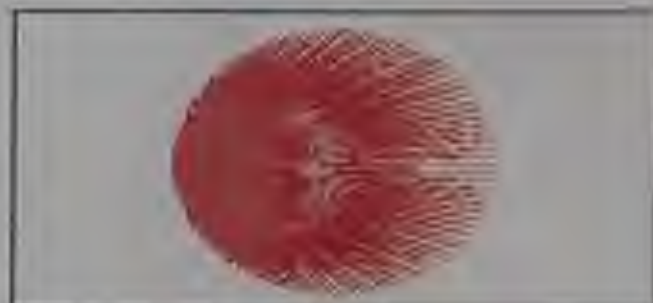


Figure 3.

Examples of what the Colorful Circle program can do.



The Colorful Circle

The Colorful Circle program in Listing 2 produces some very interesting patterns using the circle formula, and the random number generator.

Like Circle Fill, this program draws a circle with 100 dots and saves each dot into two arrays. Then, changing colors each time, lines are drawn connecting each dot to every other dot to produce interesting patterns. Figure 3 shows some examples of what this program can do.

Figure 2. Circle after fill-in.



Figure 4.

Examples of what the Four Colorful Circles program can do.



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Four Colorful Circles

The Four Colorful Circles program in Listing 3 is very similar to the Colorful Circle program. It incorporates the following changes: Instead of one circle there are now four on the screen, and the number of dots is decreased from 100 to 50. Another change was that the colors are only 1 and 2 (green and blue) instead of random.

The program uses a symmetry algorithm. In other words, when the computer plots a dot at (x,y) it will also plot three more dots at (279-x,y), (x,159-y), and (279-x,159-y). Figure 4 shows examples of what the Four Colorful Circles program can do. □

Listing 1.

```
100 REM CIRCLE FILL
110 DIM AX(100),AY(100)
120 HGR : HCOLOR= 3:C = 0
130 DIAM = 140:XP = 70:YP = 80
140 PI = 3.14159:INC = PI / 100
150 FOR J = 0 TO PI STEP INC
160 C = C + 1
170 R = DIAM * SIN (J) + 0.5
180 AX(C) = R * SIN (J) + XP
190 AY(C) = R * COS (J) + YP
200 HPLOT AX(C),AY(C)
210 NEXT J
220 REM FILL IN CIRCLE
```

```
230 FOR J = 1 TO 100 STEP 3
240 FOR C = J TO 100
250 HPLOT AX(C),AY(C) TO AX(J),A
  Y(J)
260 NEXT C NEXT J
```

Listing 2.

```
100 REM COLORFUL CIRCLE
110 DIM AX(100),AY(100)
120 HGR : HCOLOR= 3:C = 0
130 DIAM = 140:XP = 70:YP = 80
140 PI = 3.14159:INC = PI / 100
150 FOR J = 0 TO PI STEP INC
160 C = C + 1
170 R = DIAM * SIN (J) + 0.5
180 AX(C) = R * SIN (J) + XP
190 AY(C) = R * COS (J) + YP
200 HPLOT AX(C),AY(C)
210 NEXT J
220 REM FILL IN CIRCLE
230 FOR J = 1 TO 100
240 FOR C = 1 TO 100
250 HPLOT AX(C),AY(C) TO AX(J),A
  Y(J)
260 NEXT C
270 HCOLOR= INT ( RND (1) * 7) +
  1
280 NEXT J
```

Listing 3.

```
100 REM FOUR COLORFUL CIRCLES
110 DIM AX(51),AY(51)
120 HGR : HCOLOR= 3:C = 0
130 DIAM = 80:XP = 65:YP = 50
140 PI = 3.14159:INC = PI / 50
150 FOR J = 0 TO PI STEP INC
160 C = C + 1
170 R = DIAM * SIN (J) + 0.5
180 AX(C) = R * SIN (J) + XP
190 AY(C) = R * COS (J) + YP
200 HPLOT AX(C),AY(C)
210 NEXT J:W = 0
220 REM FILL IN CIRCLE
230 FOR J = 1 TO 50
240 FOR C = 1 TO 50
250 HPLOT AX(C),AY(C) TO AX(J),A
  Y(J)
260 HPLOT 279 - AX(C),AY(C) TO 2
  79 - AX(J),AY(J)
270 HPLOT 279 - AX(C),159 - AY(C
  ) TO 279 - AX(J),159 - AY(J)
280 HPLOT AX(C),159 - AY(C) TO A
  X(J),159 - AY(J)
290 NEXT C
300 W = W + 1: IF W > 2 THEN W =
  1
305 HCOLOR= W
310 NEXT J
```



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CIRCLE 131 ON READER SERVICE CARD



Programming Wheels

Anyone who writes computer programs will get the feeling sooner or later that he is turning the wheel when developing code to perform common functions.

The purpose of this article is to help you avoid the need to reinvent some common programming wheels. The wheels provided here are subroutines developed as part of an overall Medical Office system that I have written.

They include a method of printing standardized error messages, an input checking routine, a number checker, a date checker, and a way to manipulate time (now doesn't that sound intriguing).

The individual subroutines may be used singly or strung together in a program.

The system used to develop these routines is an IBM Personal Computer with 64K memory, one 5 1/4" floppy disk drive, a color graphics display board, a parallel printer interface with a C. Itoh Model 1540 printer, and an El Cheapo 13" black and white TV set. The system runs with IBM DOS and Advanced Disk BASIC. Whenever I have used an unusual IBM Basic statement, an explanation of its function is included.

Error Messages

Let's start with the subroutine that is the most important part of any program that is operated by the uninitiated (that is anyone who doesn't eat, drink, and sleep with a computer as you and I do). This is the routine which prints a customized error message on the bottom of the display in response to incorrect operator

Robert D. Hastings

input or a program failure condition. *Big deal*, you might say. So did I until I tried to create the routine and made 483 stupid mistakes. I did verify Programmer's Hypothesis #27 which states that programming errors increase exponentially with the latency of the host.

Listing 1 is the error printing subroutine. The information that must be prepared prior to calling the subroutine is the actual error message stored in ERR MSGS (clever variable name, huh?) and the position of the cursor prior to entering the subroutine stored in ROW and COL. In IBM Basic, this is acquired as follows:

```
100 ROW = CSRLIN : COL = POSIN
```

The subroutine performs several functions. It sets an error flag to indicate that an error has been printed, beeps to wake you up, prints the error message in reverse video on the bottom of the screen, and, if called in response to an incorrect input by the operator, erases the incorrect input and returns the cursor to the original location.

IBM Basic has several interesting features which are used here. The normal video size is 24 x 40 or 24 x 80. This is software controlled by the WIDTH X command. The 25th line is normally used to display the mnemonics associated with the left function keys located on the left side of the keyboard. However, the 25th line may be used by a program if the

mnemonics are turned off. Line 170 does this.

If this line were located at the beginning of the main program, it would not have to be repeated here. A unique feature of this magic 25th line is both a blessing and a curse. This is the fact that the 25th line does not scroll upward with the rest of the screen when information is displayed — what a perfect place to anchor an error message.

Now for the secret curse. Even though the 25th line does not scroll, if the contents to be printed on the line exceed the display width, the remainder of the line is printed on the 24th line and does scroll upward. Stay tuned for an explanation of how this was cleverly deduced. But first, back to the listing.

Line 990 is not a gag. The BEEP statement toggles an 800 MHz tone through the PC speaker for a quarter of a second. PRINT CHR\$(7) serves the same function. The LOCATE command in line 1000 moves the cursor to row 25, column 1 and turns off the cursor. Line 1010 invokes reverse video (black on white) and line 1020 prints the error message.

Now back to the curse. The STRING\$(X,Y) function returns a string of length X whose characters all have ASCII code Y. POSIN returns the present cursor column position which, in this application, would appear right at the end of the error message.

What I wanted to do was to print where blanks to the end of the line so that the entire line would be in reverse video, regardless of the length of the message. That's what I wanted to do. However,

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on the 20th line which then merely moves upward on the screen as you print other information.

If the previous discussion made no sense at all, just remember to keep error messages shorter than the display width. To insure that this would not happen, once again, I defined the variable `WIDTH=40` in the main program to be the value of the display width.

Then I changed line 1020 to include the error message to the length set by `WIDTH`. The `LEFT$(X$,Y)` function does this by creating a substring of `X$` that starts at the leftmost character and extends for a length of `Y` characters.

The next two lines, 1030 and 1040, return the video to normal and the cursor to the position it occupied prior to printing the error message. And before we leave this busy routine, let's do one more thing.

Good programming practice demands that the program print a prompt prior to each operator input and then check the input for correctness. If an error is detected, the program should print an error message and prompt the operator for another input.

Since the Medical System would use an 80-character monitor, I thought I would save myself a few keystrokes later on by extending the `STRING$` function to the end of an 80-character line with `STRING$(80,32)`.

What I had missed was a piece of information on page 4-160 of the IBM Basic manual which states that "If the printed

but there are important programming principles at work here. All error messages should be easy to read, easy to understand, and should attract the operator's attention immediately. This routine accomplishes two of the three objectives. Clear and simple error message text will accomplish the third.

Checking Input

A second subroutine (Listing 2) developed in the real Medical Office system provides a method of checking an operator input to see if it is a number. The operator input is placed in the variable, `CHECK$`. The subroutine first sets the error flag, `MISTAKE`, to zero and prints a line of blanks on the 25th line.

The variable `BLANK$` has been defined in the main program as a 40-character string of blanks. Remember that the 25th line is where error messages are printed by the error printing routine.

The number checking subroutine then looks at each character individually with the `MID$(X$,Y,Z)` function. `X$` is the string to be divided, `Y` is the starting position, and `Z` is the number of characters in the substring.

Line 890 checks to see if the ASCII value of the substring lies between 48 and 57—the digits 0 through 9. If the entire input is numeric, the subroutine returns to the main program. If a non-numeric character is found, line 890 checks to see if it is a decimal point. If it is not a decimal point, then `ERRMSG$` is loaded with the proper error message and the error print-

After initializing the `INPTS` variable, the routine turns on a standard stand cursor with the `LOCATE(1,6,7)` command. The 1 means turn on, and the 6,7 specifies the cursor size and position.

Lines 100 and 110 wait for an operator keystroke. Each keystroke undergoes four tests. ASCII value 27 in line 120 is the value for the ESC key, which returns the subroutine to line number 1640 at the beginning of the main program. Most Basic languages do not include this feature. This line could be changed to set a flag which the main program could check. See Figure 1 for an example.

The second check is for ASCII value 13 which is the RETURN key, the normal exit from the subroutine. The IBM keyboard has two keys that can be used to erase characters from a line, the BACKSPACE key and the DEL key; ASCII value 8, the BACKSPACE key, is checked in line 140. The DEL key returns a two-character string when pressed. The ASCII value of the second character is 83. Line 150 checks for this key. If either keystroke is detected, a short routine is called.

This routine shortens `INPTS` by one character, backs up the cursor, prints a space, and then backs up the cursor again. This has the effect of erasing one character from the screen. If the four checks are passed, then the character is added to `INPTS` and printed. Line 170 is needed because the `INKEY$` function does not automatically display the keystroke on the screen.

Checking The Date

Often a program requires a knowledge of the present date. IBM Basic has a `DAT$` function. However, if the operator makes an incorrect input while setting the date, Basic prints an error message and crashes.

I needed the ability to check operator input, to generate the appropriate error message (Where have I seen that before?), and to allow the operator to correct the mistake. I also needed the month, day, and year in separate variables. The subroutine in Listing 4 provides these features. It uses the other subroutines that we have already developed.

The format for the date that is checked by this subroutine is MM/DD/YYYY or MM-DD-YYYY. The date to be checked is contained in `DTE$`. The `INSTR` function in line 1130 searches for the location of the first occurrence of a slash character. The same function could be accomplished with the following loop:

```
1135 IF MID$(DTE$,Y,1)="/" THEN
1200
1140 NEXT Y
```

If no slash is found, the `INSTR` function

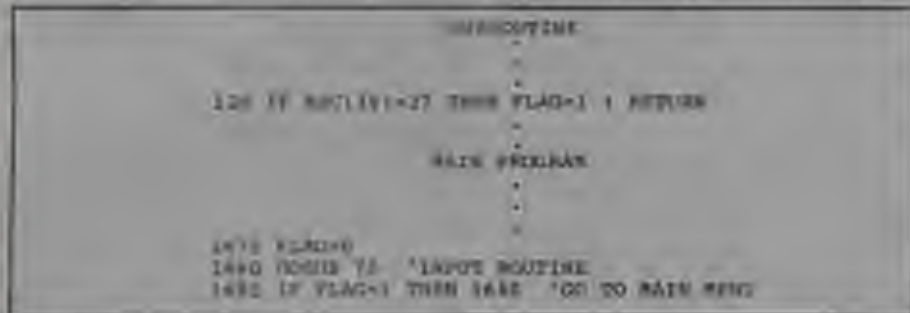


Figure 1.

line is longer than the defined `WIDTH`, Basic goes to the next physical line and continues printing." My 10" Cheapo TV displays a 40-character line.

As I mentioned before, when you try to print an 80-character string on the non-scrolling 25th line of a 40-character display, the remainder of the line is printed.

Remember that `ROW` and `COL` contain the location of the cursor prior to the printing of the error. Line 1030 prints a string of blanks to erase the incorrect input and line 1040 returns the cursor to its original position.

All of this may seem to be a great deal of trouble just to print an error message,

the error printing subroutine is called.

Since the error printing routine changes the value of `MISTAKE` from zero to one, it is an easy matter for the main program to detect an error by checking the value of `MISTAKE`.

Editing Input

Many business programs make use of multiple screens to guide operator input. They also allow the operator to return to the main menu or to the beginning of the program by pressing the ESC key. The next subroutine (Listing 3) provides this capability, as well as some input editing features.

returns a zero, and the first occurrence of a hyphen is checked. If no hyphen is found, the error printing routine is called.

If a slash is found, line 1200 extracts the substring containing the month. This substring is sent to the number checking routine and then is checked to see if it is a valid month.

Lines 1290 and 1310 look for the second occurrence of a slash or a hyphen. The substring containing the day is extracted and is run through the same checks. Finally, the same procedure is used to isolate and check the year.

If all checking is successful, the date is broken into the variables MD, DAY, and YEAR before the subroutine returns to the main program.

Manipulating Time

Now let's manipulate time. In several programs that I have written, the operator has been required to wait while a long wait or file transfer takes place. The time delay has been dependent upon the number of records being handled. The time to process a single record can be estimated.

The total transaction time can be cal-

culated based on the number of records times the single record processing time. Then it is a simple matter to provide the operator with an indication of the time required to complete the entire process. Listing 5 does this.

The only information needed by the subroutine is 5, the total number of records for the entire transaction. The subroutine calculates the hours and minutes.

It converts these separate values into strings for concatenation (that means stick them together into one thing) into HH:MM:SS format.

Unfortunately, IBM Basic places a space in front of each number when converting it to a string. The routine in Lines 730-800 strips away the space and adds a zero to any value that is only one digit long.

Finally, Line 710 puts the whole mess together. That's concatenation! This can be printed in an appropriate message telling the operator to get a cup of coffee.

Since IBM Basic has an internal clock accessible through the TIMES function, I carried the subroutine one step further

and calculated the time at which the process would be finished.

This is done by separating TIMES into hours, minutes, and seconds; adding the transaction time to these values; and recombining the total in HH:MM:SS format. Lines 530-550 adjust the date if the total transaction time exceeds 24 hours. The subroutine uses the Date Check subroutine (Listing 4) to separate today's date, which is stored by the internal IBM clock in DATE\$, into DAY, MD, and YEAR variables.

To show how these subroutines can interact with one another, I have written a simple program that asks for the date and time, prints out the separated date and then calculates a file transfer time. See Listing 6. Remember that error messages appear in reverse video at the bottom of the screen.

I hope that you can apply these routines and their underlying principles to the programs that you develop for your computer. Perhaps they will save you the trouble of reinventing a wheel or two while keeping your programming efforts rolling merrily along. □

Listing 1.

```

940 ***** PRINT ERROR MESSAGE *****
970 KEY OFF
980 MISTAKE=1
990 BEEP 1 BEEP
1000 LOCATE 25,1:8
1010 COLOR 8:7 REVERSE VIDEO
1020 PRINT LEFT$(ERRMSG$(WIDE-1),STRLEN(WIDE-POS(1)/2))
1030 COLOR 7:8 NORMAL IMAGE
1040 LOCATE ROW,COL
1050 PRINT STRLEN(WIDE-COL+1)22)
1060 LOCATE ROW,COL
1070 RETURN
1080 ***** END OF ERROR MESSAGE *****

```

Listing 2.

```

620 ***** NUMBER CHECK *****
630 MISTAKE=0
640 LOCATE 25,1:8
650 PRINT BLANK$
660 FOR I=1 TO LEN(CHECK$)
670 N=VAL(CHECK$(I))
680 IF ASC(CHAR$(N))=48 AND ASC(CHAR$(N))=57 THEN 700
690 IF N<0 THEN 720
700 NEXT I
710 RETURN
720 ERRMSG$="Error: Digits only please."
730 GOSUB 940 PRINT ERROR MESSAGE
740 RETURN
750 ***** END NUMBER CHECK *****

```

Listing 3.

```

70 ***** INPUT ROUTINE *****
80 INPUT$=""
90 LOCATE 1,1:8
100 ENDINPUT$
110 IF INPUT$="" THEN 100
120 IF ASC(CHAR$(INPUT$(1)))=27 THEN RETURN 1:ESC
130 IF ASC(CHAR$(INPUT$(1)))=13 THEN PRINT INPUT$ " " :GOTO 100
140 IF ASC(CHAR$(INPUT$(1)))=8 THEN GOSUB 940 LOCATE 25,1:8 BEEP 1:GOTO 100
150 IF LEN(INPUT$)=2 THEN IF ASC(CHAR$(INPUT$(1)))=48 THEN
    GOSUB 170 INPUT$="" :GOTO 100
160 INPUT$=INPUT$+INPUT$(1)
170 PRINT INPUT$
180 GOTO 100
190 INPUT$=LEFT$(INPUT$,LEN(INPUT$)-1)
200 LOCATE CURSOR(POS(1)-1)
210 PRINT " "

```

```

220 LOCATE CURSOR(POS(1)-1)
230 RETURN
240 ***** END INPUT *****

```

Listing 4.

```

1000 ***** DATE CHECK *****
1100 LOCATE 25,1:8 (PRINT BLANK$)
1200 MISTAKE=0
1300 YIN=0
1400 YN=INSTR(1,DATE$,"")
1500 IF YN=0 THEN 1200
1600 YN=INSTR(1,DATE$,"")
1700 IF YN=0 THEN 1200
1800 ERRMSG$="Please use MM/DD/YYYY format."
1900 GOSUB 940 PRINT ERROR MESSAGE
2000 RETURN
2100 CHECK=LEN(1,DATE$,"")
2200 GOSUB 920 NUMBER CHECK
2300 IF MISTAKE=1 THEN RETURN
2400 MONTH=VAL(CHECK$)
2500 IF MONTH=0 THEN 1200
2600 ERRMSG$="The month must be between 1 and 12."
2700 GOSUB 940 PRINT ERROR MESSAGE
2800 RETURN
2900 YIN=YIN+1
3000 YN=INSTR(1,DATE$,"")
3100 IF YN=0 THEN 1200
3200 YN=INSTR(1,DATE$,"")
3300 IF YN=0 THEN 1200
3400 ERRMSG$="Please use MM/DD/YYYY format."
3500 GOSUB 940 PRINT ERROR MESSAGE
3600 RETURN
3700 CHECK=LEN(1,DATE$,"")
3800 GOSUB 920 NUMBER CHECK
3900 IF MISTAKE=1 THEN RETURN
4000 DAY=VAL(CHECK$)
4100 IF DAY=0 AND DAY<12 THEN 1200
4200 ERRMSG$="I only know days between 1 and 31."
4300 GOSUB 940 PRINT ERROR MESSAGE
4400 RETURN
4500 CHECK=LEN(1,DATE$,"")
4600 GOSUB 920 NUMBER CHECK
4700 IF MISTAKE=1 THEN RETURN
4800 IF LEN(CHECK$)=4 THEN 1200
4900 ERRMSG$="The year must be a 4 digit year."
5000 GOSUB 940 PRINT ERROR MESSAGE
5100 RETURN
5200 YEAR=VAL(CHECK$)
5300 LOCATE ROW+1,1
5400 RETURN
5500 ***** END OF DATE ROUTINE *****

```


Listing 5.

```

250 ***** TIME CALCULATION *****
260 GOSUB 300
270 PRINT "PRINT 'The transfer will last 'TMR'
    (MIN)"
280 PRINT "The present time is 'TMR'
290 S=VAL(RIGHT(TMR,2))
300 S=S+59*(VAL(MID(TMR,4,2))+6)
310 S=S+3600*(VAL(LEFT(TMR,2))+6)
320 GOSUB 300
330 DT=DATE
340 ROW=COL+1:COL=POS(1)
350 GOSUB 300:DATE CHECK
360 DT=DT
370 IF M<24 THEN 410
380 M=M-24:GOSUB 300
390 DAY=DAY+1
400 GOTO 370
410 IF DAY<31 THEN 440
420 DAY=DAY-31
430 ROW=ROW+1
440 IF ROW=12 THEN 470
450 ROW=ROW-12
460 YEAR=YEAR+1
470 T1=STR$(DAY):GOSUB 740
480 DAYS=T1
490 T1=STR$(ROW):GOSUB 740
500 ROW=T1
510 T1=STR$(YEAR):GOSUB 740:YR=T1
520 DT=ROW+YR+DAYS+YR
530 PRINT "PRINT 'Tax transfer will end at 'TMR'
    'TMR'
540 PRINT "If you wish to start the transfer
    'YES' or 'NO'?"
550 GOSUB 70:INPUT
560 IF LEFT$(INPT,1)="" AND LEFT$(INPT,1)=""
    THEN STOP
570 PRINT "PRINT 'All done!'"
580 RETURN
590 ***** CONVERT SEC TO HRS *****
600 T=0
610 PRINT/END

```

```

620 PRINT/END
630 H=H+1
640 S=S-(H*3600+M*60)
650 T1=STR$(H):GOSUB 740
660 H=T1
670 T1=STR$(M):GOSUB 740
680 M=T1
690 T1=STR$(S):GOSUB 740
700 S=T1
710 T1=H+M+T1+""
720 RETURN
730 ***** STRIP SPACES & ADD *****
740 T1=""
750 FOR I=1 TO LEN(T1)
760 IF MID$(T1,I,1)="" THEN 700
770 T1=T1+MID$(T1,I,1)
780 NEXT I
790 IF LEN(T1)<12 THEN T1=""
800 RETURN
810 ***** END OF TIME ROUTINE *****

```

Listing 6.

```

10 SCREEN 0,0,0
20 MID=40:VARIABLE CONTAINING DISPLAY WIDTH
30 BLANK=SPACES*WIDE-1:SPACES
40 KEY OFF
50 WIDTH=(MID)/8:GETS DISPLAY WIDTH
60 GOTO 100
70 ***** INPUT ROUTINE *****
80 INPT=""
90 LOCATE 1,1:GOTO 100
100 INKEY$
110 IF INKEY$="" THEN 100
120 IF ASC(INKEY$) THEN RETURN INKEY$+CHR$(1)
130 IF ASC(INKEY$)=13 THEN PRINT "RETURN"
140 IF ASC(INKEY$)=8 THEN GOSUB 190:GOTO 100
150 IF LEN(INKEY$) THEN IF ASC(RIGHT$(INKEY$,1))>0 THEN
    GOSUB 190:GOTO 100
160 INPT=INPT+INKEY$
170 PRINT INPT
180 GOTO 100
190 INPT=LEFT$(INPT,LEN(INPT)-1)

```

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Edited by
Sol Libes

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```

288 LOCATE (ROWL*POS1):1
289 PRINT " "
290 LOCATE (ROWL*POS1):1
291 RETURN
292 ***** END INPUT *****
293 ***** TIME CALCULATION *****
294 GOSUB 599
295 PRINT IPRINT "The transfer will take
  "T1:" HOURS"
296 PRINT IPRINT "The transfer time is "T1TMR
297 S=VAL(RIGHT(T1TMR,2))
298 S=S+VAL(MID(T1TMR,4,2))*60
299 S=S+VAL(LEFT(T1TMR,2))*60
300 GOSUB 599
301 S=S+DATE
302 S=S+DAY
303 ROWL=ROWL+1
304 POS1=POS1+1
305 GOSUB 1099 " DATE CHECK
306 S=S+1
307 IF M=04 THEN 418
308 M=M+24
309 S=S+DAY-1
310 GOTO 374
311 IF DAY=04 THEN 588
312 M=M+24
313 S=S+DAY-1
314 ROWL=ROWL+1
315 IF M=02 THEN 478
316 M=M+12
317 YEAR=YEAR+1
318 T1=STR$(DAY) + " HOURS "
319 T2=STR$(M) + " HOURS "
320 T3=STR$(YEAR) + " GOSUB 1099 + "T1TMR
321 T3=STR$(M) + "T2TMR + "T3TMR
322 PRINT IPRINT "The transfer will take at
  "T1TMR "T2TMR
323 PRINT IPRINT "Do you wish to start the
  transfer (YES or NO) "
324 GOSUB 34 " INPUT
325 IF LEFT$(MPT,1)="/" AND LEFT$(MPT,1)="/"
  THEN STOP
326 PRINT IPRINT "All done!"
327 RETURN
328 ***** CONVERT DEC TO BCD *****
329 T=0
330 H=INT(T/100)
331 M=INT(T/10)
332 S=T-M*10
333 S=S+M*10
334 T1=STR$(H) + " GOSUB 744
335 H=H*10
336 T1=STR$(M) + " GOSUB 744
337 M=M*10
338 T1=STR$(S) + " GOSUB 744
339 S=S*10
340 T1=STR$(T) + "T1TMR
341 RETURN
342 ***** STRIP SPACES & ADD 0 *****
343 T2=""
344 FOR Z=1 TO LEN(T1)
345 IF MID$(T1,Z,1)="" THEN 758
346 T2=T2+MID$(T1,Z,1)
347 NEXT Z
348 IF LEN(T2)<2 THEN T2="0"+T2
349 RETURN
350 ***** END OF TIME ROUTINE *****
351 ***** NUMBER CHECK *****
352 MISTAKE=0
353 LOCATE 25,1:8
354 PRINT BLANK$
355 FOR Z=1 TO LEN(CHECK)
356 M=VAL(CHECK$(Z,1))
357 IF ASC(M)>48 AND ASC(M)<57 THEN 444
358 NEXT Z
359 RETURN
360 ERRMSG="Error! Digits only, please!"
361 GOSUB 949 " PRINT ERROR MESSAGE
362 RETURN
363 ***** END NUMBER CHECK *****
364 ***** PRINT ERROR MESSAGE *****
365 KEY OFF
366 MISTAKE=1
367 BEEP : BEEP
368 LOCATE 25,1:8
369 COLOR 8:3 " REVERSE VIDEO
370 PRINT LEFT$(ERRMSG,MID$(1)STLEN
  (MID$(POS1)+32))

```

```

1434 COLOR 7:4 "NORMAL IMAGE
1435 LOCATE ROW,1:8
1436 PRINT STR$(MID$(MID$(COL)+32))
1437 LOCATE ROW,1:8
1438 RETURN
1439 ***** END OF ERROR MESSAGE *****
1440 ***** DATE CHECK *****
1441 LOCATE 25,1:8 IPRINT BLANK$
1442 MISTAKE=0
1443 Y1=DATE
1444 Y=INT(Y1/100)
1445 IF Y=0 THEN 1248
1446 Y=INT(Y1/10)
1447 IF Y=0 THEN 1248
1448 ERRMSG="Please use MM/DD/YYYY format!"
1449 GOSUB 949 " PRINT ERROR MESSAGE
1450 RETURN
1451 CHECK=RIGHT$(Y1,2)+Y1
1452 GOSUB 829 " NUMBER CHECK
1453 IF MISTAKE=1 THEN RETURN
1454 DAY=VAL(CHECK)
1455 IF DAY=04 AND DAY=12 THEN 1488
1456 ERRMSG="The month must be between 1 and 12!"
1457 GOSUB 949 " PRINT ERROR MESSAGE
1458 RETURN
1459 Y1=Y1
1460 Y=INT(Y1/100)
1461 IF Y=0 THEN 1248
1462 Y=INT(Y1/10)
1463 IF Y=0 THEN 1248
1464 ERRMSG="Please use MM/DD/YYYY format!"
1465 GOSUB 949 " PRINT ERROR MESSAGE
1466 RETURN
1467 CHECK=RIGHT$(Y1,2)+Y1
1468 GOSUB 829 " NUMBER CHECK
1469 IF MISTAKE=1 THEN RETURN
1470 IF LEN(CHECK)=4 THEN 1518
1471 ERRMSG="The year must be 4 digits (year)"
1472 GOSUB 949 " PRINT ERROR MESSAGE
1473 RETURN
1474 YEAR=VAL(CHECK)
1475 LOCATE ROW+1,1
1476 RETURN
1477 ***** END OF DATE ROUTINE *****
1478 ***** START OF MAIN PROGRAM *****
1479 CLS IPRINT IPRINT
1480 PRINT " HELLO! THERE!"
1481 GOTO 1488
1482 INPUT "What time is it (HH:MM:SS) "
1483 TIME=TIME
1484 PRINT " PRINT "Is this the current time
  (YES or NO) (Y/N) "
1485 INPUT MPT
1486 IF LEFT$(MPT,1)="/" AND LEFT$(MPT,1)="/"
  THEN 1488
1489 PRINT IPRINT
1490 PRINT "What is today's date"
1491 PRINT "Use MM/DD/YYYY format "
1492 ROW=ROWL+1 (COL=POS1)
1493 GOSUB 34 " INPUT
1494 DATE=DATE
1495 GOSUB 1099 " DATE CHECK
1496 IF MISTAKE=1 THEN 1488
1497 INPUT "What is your name"NAME
1498 PRINT IPRINT
1499 PRINT "The date is "DATE
1500 PRINT "The year is "YEAR
1501 PRINT "The month is "MO
1502 PRINT "The day is "DAY
1503 INPUT "Give me the number of seconds to
  complete the file transfer "S
1504 GOSUB 254
1505 PRINT "Isn't that wonderful. "TMR
1506 END

```



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PICTURE ZAPPER

While developing a game program in Applesoft recently, I came up against a rather thorny problem which left me stumped. My particular game requires a fairly complex hi-res game board across which pieces are moved by the players.

My thorny problem arises when moving a game piece from one position to another on the game board; the piece must be erased or redrawn before it can be drawn in the next position. However, in doing this, part of the background of the game board itself is also erased, leaving a gaping black hole. Since my game is not of the interstellar or galactic warfare type, black holes are definitely not wanted.

There are a few options for overcoming this little problem with my 48K Apple II Plus. One, and perhaps the most obvious to the reader, is to plan always to have a black background for the game board, and so plan the size, shape, and positions of the game pieces so that they never overlap any other image elements.

This is fine, but since my game board is rather complicated with many small pieces on it, and since I am quite tired of seeing other game boards on black backgrounds, this option is less than satisfactory.

A second option is to redraw the game board after each move and then redraw the game pieces in their new positions. But with a complex board with many color blocks, lines, and figures, it takes a full minute to draw the board and all its parts—not practical at all to wait a full minute after each move before going on with the game.

William Tenney

A third option is to store the entire game board image on the disk using a BSAVE command, and then to call it back to the hi-res screen using a BLOAD command. This works fine, but although the time of loading and drawing the game board is reduced from one minute to about thirteen seconds, the disk drive is in motion for each move of the game—far too much wear and tear on the disk and drive, and still too much time wasted waiting for the disk to turn on and draw the image on the screen with its venetian blind imitation.

So these three options proved to be unworkable for me from both hardware and aesthetic points of view. But, I thought to myself, why couldn't I attempt what the memory expansion boards are toying with their disk simulators? Couldn't I move the 8K hi-res image to another part of memory, store it there, and call it back to the same hi-res screen whenever I needed it, and faster than using a BLOAD?

To accomplish this from Basic was the problem, because all it would be was a simple memory move in the assembler. With this in mind, I wrote a short machine language program which very successfully does just what I wanted.

The Program

The program uses an AppleSoft routine called COMBYTE which resides in \$E74C (thanks to Roger Wagner for pointing it out). COMBYTE checks for a comma, reads the expression which follows, and returns with a single byte (\$00 to \$FF) in the X-register, which can then be stored in a zero-page location. The four zero-page locations used are shown in Figure 1.

The program cycles 32 times (\$20) in line \$D45, each pass erasing and moving a 256-byte page of memory. It runs incredibly fast, moving all 32 pages, or an entire 8K image, in about .3 seconds.

Since I am using hi-res screen 2 (\$4000) - \$5777 for my game image, but need the bottom of the hi-res screen 1 for my program and variables, I decided that a good place to store my image would be right above hi-res screen 2, at \$6000. This location is well below the HIMEM of

Figure 1.

Low byte of the source location = \$60	(SOURCE-LO)
High byte of the source location = \$07	(SOURCE-HI)
Low byte of the destination location = \$08	(DESTIN-LO)
High byte of the destination location = \$09	(DESTIN-HI)

\$95FF (with DGS in effect), and since the image is \$2000 bytes long, it does not bump into any string variables stored from HIMEM on down.

To use this routine from Applesoft—to move an image from hi-res screen 2 to the storage area at \$6000—my syntax is as follows:

CALL 768,0,64,0,96
where 768 is equal to \$300, the starting point of the routine, 0 is the SOURCE-LO, 64 is the SOURCE-HI (remember that 64 = \$40), 0 is the DESTIN-LO, and 96 is the DESTIN-HI (96 = \$60).

To move the image back to the hi-res screen 2 (while keeping it at the storage location as well), the syntax is

CALL 768,0,96,0,64
To really speed up your programming, you could set up a %6" block:
POKE 1014,0; POKE 1015,
which sets a Jump instruction to \$300. Then your syntax would be
J 0,64,0,96 and J 0,96,0,64

Now I can erase a game piece by redrawing the entire game board using this routine, and then draw the game pieces in their respective places, all in less than a second. The game proceeds at a good clip.

Of course, this short program can be used to move any block of memory anywhere, since it is merely a memory move routine. You need only work in blocks of 256 bytes and know the starting point and number of memory pages (store this number in \$0315).

A low-res image, for example, is only four pages long. The machine language coding is completely relocatable to any spare 40 bytes of memory (remember that at a different location your CALL would be to the start of your routine). Try it, you'll like it. For moving pictures around, the program is superb—and no more black holes or venetian blinds. □

Listing 1. Picture Zapper.

```
0300- 20 4C E7 358 $E74C
0303- 80 06 578 108
0306- 20 4C E7 358 $E74C
0309- 86 07 578 107
030A- 20 4C E7 358 $E74C
030D- 86 08 578 108
030F- 20 4C E7 358 $E74C
0312- 86 09 578 109
0314- A2 20 L20 $B20
0316- A9 00 L2A $B00
0318- A8 74Y
031A- 83 06 L0A ($B6),Y
031B- 91 08 37A ($B8),Y
031D- C8 1NY
031E- 00 F9 8NC $D319
0320- E6 07 1NC $D7
0322- C6 09 1NC $D9
0324- C4 0CX
0326- D0 F2 86E $D319
0327- 6D 87S
```

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Drawart

Brad Pitzel

The TRS-80 is not a great graphics machine, but with the help of the following short program, you can easily create some amazing displays. Drawart is a masterpiece in simplicity.

No longer do you have to sit down and plot each pixel that makes up a circle. Nor do you need to figure out the equation of a line just to draw it.

Drawart takes care of these problems and more. By using one-letter commands

and the cursor control keys, Drawart makes your TRS-80 do all the tedious work, leaving you more time to be creative.

The commands are as follows:

Cursor Control: Pressing one of the arrow keys will move the cursor in the direction indicated on the key. You can't press more than one key at a time.

Draw/Erase Mode: The cursor in Drawart can be set in either the draw or erase mode. Pressing the spacebar reverses the current mode.

Lines: To enter the line mode, press L. Once you are in this mode, you must plot two points by using the spacebar and the arrow keys. Press G and these dots will be connected by a straight line in the order in which they were plotted.

Rectangles: Pressing R places you in the rectangle mode. By using the cursor control keys and the spacebar, plot two dots. After you plot the second dot, the computer will fill in the area between the two dots.

Circles: Press C to enter the circle mode. Plot two dots that have the same Y axis. The first point is the center of your circle and the second designates the radius.

Block Move: To store the ASCII values of the entire screen into the memory addresses 26000 to 27023, press P. You can then continue drawing.

Figure 1



Brad Pitzel, 122 Meadowbrook Dr., Fremont, California.

Figure 2



Listing 1

```
10 CLS : CLS : DIM X(255), Y(255), C(40), T(40)
20 D=0 : W=0 : SET (0,0) : X(0)=0 : Y(0)=0
25 Y(0)=0 : X(0)=0 : W=0
30 GOSUB 1000 : IF PK=1 THEN D=D+1
40 AD=INT(D/2) : IF AD=0 THEN J=0
50 IF AD=1 THEN J=1
60 IF AD=2 THEN J=2
70 IF AD=3 THEN J=3
80 IF AD=4 THEN J=4
90 IF AD=5 THEN J=5
100 GOTO 30
110 IF PK=0 : GOSUB 1100 : IF T=0 THEN RETURN
120 IF PK=1 THEN NEXT J, I
130 CL=0 : W=0 : H=0 : X(0)=0 : Y(0)=0
140 IF D=0 THEN GOTO 150 ELSE IF D=1 THEN GOTO 160
150 IF D=2 THEN GOTO 170 ELSE IF D=3 THEN GOTO 180
160 IF D=4 THEN GOTO 190 ELSE IF D=5 THEN GOTO 200
170 SET (0,0) : RETURN
180 W=1 : T=0
190 GOSUB 1100 : IF INKEY="G" THEN J=0
200 IF D=1 AND (Y(0)<0 OR Y(0)>255) THEN D=D+1
210 IF D=2 THEN GOTO 220
220 IF D=3 THEN GOTO 230
230 IF D=4 THEN GOTO 240
240 IF D=5 THEN GOTO 250
250 FOR I=0 TO 255 : Y(I)=Y(0) : NEXT I
260 CL=0 : W=0 : H=0 : X(0)=0 : Y(0)=0
270 GOSUB 1100 : NEXT J, I : GOTO 30
280 IF PK=0 : GOTO 30
290 IF PK=1 : GOTO 30
300 IF PK=2 : GOTO 30
310 IF PK=3 : GOTO 30
320 IF PK=4 : GOTO 30
330 IF PK=5 : GOTO 30
340 IF PK=6 : GOTO 30
350 IF PK=7 : GOTO 30
360 IF PK=8 : GOTO 30
370 IF PK=9 : GOTO 30
380 IF PK=10 : GOTO 30
390 IF PK=11 : GOTO 30
400 IF PK=12 : GOTO 30
410 IF PK=13 : GOTO 30
420 IF PK=14 : GOTO 30
430 IF PK=15 : GOTO 30
440 IF PK=16 : GOTO 30
450 IF PK=17 : GOTO 30
460 IF PK=18 : GOTO 30
470 IF PK=19 : GOTO 30
480 IF PK=20 : GOTO 30
490 IF PK=21 : GOTO 30
500 IF PK=22 : GOTO 30
510 IF PK=23 : GOTO 30
520 IF PK=24 : GOTO 30
530 IF PK=25 : GOTO 30
540 IF PK=26 : GOTO 30
550 IF PK=27 : GOTO 30
560 IF PK=28 : GOTO 30
570 IF PK=29 : GOTO 30
580 IF PK=30 : GOTO 30
590 IF PK=31 : GOTO 30
600 IF PK=32 : GOTO 30
610 IF PK=33 : GOTO 30
620 IF PK=34 : GOTO 30
630 IF PK=35 : GOTO 30
640 IF PK=36 : GOTO 30
650 IF PK=37 : GOTO 30
660 IF PK=38 : GOTO 30
670 IF PK=39 : GOTO 30
680 IF PK=40 : GOTO 30
690 IF PK=41 : GOTO 30
700 IF PK=42 : GOTO 30
710 IF PK=43 : GOTO 30
720 IF PK=44 : GOTO 30
730 IF PK=45 : GOTO 30
740 IF PK=46 : GOTO 30
750 IF PK=47 : GOTO 30
760 IF PK=48 : GOTO 30
770 IF PK=49 : GOTO 30
780 IF PK=50 : GOTO 30
790 IF PK=51 : GOTO 30
800 IF PK=52 : GOTO 30
810 IF PK=53 : GOTO 30
820 IF PK=54 : GOTO 30
830 IF PK=55 : GOTO 30
840 IF PK=56 : GOTO 30
850 IF PK=57 : GOTO 30
860 IF PK=58 : GOTO 30
870 IF PK=59 : GOTO 30
880 IF PK=60 : GOTO 30
890 IF PK=61 : GOTO 30
900 IF PK=62 : GOTO 30
910 IF PK=63 : GOTO 30
920 IF PK=64 : GOTO 30
930 IF PK=65 : GOTO 30
940 IF PK=66 : GOTO 30
950 IF PK=67 : GOTO 30
960 IF PK=68 : GOTO 30
970 IF PK=69 : GOTO 30
980 IF PK=70 : GOTO 30
990 IF PK=71 : GOTO 30
1000 IF PK=72 : GOTO 30
1010 IF PK=73 : GOTO 30
1020 IF PK=74 : GOTO 30
1030 IF PK=75 : GOTO 30
1040 IF PK=76 : GOTO 30
1050 IF PK=77 : GOTO 30
1060 IF PK=78 : GOTO 30
1070 IF PK=79 : GOTO 30
1080 IF PK=80 : GOTO 30
1090 IF PK=81 : GOTO 30
1100 IF PK=82 : GOTO 30
1110 IF PK=83 : GOTO 30
1120 IF PK=84 : GOTO 30
1130 IF PK=85 : GOTO 30
1140 IF PK=86 : GOTO 30
1150 IF PK=87 : GOTO 30
1160 IF PK=88 : GOTO 30
1170 IF PK=89 : GOTO 30
1180 IF PK=90 : GOTO 30
1190 IF PK=91 : GOTO 30
1200 IF PK=92 : GOTO 30
1210 IF PK=93 : GOTO 30
1220 IF PK=94 : GOTO 30
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CIRCLE 203 ON READER SERVICE CARD

Eight by Eight Create

8x8 Create is a program designed for a 5K or 8K Commodore Vic-20 computer. The program allows you to examine the make-up of the Pet-character set. While a character is being examined, it can be changed into any other character that can be created in an 8 x 8 matrix, hence the title and program name.

The program works as follows: after loading the program and typing RUN, a countdown appears at the top of the screen. While the countdown is progressing, the remainder of the screen becomes a canvas of changing colors and characters. This delay allows the computer to duplicate the character set into RAM so that it can later be changed. Soon, the screen changes to an orange background with a cyan border. The screen clears and the characters you will be working with are put into the top few lines of the screen.

When a flashing cursor appears in the upper left-hand corner of the screen, you move the cursor (using the normal cursor control keys) to the character you would like to change. When you arrive at the character, press the left arrow key, and an enlarged copy of the character will be displayed. To the left of this appear eight numbers that tell the computer how the character is created. To the right of both of these is a copy of the character in its normal size.

Once again, a flashing cursor will appear, this time in the upper left of the enlarged character. You move the cursor to the square that you want to turn on or off and hit the RVS/ON (9 key) to light it up (yellow) or the RVS/OFF (0 key)

Robert Spahitz



to darken it (in red). As you do this, the character on the far right will change accordingly. Note: if a square is orange, it was off when you began; if it is red it was manually turned off; if it is white, it was on when you began; and if it is yellow, it was manually turned on.

Listing 1

```
1 REMARKS CREATE BY R SPAHITZ
2 POKE 56,24:POKE52,24:POKE 57079,150 REMARKS ROOMS:SPEED (9 FREEDOM)
3 FOR I=0 TO 1023
4 PRINT CHR$(151)*COUNTDOWN+INT((1024-I)/10,24)
5 POKE INT((1+4484+7792+INT(1+4256
6 POKE INT(1+4484+3822+INT(1+415
7 POKE 2+4144,PEEK(2+32768))
8 NEXT I:ENDCHARACTERS:CLOSE
9 POKE 36879,150
10 POKE 36880,254 REMARKS NEW CHARACTERS
11 FOR I=0 TO 254:FOR J=0 TO 254:FOR K=0 TO 254:FOR L=0 TO 254:FOR M=0 TO 254:FOR N=0 TO 254:FOR O=0 TO 254:FOR P=0 TO 254:FOR Q=0 TO 254:FOR R=0 TO 254:FOR S=0 TO 254:FOR T=0 TO 254:FOR U=0 TO 254:FOR V=0 TO 254:FOR W=0 TO 254:FOR X=0 TO 254:FOR Y=0 TO 254:FOR Z=0 TO 254:FOR AA=0 TO 254:FOR AB=0 TO 254:FOR AC=0 TO 254:FOR AD=0 TO 254:FOR AE=0 TO 254:FOR AF=0 TO 254:FOR AG=0 TO 254:FOR AH=0 TO 254:FOR AI=0 TO 254:FOR AJ=0 TO 254:FOR AK=0 TO 254:FOR AL=0 TO 254:FOR AM=0 TO 254:FOR AN=0 TO 254:FOR AO=0 TO 254:FOR AP=0 TO 254:FOR AQ=0 TO 254:FOR AR=0 TO 254:FOR AS=0 TO 254:FOR AT=0 TO 254:FOR AU=0 TO 254:FOR AV=0 TO 254:FOR AW=0 TO 254:FOR AX=0 TO 254:FOR AY=0 TO 254:FOR AZ=0 TO 254:FOR BA=0 TO 254:FOR BB=0 TO 254:FOR BC=0 TO 254:FOR BD=0 TO 254:FOR BE=0 TO 254:FOR BF=0 TO 254:FOR BG=0 TO 254:FOR BH=0 TO 254:FOR BI=0 TO 254:FOR BJ=0 TO 254:FOR BK=0 TO 254:FOR BL=0 TO 254:FOR BM=0 TO 254:FOR BN=0 TO 254:FOR BO=0 TO 254:FOR BP=0 TO 254:FOR BQ=0 TO 254:FOR BR=0 TO 254:FOR BS=0 TO 254:FOR BT=0 TO 254:FOR BU=0 TO 254:FOR BV=0 TO 254:FOR BW=0 TO 254:FOR BX=0 TO 254:FOR BY=0 TO 254:FOR BZ=0 TO 254:FOR CA=0 TO 254:FOR CB=0 TO 254:FOR CC=0 TO 254:FOR CD=0 TO 254:FOR CE=0 TO 254:FOR CF=0 TO 254:FOR CG=0 TO 254:FOR CH=0 TO 254:FOR CI=0 TO 254:FOR CJ=0 TO 254:FOR CK=0 TO 254:FOR CL=0 TO 254:FOR CM=0 TO 254:FOR CN=0 TO 254:FOR CO=0 TO 254:FOR CP=0 TO 254:FOR CQ=0 TO 254:FOR CR=0 TO 254:FOR CS=0 TO 254:FOR CT=0 TO 254:FOR CU=0 TO 254:FOR CV=0 TO 254:FOR CW=0 TO 254:FOR CX=0 TO 254:FOR CY=0 TO 254:FOR CZ=0 TO 254:FOR DA=0 TO 254:FOR DB=0 TO 254:FOR DC=0 TO 254:FOR DD=0 TO 254:FOR DE=0 TO 254:FOR DF=0 TO 254:FOR DG=0 TO 254:FOR DH=0 TO 254:FOR DI=0 TO 254:FOR DJ=0 TO 254:FOR DK=0 TO 254:FOR DL=0 TO 254:FOR DM=0 TO 254:FOR DN=0 TO 254:FOR DO=0 TO 254:FOR DP=0 TO 254:FOR DQ=0 TO 254:FOR DR=0 TO 254:FOR DS=0 TO 254:FOR DT=0 TO 254:FOR DU=0 TO 254:FOR DV=0 TO 254:FOR DW=0 TO 254:FOR DX=0 TO 254:FOR DY=0 TO 254:FOR DZ=0 TO 254:FOR EA=0 TO 254:FOR EB=0 TO 254:FOR EC=0 TO 254:FOR ED=0 TO 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GO=0 TO 254:FOR GP=0 TO 254:FOR GQ=0 TO 254:FOR GR=0 TO 254:FOR GS=0 TO 254:FOR GT=0 TO 254:FOR GU=0 TO 254:FOR GV=0 TO 254:FOR GW=0 TO 254:FOR GX=0 TO 254:FOR GY=0 TO 254:FOR GZ=0 TO 254:FOR HA=0 TO 254:FOR HB=0 TO 254:FOR HC=0 TO 254:FOR HD=0 TO 254:FOR HE=0 TO 254:FOR HF=0 TO 254:FOR HG=0 TO 254:FOR HH=0 TO 254:FOR HI=0 TO 254:FOR HJ=0 TO 254:FOR HK=0 TO 254:FOR HL=0 TO 254:FOR HM=0 TO 254:FOR HN=0 TO 254:FOR HO=0 TO 254:FOR HP=0 TO 254:FOR HQ=0 TO 254:FOR HR=0 TO 254:FOR HS=0 TO 254:FOR HT=0 TO 254:FOR HU=0 TO 254:FOR HV=0 TO 254:FOR HW=0 TO 254:FOR HX=0 TO 254:FOR HY=0 TO 254:FOR HZ=0 TO 254:FOR IA=0 TO 254:FOR IB=0 TO 254:FOR IC=0 TO 254:FOR ID=0 TO 254:FOR IE=0 TO 254:FOR IF=0 TO 254:FOR IG=0 TO 254:FOR IH=0 TO 254:FOR II=0 TO 254:FOR IJ=0 TO 254:FOR IK=0 TO 254:FOR IL=0 TO 254:FOR IM=0 TO 254:FOR IN=0 TO 254:FOR IO=0 TO 254:FOR IP=0 TO 254:FOR IQ=0 TO 254:FOR IR=0 TO 254:FOR IS=0 TO 254:FOR IT=0 TO 254:FOR IU=0 TO 254:FOR IV=0 TO 254:FOR IW=0 TO 254:FOR IX=0 TO 254:FOR IY=0 TO 254:FOR IZ=0 TO 254:FOR JA=0 TO 254:FOR JB=0 TO 254:FOR JC=0 TO 254:FOR JD=0 TO 254:FOR JE=0 TO 254:FOR JF=0 TO 254:FOR JG=0 TO 254:FOR JH=0 TO 254:FOR JI=0 TO 254:FOR JJ=0 TO 254:FOR JK=0 TO 254:FOR JL=0 TO 254:FOR JM=0 TO 254:FOR JN=0 TO 254:FOR JO=0 TO 254:FOR JP=0 TO 254:FOR JQ=0 TO 254:FOR JR=0 TO 254:FOR JS=0 TO 254:FOR JT=0 TO 254:FOR JU=0 TO 254:FOR JV=0 TO 254:FOR JW=0 TO 254:FOR JX=0 TO 254:FOR JY=0 TO 254:FOR JZ=0 TO 254:FOR KA=0 TO 254:FOR KB=0 TO 254:FOR KC=0 TO 254:FOR KD=0 TO 254:FOR KE=0 TO 254:FOR KF=0 TO 254:FOR KG=0 TO 254:FOR KH=0 TO 254:FOR KI=0 TO 254:FOR KJ=0 TO 254:FOR KK=0 TO 254:FOR KL=0 TO 254:FOR KM=0 TO 254:FOR KN=0 TO 254:FOR KO=0 TO 254:FOR KP=0 TO 254:FOR KQ=0 TO 254:FOR KR=0 TO 254:FOR KS=0 TO 254:FOR KT=0 TO 254:FOR KU=0 TO 254:FOR KV=0 TO 254:FOR KW=0 TO 254:FOR KX=0 TO 254:FOR KY=0 TO 254:FOR KZ=0 TO 254:FOR LA=0 TO 254:FOR LB=0 TO 254:FOR LC=0 TO 254:FOR LD=0 TO 254:FOR LE=0 TO 254:FOR LF=0 TO 254:FOR LG=0 TO 254:FOR LH=0 TO 254:FOR LI=0 TO 254:FOR LJ=0 TO 254:FOR LK=0 TO 254:FOR LL=0 TO 254:FOR LM=0 TO 254:FOR LN=0 TO 254:FOR LO=0 TO 254:FOR LP=0 TO 254:FOR LQ=0 TO 254:FOR LR=0 TO 254:FOR LS=0 TO 254:FOR LT=0 TO 254:FOR LU=0 TO 254:FOR LV=0 TO 254:FOR LW=0 TO 254:FOR LX=0 TO 254:FOR LY=0 TO 254:FOR LZ=0 TO 254:FOR MA=0 TO 254:FOR MB=0 TO 254:FOR MC=0 TO 254:FOR MD=0 TO 254:FOR ME=0 TO 254:FOR MF=0 TO 254:FOR MG=0 TO 254:FOR MH=0 TO 254:FOR MI=0 TO 254:FOR MJ=0 TO 254:FOR MK=0 TO 254:FOR ML=0 TO 254:FOR MM=0 TO 254:FOR MN=0 TO 254:FOR MO=0 TO 254:FOR MP=0 TO 254:FOR MQ=0 TO 254:FOR MR=0 TO 254:FOR MS=0 TO 254:FOR MT=0 TO 254:FOR MU=0 TO 254:FOR MV=0 TO 254:FOR MW=0 TO 254:FOR MX=0 TO 254:FOR MY=0 TO 254:FOR MZ=0 TO 254:FOR NA=0 TO 254:FOR NB=0 TO 254:FOR NC=0 TO 254:FOR ND=0 TO 254:FOR NE=0 TO 254:FOR NF=0 TO 254:FOR NG=0 TO 254:FOR NH=0 TO 254:FOR NI=0 TO 254:FOR NJ=0 TO 254:FOR NK=0 TO 254:FOR NL=0 TO 254:FOR NM=0 TO 254:FOR NN=0 TO 254:FOR NO=0 TO 254:FOR NP=0 TO 254:FOR NQ=0 TO 254:FOR NR=0 TO 254:FOR NS=0 TO 254:FOR NT=0 TO 254:FOR NU=0 TO 254:FOR NV=0 TO 254:FOR NW=0 TO 254:FOR NX=0 TO 254:FOR NY=0 TO 254:FOR NZ=0 TO 254:FOR OA=0 TO 254:FOR OB=0 TO 254:FOR OC=0 TO 254:FOR OD=0 TO 254:FOR OE=0 TO 254:FOR OF=0 TO 254:FOR OG=0 TO 254:FOR OH=0 TO 254:FOR OI=0 TO 254:FOR OJ=0 TO 254:FOR OK=0 TO 254:FOR OL=0 TO 254:FOR OM=0 TO 254:FOR ON=0 TO 254:FOR OO=0 TO 254:FOR OP=0 TO 254:FOR OQ=0 TO 254:FOR OR=0 TO 254:FOR OS=0 TO 254:FOR OT=0 TO 254:FOR OU=0 TO 254:FOR OV=0 TO 254:FOR OW=0 TO 254:FOR OX=0 TO 254:FOR OY=0 TO 254:FOR OZ=0 TO 254:FOR PA=0 TO 254:FOR PB=0 TO 254:FOR PC=0 TO 254:FOR PD=0 TO 254:FOR PE=0 TO 254:FOR PF=0 TO 254:FOR PG=0 TO 254:FOR PH=0 TO 254:FOR PI=0 TO 254:FOR PJ=0 TO 254:FOR PK=0 TO 254:FOR PL=0 TO 254:FOR PM=0 TO 254:FOR PN=0 TO 254:FOR PO=0 TO 254:FOR PP=0 TO 254:FOR PQ=0 TO 254:FOR PR=0 TO 254:FOR PS=0 TO 254:FOR PT=0 TO 254:FOR PU=0 TO 254:FOR PV=0 TO 254:FOR PW=0 TO 254:FOR PX=0 TO 254:FOR PY=0 TO 254:FOR PZ=0 TO 254:FOR QA=0 TO 254:FOR QB=0 TO 254:FOR QC=0 TO 254:FOR QD=0 TO 254:FOR QE=0 TO 254:FOR QF=0 TO 254:FOR QG=0 TO 254:FOR QH=0 TO 254:FOR QI=0 TO 254:FOR QJ=0 TO 254:FOR QK=0 TO 254:FOR QL=0 TO 254:FOR QM=0 TO 254:FOR QN=0 TO 254:FOR QO=0 TO 254:FOR QP=0 TO 254:FOR QQ=0 TO 254:FOR QR=0 TO 254:FOR QS=0 TO 254:FOR QT=0 TO 254:FOR QU=0 TO 254:FOR QV=0 TO 254:FOR QW=0 TO 254:FOR QX=0 TO 254:FOR QY=0 TO 254:FOR QZ=0 TO 254:FOR RA=0 TO 254:FOR RB=0 TO 254:FOR RC=0 TO 254:FOR RD=0 TO 254:FOR RE=0 TO 254:FOR RF=0 TO 254:FOR RG=0 TO 254:FOR RH=0 TO 254:FOR RI=0 TO 254:FOR RJ=0 TO 254:FOR RK=0 TO 254:FOR RL=0 TO 254:FOR RM=0 TO 254:FOR RN=0 TO 254:FOR RO=0 TO 254:FOR RP=0 TO 254:FOR RQ=0 TO 254:FOR RR=0 TO 254:FOR RS=0 TO 254:FOR RT=0 TO 254:FOR RU=0 TO 254:FOR RV=0 TO 254:FOR RW=0 TO 254:FOR RX=0 TO 254:FOR RY=0 TO 254:FOR RZ=0 TO 254:FOR SA=0 TO 254:FOR SB=0 TO 254:FOR SC=0 TO 254:FOR SD=0 TO 254:FOR SE=0 TO 254:FOR SF=0 TO 254:FOR SG=0 TO 254:FOR SH=0 TO 254:FOR SI=0 TO 254:FOR SJ=0 TO 254:FOR SK=0 TO 254:FOR SL=0 TO 254:FOR SM=0 TO 254:FOR SN=0 TO 254:FOR SO=0 TO 254:FOR SP=0 TO 254:FOR SQ=0 TO 254:FOR SR=0 TO 254:FOR SS=0 TO 254:FOR ST=0 TO 254:FOR SU=0 TO 254:FOR SV=0 TO 254:FOR SW=0 TO 254:FOR SX=0 TO 254:FOR SY=0 TO 254:FOR SZ=0 TO 254:FOR TA=0 TO 254:FOR TB=0 TO 254:FOR TC=0 TO 254:FOR TD=0 TO 254:FOR TE=0 TO 254:FOR TF=0 TO 254:FOR TG=0 TO 254:FOR TH=0 TO 254:FOR TI=0 TO 254:FOR TJ=0 TO 254:FOR TK=0 TO 254:FOR TL=0 TO 254:FOR TM=0 TO 254:FOR TN=0 TO 254:FOR TO=0 TO 254:FOR TP=0 TO 254:FOR TQ=0 TO 254:FOR TR=0 TO 254:FOR TS=0 TO 254:FOR TT=0 TO 254:FOR TU=0 TO 254:FOR TV=0 TO 254:FOR TW=0 TO 254:FOR TX=0 TO 254:FOR TY=0 TO 254:FOR TZ=0 TO 254:FOR UA=0 TO 254:FOR UB=0 TO 254:FOR UC=0 TO 254:FOR UD=0 TO 254:FOR UE=0 TO 254:FOR UF=0 TO 254:FOR UG=0 TO 254:FOR UH=0 TO 254:FOR UI=0 TO 254:FOR UJ=0 TO 254:FOR UK=0 TO 254:FOR UL=0 TO 254:FOR UM=0 TO 254:FOR UN=0 TO 254:FOR UO=0 TO 254:FOR UP=0 TO 254:FOR UQ=0 TO 254:FOR UR=0 TO 254:FOR US=0 TO 254:FOR UT=0 TO 254:FOR UJ=0 TO 254:FOR UV=0 TO 254:FOR UW=0 TO 254:FOR UX=0 TO 254:FOR UY=0 TO 254:FOR UZ=0 TO 254:FOR VA=0 TO 254:FOR VB=0 TO 254:FOR VC=0 TO 254:FOR VD=0 TO 254:FOR VE=0 TO 254:FOR VF=0 TO 254:FOR VG=0 TO 254:FOR VH=0 TO 254:FOR VI=0 TO 254:FOR VJ=0 TO 254:FOR VK=0 TO 254:FOR VL=0 TO 254:FOR VM=0 TO 254:FOR VN=0 TO 254:FOR VO=0 TO 254:FOR VP=0 TO 254:FOR VQ=0 TO 254:FOR VR=0 TO 254:FOR VS=0 TO 254:FOR VT=0 TO 254:FOR VU=0 TO 254:FOR VV=0 TO 254:FOR VW=0 TO 254:FOR VX=0 TO 254:FOR VY=0 TO 254:FOR VZ=0 TO 254:FOR WA=0 TO 254:FOR WB=0 TO 254:FOR WC=0 TO 254:FOR WD=0 TO 254:FOR WE=0 TO 254:FOR WF=0 TO 254:FOR WG=0 TO 254:FOR WH=0 TO 254:FOR WI=0 TO 254:FOR WJ=0 TO 254:FOR WK=0 TO 254:FOR WL=0 TO 254:FOR WM=0 TO 254:FOR WN=0 TO 254:FOR WO=0 TO 254:FOR WP=0 TO 254:FOR WQ=0 TO 254:FOR WR=0 TO 254:FOR WS=0 TO 254:FOR WT=0 TO 254:FOR WU=0 TO 254:FOR WV=0 TO 254:FOR WW=0 TO 254:FOR WX=0 TO 254:FOR WY=0 TO 254:FOR WZ=0 TO 254:FOR XA=0 TO 254:FOR XB=0 TO 254:FOR XC=0 TO 254:FOR XD=0 TO 254:FOR XE=0 TO 254:FOR XF=0 TO 254:FOR XG=0 TO 254:FOR XH=0 TO 254:FOR XI=0 TO 254:FOR XJ=0 TO 254:FOR XK=0 TO 254:FOR XL=0 TO 254:FOR XM=0 TO 254:FOR XN=0 TO 254:FOR XO=0 TO 254:FOR XP=0 TO 254:FOR XQ=0 TO 254:FOR XR=0 TO 254:FOR XS=0 TO 254:FOR XT=0 TO 254:FOR XU=0 TO 254:FOR XV=0 TO 254:FOR XW=0 TO 254:FOR XX=0 TO 254:FOR XY=0 TO 254:FOR XZ=0 TO 254:FOR YA=0 TO 254:FOR YB=0 TO 254:FOR YC=0 TO 254:FOR YD=0 TO 254:FOR YE=0 TO 254:FOR YF=0 TO 254:FOR YG=0 TO 254:FOR YH=0 TO 254:FOR YI=0 TO 254:FOR YJ=0 TO 254:FOR YK=0 TO 254:FOR YL=0 TO 254:FOR YM=0 TO 254:FOR YN=0 TO 254:FOR YO=0 TO 254:FOR YP=0 TO 254:FOR YQ=0 TO 254:FOR YR=0 TO 254:FOR YS=0 TO 254:FOR YT=0 TO 254:FOR YU=0 TO 254:FOR YV=0 TO 254:FOR YW=0 TO 254:FOR YX=0 TO 254:FOR YY=0 TO 254:FOR YZ=0 TO 254:FOR ZA=0 TO 254:FOR ZB=0 TO 254:FOR ZC=0 TO 254:FOR ZD=0 TO 254:FOR ZE=0 TO 254:FOR ZF=0 TO 254:FOR ZG=0 TO 254:FOR ZH=0 TO 254:FOR ZI=0 TO 254:FOR ZJ=0 TO 254:FOR ZK=0 TO 254:FOR ZL=0 TO 254:FOR ZM=0 TO 254:FOR ZN=0 TO 254:FOR ZO=0 TO 254:FOR ZP=0 TO 254:FOR ZQ=0 TO 254:FOR ZR=0 TO 254:FOR ZS=0 TO 254:FOR ZT=0 TO 254:FOR ZU=0 TO 254:FOR ZV=0 TO 254:FOR ZW=0 TO 254:FOR ZX=0 TO 254:FOR ZY=0 TO 254:FOR ZZ=0 TO 254:FOR
```

Robert Spahitz, 143 Denner Ave., Mount Islip, NY 11760.

To exit the character-change mode, type either a or +. Hitting the plus key (+) will save the character that you created and return you to character-select mode. To examine the character again, or to get the numbers that can create it, hit the left arrow key. To return the character to the way it was when you first ran the program, just type X instead of +. This also returns you the character-select mode.

Once you have created, designed and examined enough characters, you can copy their associated numbers on paper to be used in any programs you make. Some good designs to try include Space Invader characters, animals, and abstract patterns.

The Program

Lines 10 to 170 initialize everything. The memory pointer (locations 55-56) is adjusted so characters being created are not disturbed by program overhead (string storage).

Lines 20 to 70 duplicate the charac-

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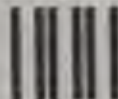
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8 x 8 Create, continued...

ters from ROM to RAM (line 60) while the colorful display of characters is being POKEd into the screen. Memory location 36879 changes the background/border color while 36869 changes from the normal character set to the programmable character set. After the characters are screen-POKEd (line 120), two special characters are created for later use (lines 140-170).

Lines 180 to 290 allow the cursor to move only within the boundary of the printed characters. If a left-arrow is hit (line 280) a jump is made to the section which handles character-changing.

Lines 300 to 360 test the cursor for out-of-bounds and also adjust the variables that will move the cursor (up, down, right, or left).

Lines 370 to 480 print the numbers, enlarged character, and normal-sized character as described in the instructions.

Lines 490 to 560 prepare the present cursor position for any change that may take place.

Lines 570 to 660 allow for the different types of changes (cursor up, down, right, left, exit and restore original character; turn on square; turn off square; in and out and save).

Lines 670 to 710 allow the cursor to move without going beyond the boundaries.

Lines 720 to 750 restore the original character from ROM to the appropriate position, and return program control to the character-select section.

Lines 760 to 800 turn a position on not only in the enlarged character, but also in the normal-sized character.

Lines 810 to 840 turn a position off in both the enlarged character and the normal-sized character.

Notes

When in character-create mode, hit the left arrow then the = to increase the character in only two colors (orange/white) or to examine the correct numbers required to create the character.

Avoid changing the number characters (0,1,2,3,4,5,6,7,8,9) unless you have no use for the values left of the enlarged character. If you change them, the numbers printed to the left will also be changed. They can be restored using the X function for each number.

To start out with a different character set, change the 32768 in line 60, and the 28472 in line 730 (4096 less than the number in line 60). I suggest using 33792 for reversed upper case, 34816 for lower case, or 33840 for reversed lower case. Caution: using a different character set may affect the appearance of numbers and thereby make reading the numbers virtually impossible. □

```

160 POKE 24936,130
165 POKE 24936,130
170 NEXT Z: REMOVCURSOR: GOTO 200
180 POKE 36869,0
190 REMOVCURSOR
200 IF Z=131 THEN GOTO 220
210 ON LSI: REMOVCURSOR ON OR OFF
220 POKE Z,0
230 SET A#
240 IF REMOVR(28) THEN VWH: GOTO 280
250 IF REMOVR(157) THEN WH: GOTO 280
260 IF REMOVR(17) THEN WHH: GOTO 300
270 IF REMOVR(145) THEN WHH: GOTO 320
280 IF REMOVR(151) THEN WH
290 GOTO 280
300 IF V# THEN V#-2: GOTO 310
310 IF V# THEN V#-1: GOTO 310
320 IF WH THEN WH#
330 IF WH THEN WH#
340 IF WH# THEN WH#-1: GOTO 310
350 POKE Z,X
360 GOTO 180
370 POKE Z,3: REMOVCURSOR: GOTO 180
380 POKE 36869,0
390 FOR V# TO 7
400 REMOVR(28)=0
410 PRINT: GOTO(157)OVR(157)OVR(157)
420 FOR Z# TO 8: STOP: -1
430 POKE 36869,0: GOTO 310
440 POKE 36869,0: GOTO 310
450 IF Z#-2 THEN POKE 36869,0: GOTO 310
460 NEXT Z
470 NEXT V
480 PRINT: GOTO(157)OVR(157)OVR(157)OVR(157)OVR(157)OVR(157)OVR(157)OVR(157)OVR(157)OVR(157)
510
520 A#
530 B#
540 ON Z#-2: GOTO 550
550 IF REMOVR(157) THEN Z#-1
560 POKE Z,130
570 POKE Z,130
580 IF B# THEN POKE Z,130
590 SET A#
600 IF REMOVR(28) THEN WHH: GOTO 670
610 IF REMOVR(157) THEN WHH: GOTO 670
620 IF REMOVR(17) THEN WHH: GOTO 670
630 IF REMOVR(145) THEN WHH: GOTO 670
640 IF REMOVR(151) THEN WHH
650 IF REMOVR(157) THEN WHH
660 IF REMOVR(151) THEN WHH
670 IF WH THEN WH#-2: GOTO 680
680 IF WH THEN WH#-1: GOTO 680
690 IF WH# THEN WH#
700 IF WH# THEN WH#
710 GOTO 670
720 FOR V# TO 7
730 POKE 36869,0: REMOVR(28)=0
740 NEXT V: REMOVCURSOR: GOTO 180
750 GOTO 180
760 POKE Z,131: REMOVCURSOR
770 POKE 36869,0
780
790 POKE 36869,0: REMOVR(28)=0: REMOVR(157)=0: REMOVR(17)=0: REMOVR(145)=0: REMOVR(151)=0
800 GOTO 540
810 POKE Z,130: REMOVCURSOR
820 POKE 36869,0
830 POKE 36869,0: REMOVR(28)=0: REMOVR(157)=0: REMOVR(17)=0: REMOVR(145)=0: REMOVR(151)=0
840 GOTO 540

```

Table 1.

CHRS (x)	can be replaced by	found on line (s)
x=15	home key	30
x=147	clear key	400
x=17	cursor down	100, 105, 160, 600
x=25	cursor right	240, 560
x=147	cursor left	290, 400, 560
x=145	cursor up	270, 480, 610
x=95	up arrow (↑)	290
x=32	space ()	400

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Why We Really Buy Creative Computing

Fred Gunther

Isn't it about time that we let the editors and managers know why we really buy *Creative Computing*? The editors think that we put our money down on the cover because of the exciting layouts and the stimulating ads. The feature writers think that we subscribe because we don't want to miss an installment on how "My Personal Computer Lets Me Dig Ditches for Fun and Profit." The advertising staff and the advertisers think that we rub the kids' piggy banks each month to learn what the new hardware and software might be.

While there are elements of truth in all these theories, the real reason we buy and read this magazine is to find programming challenges. Has someone published a new game; will I type it in, what can I do to make it work "better"?

Has someone published a program in a language different than the ones my computer uses; how can I make the transition? Has someone advertised a new game or widget; how can I produce a super-game, or a widget simulator?

Let's take a case in point. We have all seen the Squirrel advertisement for 44-res drawing on the Apple II. The Lisp people have used it to prove how easy it



Figure 5.



Figure 6.



Figure 7.

Fred A. Gunther, 1958 Woodmont Way, Columbia, MO 65203.

is to produce graphic designs.

What can be done in one language can be done in another. The challenge is to actually do it. My answer to the Squirrel challenge is a program I call Basic Squirrel (Listing 1). Written in AppleSoft Basic, it will produce many different figures.

Like the Logo version, angle values of 59, 60, 61, or 69, 90, 91, or 118, 120, 123, etc., will produce interesting designs (Figures 1-4). It is even possible to add a little more code, so that the designs are plotted in color, on a color background (Figures 5 and 6).



Figure 2



Figure 3



Figure 4

Editor's Note: Taking the challenge a step farther, we have translated Basic Squirrel from AppleSoft to TRS-80 Color and Atari Basic.

Listing 1. AppleSoft Basic Squirrel

```
10 TEXT 1 HOME 1 VTAB 5: PRINT "*****" INDIC
    SQUIRAL *****
20 LET PI = 3.14159:M = 61 / 100.1:VTAB 15
30 HTAB 12: PRINT "SUPPLY VARIABLES": PRINT 1 PRINT "
    -- DISTANCE, ANGLE,
    INCREMENT --": PRINT 1 INPUT D,ANG,I
40 HPR2 15 = 180:V = Y0:HCOLOR= 31A = ANG
50 LET XN = X = D * COS (M * A):YN = Y = D * SIN
    (M * A)
60 HPL0T X,Y TO XN,YN
70 LET D = D * I
80 IF D > 200 THEN STOP
90 LET A = A + ANG
100 LET X = XN:Y = YN
120 GOTO 50
```

Sample run for AppleSoft Squirrel

```
3RUN
***** BASIC SQUIRAL *****
SUPPLY VARIABLES

-- DISTANCE, ANGLE, INCREMENT --
71,123,5
```

Listing 2. TRS-80 Color Basic Squirrel

```
10 CLS : PRINT "BASIC SQUIRAL"
20 PRINT : PRINT "SUPPLY VARIABLES"
30 PRINT "--DISTANCE, ANGLE, INCREMENT--"
40 INPUT D, ANG, I
50 LET PI = 3.14159 : M = PI/ANG
60 HPR2 9.1 : HCOL 2 : HPR2 12
70 X = 0 : Y = 0 : XN = 0 : YN = 0
80 XN = X + D * COS(M * A)
90 YN = Y + D * SIN(M * A)
100 LTHE 18,11-18H,YN,156)
110 IF D/100 THEN 120
120 A = A + ANG
130 X = XN
140 Y = YN
150 GOTO 80
160 AT = TIME * 100 : AT = AT/1000000
170 GOTO 150
```

Listing 3. Atari Basic Squirrel

```
10 DIM ANGLE:ATARI TRANSLATION
20 GRAPHICS 0:COLOR 1:TRAP 140
30 PRINT "*****BASIC SQUIRAL*****"
40 PI=3.14159:M=PI/180
50 PRINT "SUPPLY VARIABLES":PRINT "DISTANCE, ANGLE, INCREMENT"
60 INPUT D,ANG,I
70 X=180:Y=90:ANGPLOT X,Y
80 XN=X+D*COS(M*ANG):YN=Y+D*SIN(M*ANG)
90 DRAWTO XN,YN:D=D*I
100 IF D/200 THEN STOP
110 A=ANG:ANG=XN*Y
120 GOTO 80
130 GOTO 75
140 PRINT "WANT TO GO AGAIN?INPUT AN:IF AN=Y THEN GOTO 20"
```


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Brain Warp

Brain Warp is a puzzle program designed to make use of the sound and color capabilities of the Commodore Vic-20. The program fits in standard Vic memory. The object is to manipulate the rows and columns of six squares and make color out of chaos. Six squares of scattered color are rearranged into six solid-colored squares. Sounds easy, huh? Try it.

There are thousands of paths to a solution and a total of 720 possible columns. Most solutions will average around 60 moves, though it is possible to reach one in 30 or fewer moves. The more you practice, the better you'll get and the fewer moves you'll require.

Moves are made by specifying a pair of numbered squares and then designating a particular row or column. This row or column is then swapped between the two squares. For example, if squares two and five are specified and the designated row or column is row three, then row three of square two will swap places with row three of square five. This move is depicted in Figure 1.

The puzzle is designed around a three-dimensional array $Z(S,R,C)$, where S is the square number and R and C are the row and column numbers, respectively. There are six squares consisting of four rows and four columns each, hence a total of 96 block positions. $Z(2,2,3)$ designates the third column of the second row, while $Z(3,4,1)$ designates the fourth column of the third row. Both of these squares, as we can see from the first number, are in square two. Rows are horizontal and numbered from top to bottom, while columns are vertical and numbered from left to right. See Figure 2 for an example of the block positions of square two.

Square three would be identical to

Dub Scroggin

this, but in each case the first number would be three. Of course, the contents, colors and screen locations would also be different.



By holding the square and row numbers constant and varying the column number from one to four, it is possible to isolate a row of a particular square and manipulate it. Holding the square and

column numbers constant and varying the row number from one to four, we get the contents of a particular column. Again, Figure 2 should help make this clear.

Initially, the program reads a number into each of the 96 block positions. This number is the color code for the particular location and determines the color of the block. The colors used are black, white, red, cyan, blue, and yellow, and the codes are those found in the Vic manual.

Moving a color code to a different position in the array causes the block at that position to change color. Movements, of course, are made a row or column at a time, rather than by individual block.

Step 20 of the program reserves 96 blocks in memory for the contents of the three-dimensional array and an additional six on which the screen location of each square is based. Step 30 reads the values into these two arrays. K is the column number, J is the row number and I is the square number.

Step 40 puts the square numbers on the screen and marks the start of the main

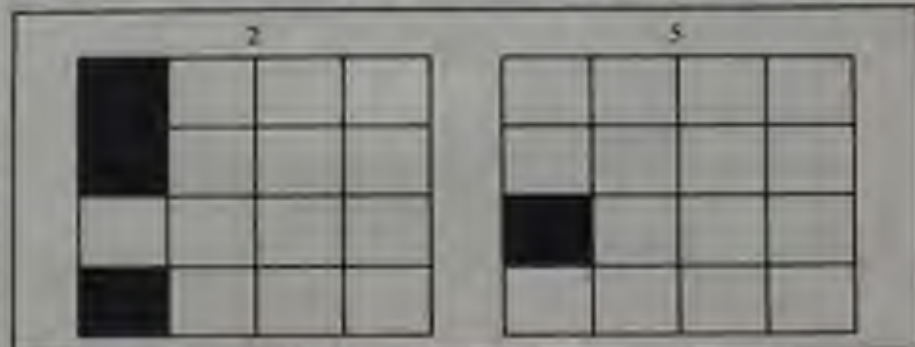


Figure 1. In this example, swapping row three between squares two and five will produce a column of solid black which can then be joined with other such columns to form a black square.

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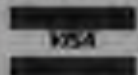
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Brain Warp, continued...

program loop. Steps 90-70 translate the current contents of array Z into the six squares of sixteen blocks each on the screen, as well as providing the double-voiced sound effect.

In step 60 LOH is the screen position to the left and above where square 1 will be placed. Multiplying J by 22 moves down one space. Then, as K goes from 1 to 4, the top row of the square is set in place. When J then changes to 2, we drop in the second row and place its four columns, and so on.

POKING 207 into each location gives each square its border and sets off the colors. In the latter half of step 60 SC is used to shift to the screen color coding and Z(I,J,K) determines the color of the block just positioned.

Steps 80-100 check for a correct solution by comparing the color of the first block (row one, column one) of each square to each of the other blocks. You may notice a slight delay here, especially as the puzzle nears solution. If a mismatch is found, the triple loop is terminated and the program continues. If no mismatches are found, then the puzzle is solved and step 110 initiates the end-of-game routine starting at line 3080.

To test the end-of-game routine you may temporarily change L20 in line 90 to L10. The program will then go directly to the end-of-game routine on a mismatch.

Beginning in step 130 and ending with the end of the main program loop in step 210, the user inputs the pair of squares and the row or column he wants to swap between them. The swap is actually made in step 180 for rows or in step 200

for columns.

To swap rows, I hold the square and row number constant and vary the column number using M, F and T represent the input "from" and "to" squares, respectively, while R is the input row number to be swapped. The contents of Z(F,R,M) are temporarily placed in HO while the contents of Z(T,R,M) are moved to Z(F,R,M). The contents of HO are then placed in Z(T,R,M) and the swap is completed. A similar method is used for swapping columns.

Step 210 keeps count of the number of moves and marks the end of the main program loop. Control passes back in step 40 and the screen is set up for your next move.

Steps 1000-1050 are the contents of the LO array and the initial contents of the Z array. LO is the first number, while the next 16 are the color codes for that square. If, in trying to solve the puzzle, you run into a non-solvable setup, check to be sure these numbers are correct. Certain arrangements will preclude a solution, but not give an error message to tell you about it.

These values were obtained by setting up a solution, i.e., making the numbers for square one all zeros, etc., then using the program to scramble the squares. I then recorded the result, translated to the color codes and altered the data. The same method may be used to change the initial setup, but the values should not be altered haphazardly.

Steps 2000-2110 are the title display and direction subroutine called by line 10. The value of P in step 2010 is used to

LOC=	SQUARE 2			
	Col. #1	2	3	4
Row #				
1	7755 Z(2,1,1)=2 red	7756 Z(2,1,2)=0 black	7757 Z(2,1,3)=2 red	7758 Z(2,1,4)=7 yellow
2	7757 Z(2,2,1)=7 yellow	7758 Z(2,2,2)=6 blue	7759 Z(2,2,3)=7 yellow	7760 Z(2,2,4)=7 yellow
3	7764 Z(2,3,1)=7 yellow	7800 Z(2,3,2)=2 red	7801 Z(2,3,3)=0 black	7802 Z(2,3,4)=1 white
4	7821 Z(2,4,1)=7 yellow	7822 Z(2,4,2)=1 white	7823 Z(2,4,3)=6 blue	7824 Z(2,4,4)=0 black

Figure 2. This figure illustrates the block positions for square two and shows how they are numbered. It also gives the initial contents and corresponding colors for each block. The top number in each block is the screen location based on LOC.

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Graphmag creates diagrams from mathematical data. Pie charts, line graphs, bar graphs, and scatter diagrams are among the options. The program is compatible with DIF data, costs less than \$100, and requires an Apple II with a disk drive. International Software Marketing, 120 E. Washington St., Suite 421, University Bldg., Syracuse, NY 13202.

CIRCLE 400 ON READER SERVICE CARD

The **Game Application Package** makes it possible for Applesoft programmers to program animated graphics. It costs \$49.95 and requires DOS 3.3, 48K, and Applesoft. Synergistic Software, 830 North Riverside Dr., Suite 201, Renton, WA 98055.

CIRCLE 401 ON READER SERVICE CARD

Micromap II is used on a micro-computer to make maps: colored and textured area maps, contour maps, 3-D polyhedron or proportional circle maps, and statistical charts and graphs and perspective views of digital terrain models. Micromap II is written in Applesoft and requires 48K of memory, Apple DOS 3.3, and one 5-1/4" disk drive. \$650. The discrete mapping and contour sections are \$350. Morgan-Fairfield Graphics, P.O. Box 5457, Seattle, WA 98105. (206) 632-1374.

CIRCLE 402 ON READER SERVICE CARD

Musibox is a package for Atari owners who write their own programs. The disk contains six programs: Convert, Playtest, Colorgan, Manichex, Translat, and Data Files. Musibox is available for Atari computers with a memory of at least 32K. \$29.95. Program Design, Inc., 11 Ida Court, Greenwich, CT 06830. (203) 661-8799.

CIRCLE 403 ON READER SERVICE CARD

Grappler Plus is an Apple printer interface that combines on-board firmware for Apple hi-res graphics, with other features such as Apple III compatibility, an on-

board dip switch for printer selection, and Orange Micro's Dual Hi-Res Graphics. A single Grappler Plus interface is compatible with the NEC 8023, Centronics 739, C. Itoh Prowriter, Anadex, Okidata, Datamath DS-680 and the line of Epson printers. Also it is Apple, Pascal, CP/M, and Logo compatible. Orange Micro, Inc., 3150 E. La Palma, Suite G, Anaheim, CA 92806. (714) 630-3620.

CIRCLE 404 ON READER SERVICE CARD

Hires and **Hires2** are high-speed, high-resolution drivers for 48K or 16K LNW-80 computers. They use the 480 x 192 graphics capability of the LNW. Features included are: LINE draw/erase, CIRCLE draw/erase, check DOT on/off, TONE generation, and a character table for 80 x 16 or 80 x 24 text display. The length of both drivers is less than 2500 bytes. They come with five demonstration programs, and are available on cassette or single-density diskette. \$20. Enert/Humtel Software, 4943 Antioch Blvd., Baton Rouge, LA 70816. (504) 293-3403.

CIRCLE 405 ON READER SERVICE CARD

The **Fig Factory** is a figures graphics utility which allows the user to sketch on-screen with the Apple III computer. Over 100 symbols can be sketched, and up to five pictures on each diskette can be retrieved. It requires the 128K-1 external disk drive with optional joystick and Silentype printer. \$49.95. Sun Software, P.O. Box 189, Tustin, CA 92680. (714) 559-1790.

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GAMES, RECREATIONAL

Radio Shack has released **Games II** for the TRS-80 Pocket Computer. Eight game programs challenge deductive reasoning, marksmanship, and gambling talents. The package includes Missile Marksmanship, Buccaneer, Blackjack, Acey-Deucey, One-Armed Bandit, Pokerlot, Nangress and Craps. Two cassettes retail for \$14.95. Tandy Corporation, 1800 One Tandy Center, Fort Worth, TX 76102.

CIRCLE 407 ON READER SERVICE CARD

Firebug, from Muse Software, is a new game by Silas Warner. The scenario puts

you, the Firebug, at the top of a five-story maze, complete with burning fuse, gasoline can, and the dare to burn down the floors one at a time. The game runs on the Apple II or Apple II+ with 48K and disk drive, and costs \$24.95. Muse, 347 N. Charles St., Baltimore, MD 21201.

CIRCLE 408 ON READER SERVICE CARD

Star ships confront alien attack ships and an intergalactic leech in **K-Star Patrol**. The package contains one ROM cartridge and a 12-page color instruction booklet. The cartridge fits Atari 400 and 800 Personal Computer Systems, K-Byte, Division of Kay Enterprises Co., 1705 Austin St., Troy, MI 48064. (313) 524-9878.

CIRCLE 409 ON READER SERVICE CARD

Alien Garden is a strategy-action game in which the player must eat life-giving crystals while avoiding death-making crystals. The game sells for \$39.95 in cartridge form and requires an Atari 400 or 800. Epps, P.O. Box 4247, Mountain View, CA 94040.

CIRCLE 410 ON READER SERVICE CARD

King Cribbage is a new version of the age old English card game. The King plays six-card cribbage as dealt from a standard 52-card deck. The program retails for \$24.95 and requires an Apple II, 48K, and a disk drive. Hayden Book Company, 50 Essex St., Rochelle Park, NJ 07662.

CIRCLE 411 ON READER SERVICE CARD

BUSINESS

The **Conest MBA** incorporates spreadsheet, word processing, graphics, and database functions in one package. A telecommunication feature will soon be added and will be provided as a no-cost upgrade to early buyers of the package.



The system requires an IBM Personal Computer, 256K, 2 disk drives, and color graphics card. Contact Management Systems, 2384 Hawthorne Blvd., Suite 100, Turance, CA 91604.

CIRCLE 413 ON READER SERVICE CARD

ServiceManager is a business software package which performs administrative and clerical chores for repair shops and service departments. It has word processing capability and prints all standard forms. It runs on the Apple II with the ProFile hard disk or 5-1/4" diskettes. The Denver Software Company, 14100 E. Jewell Ave., Suite 13, Aurora, CO 80012. (303) 751-9980.

CIRCLE 413 ON READER SERVICE CARD

The **Execuware Economic Order Quantity** package is a cost control software package for use with the Apple II, Apple II plus, and IBM personal computers. Execuware minimizes inventory costs while maintaining ideal stocking levels. Microcomputer Software Division of Aercon, Inc., 4530 Park Rd., Suite 340, Charlotte, NC 28209. (704) 525-9881.

CIRCLE 414 ON READER SERVICE CARD

VistaForm Business Form Processor allows a nonprogrammer to set up business forms on the Apple computer, to store them as files, and to generate analyses and management reports for their data. VistaForm may be installed on Apple systems using ProFile, Corvus, and other hard disks supporting the Pascal operating system. Both Apple II and Apple III versions have 80-column screen formats. \$495. Applied Software Technology, 14125 Capri Dr., Los Gatos, CA 95030. (408) 370-2662.

CIRCLE 415 ON READER SERVICE CARD

The **Accountant Finance Database System** is a double entry system that permits those who are not familiar with accounting terminology to use the double entry process. It requires an Apple II computer with 48K of RAM and can operate with one or two disk drives. Decision Support Software, 1438 Ironwood Dr., McLean, VA 22101. (800) 368-2022.

CIRCLE 416 ON READER SERVICE CARD

The **TRS-80 Expense Ledger** is for business/personal payments and keeps a one disk record of payments made during any year or part-year period. Entries can be reviewed by page screen scrolling, added, deleted or added to, and machine-language sorting puts entries into date order. The program is for TRS-80 Models I and III, and is available in 48K (470 entries) and 32K (200 entries) versions. \$35. Manhattan Software, P.O. Box 1063, Woodland Hills, CA 91365. (213) 704-8495.

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CIRCLE 418 ON READER SERVICE CARD

An Apple II medical applications software system, **Automated Medical Administration**, is designed to automate the accounts receivable and claim form preparation tasks of the multi-doctor medical practice. The system allows for the maintenance of up to 200,000 accounts for up

to ten physicians. Boardroom Executive Software, Suite 240, Airport Park Plaza, 255 North El Cielo Rd., Palm Springs, CA 92262. (714) 365-6770.

CIRCLE 419 ON READER SERVICE CARD

A **Business Bookkeeping System** for small businesses is a set of menu-driven ledgers that allows the user to switch to an accrual system later. Some of the features are three cash basis activity ledgers, a complete general ledger, a security password for accessing employee information, and other reports. Dakin 5 Corporation, P.O. Box 21187, Denver, CO 80221. (303) 426-6090.

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New Products, continued...

can break the items down into 13 different categories. Inventory Manager issues reports which summarize profit margins, calculate wholesale to retail mark-ups, list back order status, print purchase orders, and more. \$149.95. **Integer Basic Compiler** is a utility software program for the Apple II computer with Integer Basic. Standard features include full support of hires and lores graphics and full support of lower case characters, disk error recovery, CHR\$, GET\$, and KEY functions. The IBC requires an Apple II computer, 48K, DOS 3.3, and one disk drive. \$149.95. Synergistic Software, 830 N. Riverside Dr., Suite 201, Renton, WA 98055. (206) 226-3216.

CIRCLE 421 ON READER SERVICE CARD

Loan Sales/Purchase Analysis is a program for analyzing the sale or purchase of a loan. Loans of any amount, bearing any interest rate and due date can be handled by this program. Loans in foreign currencies may be analyzed as well as loans in U.S. dollars. **Loan Sales/Purchase Analysis** is available on diskette or cassette for the Apple II or III and TRS-80 Model I or III. \$50. Ready Software Company, 1116 'E' 8th St., Manhattan Beach, CA 90266. (213) 372-9419.

CIRCLE 422 ON READER SERVICE CARD

The **Integrated Business Information System** is a set of accounting packages designed for the DEC VT180 and the Rainbow, DiCroma II and Professional Series computers. IBIS is for professional accounting firms, bookkeeping agencies,

and small businesses. It generates user defined financial statements and more than 25 printed reports for financial analysis and planning. PDS Microsystems, P.O. Box 5369, Carson, CA 90749. (213) 536-3962.

CIRCLE 423 ON READER SERVICE CARD

The **Micro-DSS/Analysis** software package is a support tool that enables managers, analysts, and policy administrators to handle information for plan-



ning, evaluation, and reporting. It is available for the 48K Apple II with Pascal, two floppy disk drives, monitor, and printer. \$495. Addison-Wesley Publishing Company, Inc., Jacob Way, Reading, MA 01867. (617) 944-3700.

CIRCLE 424 ON READER SERVICE CARD

Ap/Pac is an agricultural software package which enables the user to view a wide range of alternatives in common agricultural problem areas. Ap/Pac consists of 80 agricultural programs packaged in 32 modules, and will run on most microcomputers. Wisconsin Microware, One South Park St., Suite 220, Madison, WI 53715. (608) 255-9000.

CIRCLE 425 ON READER SERVICE CARD

WORD PROCESSING

Footprint is a text formatting program which is compatible with any text editor and computer and for which a Pascal compiler is available. It can be used by law firms and businesses of any size in their word processing centers. A single user license for a microcomputer configuration is \$200. Alexander Hamilton Institute, Inc., 1633 Broadway, New York, NY 10019. (212) 619-3346.

CIRCLE 426 ON READER SERVICE CARD

Copyart II is a word processor that offers graphics, math, sorting, and mail-merge utilities. Columns may be created for journals and reports, and Copyart II can be used to edit basic programs. The

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CIRCLE 366 ON READER SERVICE CARD

program runs on the TRS-80 Model I and III or LNW, \$149.95. Simstack Computer Products Inc., 8877 E. Speedway Blvd., Tucson, AZ 85712, (602) 323-9391.

CIRCLE 427 ON READER SERVICE CARD

PERSONAL

Quikrete Real Estate Investor is a real estate financial analysis package for 8" CP/M systems. It requires SuperCalc and a minimum of 64K, and is used on the Apple and IBM Personal Computers with VisiCalc. Two models, individual residence and income property, are available. \$129.95. Simple Soft, Inc., 480 Eagle Dr., Suite 101, Elk Grove, IL 60007, (312) 364-0752.

CIRCLE 428 ON READER SERVICE CARD

Market Analyst is a software package for the stock market investor. The system features Technical Analyst for computerized charting, Portfolio Manager to monitor holdings, and News, Views and Quotes for on-line information access. It runs on an Apple II/II Plus equipped with a 16K RAM card, a color or black and white monitor, and one or more disk drives. \$295. Anidata, 813 Janger Ct., Sicklerville, NJ 08081.

CIRCLE 429 ON READER SERVICE CARD

Darkstar provides advice on matters pertaining to the darkroom. It is available for the Sinclair ZX81, Apple II and Atari on either tape or disk. \$129.95. P/22 Press, P.O. Box 141, Leonia, NJ 07605, (201) 565-6250.

CIRCLE 430 ON READER SERVICE CARD

UTILITIES AND MISCELLANEOUS

Synergistic Software has released **The Programmer's Workshop**, a new utility series for the 32K Atari 400/800 computer with one disk drive. The package consists of seven separate programs designed to assist in programming. \$34.95. Synergistic Software, 830 North Riverside Dr., Suite 201, Renton, WA 98055.

CIRCLE 431 ON READER SERVICE CARD

Macro-80C is a macro assembler, screen-oriented editor, and machine language monitor for the Radio Shack Color Computer. 16K and a Radio Shack disk drive are required. The price is \$99.95. Micro Works, P.O. Box 1110, Del Mar, CA 92014.

CIRCLE 432 ON READER SERVICE CARD

The Filer is an Apple utility system for 35-, 40- and 70-track drives. It contains a disk drive speed check, disk drive test, fast copy program, and a file manager. Options include: Catalog with space on disk, Copy files, Copy disk, Copy DOS, Delete, Lock and Unlock Files, and Change Booting Program. \$19.95. Central Point Software, Inc., P.O. Box 19730-8203, Portland, OR 97219, (503) 244-5782.

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New Products, continued...

Deadline Calendar is a system that provides a way of scheduling as much as possible without overscheduling. A different schedule can be used for each person, manufacturing machine, etc. It operates on TRS-80 Model I and Model III with minimum of 32K, one disk drive and printer. \$160. Lefkoff Innovation Corp., P.O. Box 28347, Washington, DC 20005, (202) 547-2789.

CIRCLE 434 ON READER SERVICE CARD

VIZ-A-CON can add a third dimension to VisiCalc models. It can combine multiple pages of VisiCalc data from a model for consolidation or for summations over periods of time. VIZ-A-CON runs on the Radio Shack TRS-80 Model I/III. \$89.95. Abacus Associates, Suite #240, 6565 W. Loop So., Bellaire, TX 77401, (713) 666-8146.

CIRCLE 435 ON READER SERVICE CARD

Seven software programs are available for the IBM-PC with 48K memory, one disk drive, DOS and disk basic, and either monochrome or color graphics. **String Sort** is a machine language sort routine that will sort any string array into ascending alphabetical order. \$24.95. **Electronic Disk** permits the use of expanded capacity disk drives and allows RAM memory to be used as an electronic disk drive and a printer spooler. \$69.95. **ISAM Database** provides keyed access to data files for reading, writing, updating, and deleting records within the file. \$69.95. **Cross Reference** lists alphabetically all variables and the line numbers where the variables occur. The program may be saved on disk in either ASCII or binary format. \$24.95. **Games Package 1** is a collection of ten games including Qubic, Othello, Crilbage, Space Trek, Black Jack, Master Mind, American Quiz and others. \$29.95. **HP7470 Plotter Demo** has nine demonstration programs including 12-Month Trend and Phone Chart. \$24.95. **Bowling League Statistics Manager** maintains all bowling league statistics and memberships, computes individual handicaps and team standings, and prints reports. \$99.95. Ensign Software, 2312 N. Cole Rd., Suite E, Boise, ID 83704, (208) 376-8046.

CIRCLE 436 ON READER SERVICE CARD

CatalogCard and LabelWriter is an Apple II program that generates catalog cards and spine labels. The program requires a standard 80-column printer (Epson, Centronics, Microline, etc.), a lower case adaptor, and continuous-form cards and labels. The program is available on a 30-day approval basis for \$199 with a lower case adaptor and \$169 without the adaptor. The **Library Circulation Management Program** is for the TRS-80 and Apple II. It is for small school libraries, and records information for 300 students borrowing up to six books each.

The system requires a 12K TRS-80 Model III or Model II, or Apple II with at least one disk drive and any 80-column printer. \$249. 8-12 MicroMedia, 172 Broadway, Woodcliff Lake, NJ 07675. (201) 391-7335.

CIRCLE 437 ON READER SERVICE CARD

Diskweaver is an Apple disk utility package that supports 35-, 40-, 70-, and 80-track drives in 15- and 16-sector formats including CP/M and Pascal. Diskweaver includes several programs for repairing damaged diskettes, undeleting files, testing drive speed, and more. A 130-page manual is included in the \$59.95 price. Micro Mantic Computer, 541 N.E. McWilliams Rd., Bremerton, WA 98310. (206) 375-9231.

CIRCLE 438 ON READER SERVICE CARD

Basic Aid is an enhancement to the TRS-80 Color Computer. It contains features such as automatic line numbering and single key entry of most Basic commands. The Merge command allows Basic routines stored on cassette to be merged with the program in memory. The Move Line command allows any program line or lines to be moved anywhere and renumbered. Basic Aid comes in a ROM cartridge, \$39.99. Eigon Systems, Box 10234, Austin, TX 78766. (512) 837-4665.

CIRCLE 439 ON READER SERVICE CARD

Apple computer users can plug into the **Prostar World Videotex Service** with an **Appletel Disk**. This software turns the personal computer into a terminal to retrieve international data including updated prices of commodities, currency exchange and IMM rates, and stocks. Other useful databases include financial management information, economic indicators, locations of deep sea ships, hotel bookings, and international news, sports, and weather. Logtel/BVT, 666 Third Ave., New York, NY 10017. (212) 599-0825.

CIRCLE 440 ON READER SERVICE CARD

The **Terminal Program** for the Hayes Microsystem II and Apple II is a software package for communicating over telephone lines with other computers. It originates and answers calls, creates, lists, sends, and receives files and manages communication parameters. It is compatible with three Apple operating systems: DOS 3.3, Pascal, and CP/M. The



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New Products, continued...

program supports up to six disk drives, several printer interface cards, 40- and 80-column screens, and lower case characters through hardware modifications. The Microtend II system connects directly to the telephone line. The terminal program is \$79, and the Microtend II package is \$399. Hayes Microcomputer Products Inc., 5835 Peachtree Corners East, Norcross, GA 30092. (404) 448-8791.

CIRCLE 441 ON READER SERVICE CARD

Key-Wiz is a multi-key search utility designed to search a file of index cards and find all entries which match a profile of keywords. Included with Key-Wiz is Sort-Wiz, a utility that provides a way to sort the data files. Key-Wiz is available in ABS or COM format on a 5-1/4" hard sector diskette for HDOS or CP/M and may be used on a Heath HS or Heath/Zenith HS9 with 48K memory. \$19.95. Interactive Micro Systems, P.O. Box 21007, Columbus, OH 43221. (614) 363-1534.

CIRCLE 442 ON READER SERVICE CARD

Computerized Inventory System is a computer program for coin collectors. Coins is intended to run on either the TRS-80 Model I or Model III. 48K, with two disk drives. An updated value file is included. \$95. CompuQuest, 6914 Ber-



quist Ave., Castro Park, CA 91001. (213) 348-3662.

CIRCLE 443 ON READER SERVICE CARD

Platinum Workover is a programming aid that is designed for the 16K TRS-80 Color Computer and occupies less than 2K of memory. It provides full screen editing of Basic programs with automatic line numbering, changes, deletes, and inserts, using a movable cursor. \$30. Platinum Software, P.O. Box 833, Pittsburgh, NY 12001. (516) 643-6796.

CIRCLE 444 ON READER SERVICE CARD

EZ-Camp is a set of programs designed for camp management. This system maintains complete camper information and can produce mailing lists, medical records, bunk lists, and other camp reports. It is to be used on the TRS-80. \$50. EZR Micro, Inc., 31 Cornwell Dr., Maple Glen, PA 19002.

CIRCLE 445 ON READER SERVICE CARD

Comcom enables any CP/M-based computer to access time-sharing systems, databases, bulletin boards, or other computers via any link the CP/M system supports (e.g., RS-232, modem, parallel port). Various options allow communication with almost any computer system, and may be used for functions such as local modem control and auto-dialing. Comcom is written in Z80 macro-assembly language. Compu-Draw Software, 1227 Golfer House, Rochester, NY 14620. (716) 454-3186.

CIRCLE 446 ON READER SERVICE CARD

MergeCalc merges VisiCalc files and extends the utility of VisiCalc. It runs on Apple II Plus and the IBM PC. It can have up to 15 files, is menu driven, has individual rows and columns, and is not memory dependent. \$125 for the Apple II Plus MergeCalc. Cypher, 121 Second St., San Francisco, CA 94105. (415) 979-3297.

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Swift is an interface between WordPro and database packages such as Insumail, mailing list packages such as Sipper, and other word processors such as Papermate. Swift translates sequential files into WordPro-readable text files. It is designed to run on the Commodore 8032 CRM computer with 8050 disk drives. Int. Inc., 4013 Chestnut St., Philadelphia, PA 19104. (215) 386-7994.

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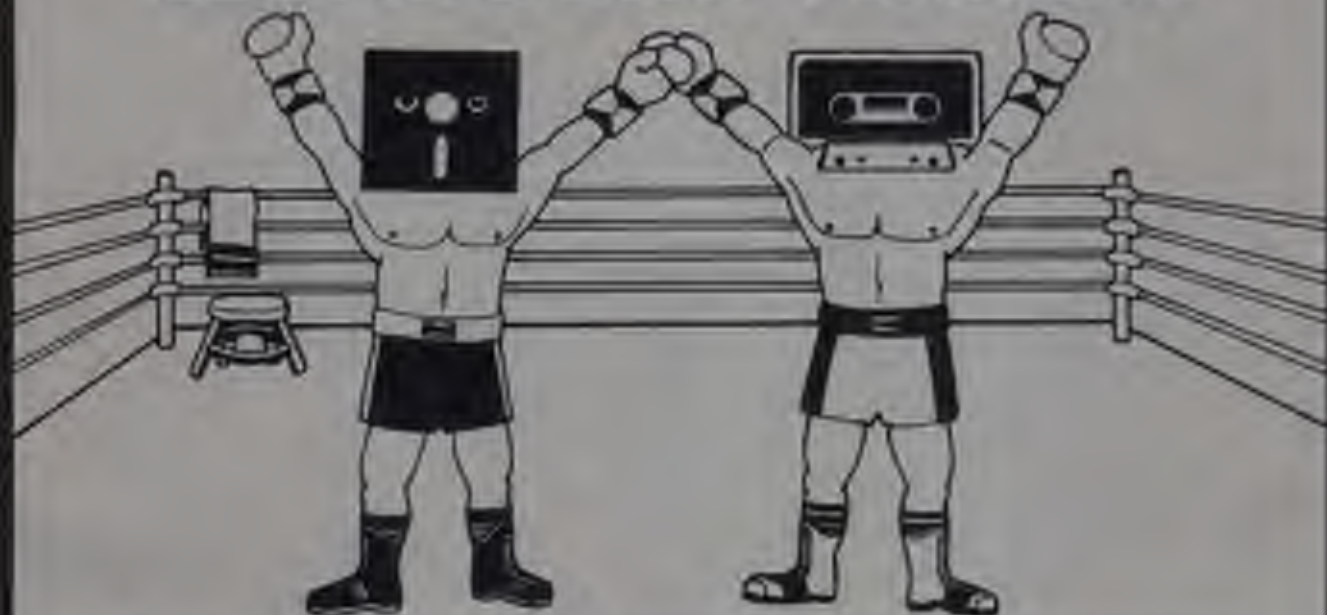
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The Graph Paper

David Lubar

Last month, we covered some methods of screen manipulation and took a preliminary look at character graphics. This time, we'll go deeper into character graphics and cover some other types of screen manipulation, such as scrolling. If you haven't already made a copy of the lookup table listed in the last issue, I'd suggest doing so now, since it will be used extensively from here on.

The question of the month comes from Aiv N. Wyatt, Jr., who asks "How can you print on the high resolution screen?" Several methods are discussed below.

The Art of Text

The single example of character graphics listed last month covered the basic concept of placing a series of bytes on the screen to form an image. The strength of this method is that each image uses little memory and each shape can easily be placed on the screen.

The disadvantage is that minimum horizontal motion is limited to steps of one byte, causing the image to jump seven pixels whenever it moves. While this may seem like a large jump, it works well in some programs. There

are actually many programs on the market that move objects two bytes at a time.

If the object is large enough, the result is still smooth animation. Next month, we'll go into smooth, single bit movements. For now, we'll look at various applications of character techniques.

There are two main uses for character graphics. One, as mentioned, and as demonstrated last month, is animation. The other, more crucial application is for placing text on the graphics screen. In the old days, games usually put all text on the bottom four lines, making use of the Apple text window. Nowadays, messages appear all over the place, in various fonts.

Text messages can be broken into two types: dedicated blocks and character sets. A dedicated block is a message that doesn't change, such as the phrase HIGH SCORE. A phrase such as this can be saved as a group of

bytes, and then can be placed on the screen whenever it is needed. There is no reason to develop a whole character set for such a message. To do so would be analogous to primitive printing methods where whole words were carved from wood.

Listing 1 shows a general program for placing a message on the screen. To use the routine, just pass the desired coordinates and the routine will place the block of bytes on the screen. See Figure 1 for an example of how the byte pattern for the message was composed. Note that the routine doesn't check for screen boundaries. Since this is an important consideration, I'll take a short sidetrip into the topic now.

Checking For Screen Boundaries

When an object goes past the edge of the screen, it should either disappear or wrap around. Unlike Apple's old shape tables, here the programmer has control of what happens. But if you aren't careful, you can blow your whole program away and hang the system in various nasty manners. The lookup table we use contains a hi byte and lo byte for each line of the screen. But if your program tried to use the table for a location greater than 4095,

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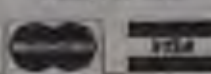
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Graph Paper, continued...

(the last line of the screen), it would produce an address that might be anywhere in memory. It would grab a bit byte from the beginning of the 16 byte table, and a bit byte from somewhere near the end of the 16 byte table.

If the resulting address were to be used as a pointer, you might end up placing bytes in undesirable areas.

Objects that go past the screen horizontally are not as disastrous, but can be unattractive since they don't wrap smoothly but appear on the next memory location which, as you know, is not the next screen location.

There are two ways to handle these problems. The first is to pad out the lookup table. Since each table is only 192 bytes long, and the 6502 registers can index 256 bytes, the rest of the table can be padded with harmless addresses.

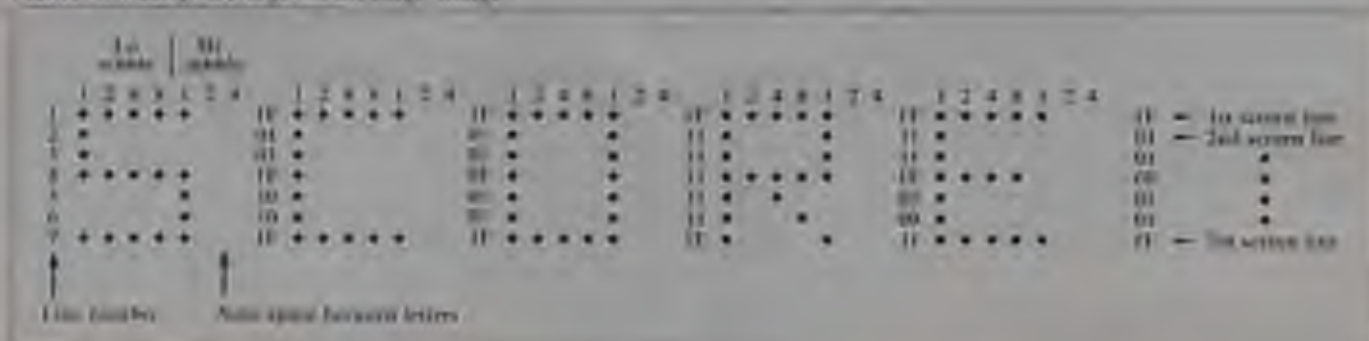
As mentioned last month, there are certain unusual portions of the screen, and objects that go past the bottom line can safely be placed in them. If the hi byte table is padded with values of \$FF and the lo byte table padded with \$20, shapes that go past the bottom of the screen will be placed in the undisplayed portion of memory starting at \$20FA. This works fine as long as the shape occupies no more than eight bytes per line.

A better method is to check coordinates within your plotting routine. If the vertical coordinate is greater than 500, nothing is put to the screen. This cuts an object off if it leaves the screen.

To create wraparound, the vertical value is set to 500 when it passes 500. Horizontal coordinates are treated in a similar manner. You can clip an image by stopping the display when the horizontal location exceeds 527, or create wraparound by allowing the values to cycle. If the horizontal position goes past 527, it becomes 500. If it goes below 500, it becomes 527. In essence, the line is treated in a MOD 27 fashion. We'll explore this in greater depth in later articles.

Levinsón, J.[illegible]

Figure 1. Blue screen for a grayscale image.



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characters into a single page of memory, and need be concerned only with the 10 bytes of the address of each character. These 10 bytes can be either calculated or looked up from a table. In this example, where eight bytes are used for each character, the calculation is simple. Three ASL operations suffice to multiply a number by 8, thus providing the 10 byte location.

A partial character display routine is given in Listing 2. I have defined the first few entries of the set, but haven't done the entire alphabet. To show how this routine might be used, Listing 3 contains a program that makes use of Listing 2. The program puts up a six-digit number and increments it.

This sort of program could be used for score keeping and other such functions.

Note the use of the 8502 BCD (Binary Coded Decimal) mode. I have found this to be the easiest method for keeping scores. The BCD mode treats each byte as two decimal digits, limiting each nibble to values from 0-9. Addition and subtraction are handled just as if the nibbles were decimal digits. But increment and decrement instructions still operate as if the digit were normal hex, so be careful.

If you add 01 to 009 in the BCD mode, the result will be 10, but an increment will produce 0A, which is not a valid BCD value. Also, be careful of branches when the decimal mode is set. It is best to clear the mode immediately after using it.

Listing 2 can be thought of as a dedicated routine. Each shape is the same size, but there is no need to restrict characters to one byte in width, nor is there any rule that says all characters must be the same size. Each character can be preceded by two bytes telling how wide and deep it is, allowing character sets with differing sizes. Also, larger characters allow for more creative use of color, a subject we'll look at now.

Colorforms

Small character fonts really can't make much use of color. Since there are only seven plotting bits in a byte, and since each letter should be bordered by blank bits on one side to prevent the text from blurring together, there isn't much room to produce both color and an appealing font.

As mentioned in previous articles, color is produced by plotting every second bit. This can't be done effectively in a small font. But it works out nicely in larger displays, as evidenced by the colorful large fonts found in many games.

If you create a large font and place

Listing 3

```
10004 80 20
10005 85 FC
10006 8A
10007 8F 00
10008 80 FB
10009 8A
1000A 71 FB
1000B C8
1000C 3C FA
1000D 5A FC
1000E CA
1000F 15 FA
10010 80 00 CO
10011 80 02 CO
10012 80 54 CO
10013 80 57 CO
10014 80 12
10015 80 17
10016 85 14

10261 80 00
10262 85 11
10263 8F 13
10264 80 10
10265 8A 14
10266 80 12
10267 4A
10268 8A
10269 8A
1026A 8A
1026B 80 FA
1026C AD 10
1026D 80 FB
1026E 80 00
1026F 80 FB
10270 30 00
10271 8A 10
10272 8A 11
10273 80 12
10274 80 14
10275 80 16
10276 80 18
10277 80 1A
10278 80 1C
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Graph Paper, continued...

it on the screen, you may find that the letters alternate in color, since an image started on an odd byte will be a different color than the same pattern started on an even byte. There are several ways around this problem.

One fairly painless but limiting solution is to make each image an even number of bytes wide. Thus, if a message is started on an odd byte, each succeeding letter will also start on an odd byte. Figure 2 shows an image for a letter that is two bytes wide and a single color. Note how the hi bit is skipped and how the set bits are designed to maintain color.

Other methods of dealing with color involve color masks and shifting. A color mask is simply a byte pattern that turns off undesired bits. The first step would be to create a white image by setting sequential bits in the shape.

Now suppose you want only the odd bits to be set. You would make two masks, one with only even bits set (\$2A) — the other with odd bits set (\$55 ignoring the hi bit).

Now, when a byte is placed on an even byte, it is ANDed with the even mask value \$2A. This turns off all the bits occurring on even locations. When the byte is to be placed on an odd position, it is ANDed with the \$55 mask. As a result, only bits occurring on odd positions will be displayed (see Figure 3).

Fortunately, it is very easy to determine whether a coordinate is odd or even. Just take the horizontal value and perform the LSB operation. If the carry is set, the number is odd.

Rotation can be used to change or control the color of an image. Let's say you have a character set defined with internal color by skipping every other bit. As mentioned, it will have one color when a character is started on odd bytes, and another color when started on even bytes.

But suppose you want to maintain color. The solution is to rotate each byte before putting it on the screen. Assume the color you desire is the one produced when the byte starts at an odd location. To produce the same color on even locations, each byte is rotated before being placed on the screen.

The problem with this method is that bits that rotate out of one byte must be placed in the next byte. If all eight bits of a byte were used for plotting, this would be a simple operation, since the carry would pass on such bits, but the hi bit of the Apple gets in the way, complicating the process. In general, the masking method is quicker and simpler.

One other alternative, when space is

Listing 4

```

1      ORG $1000
2      * PROGRAM TO SCROLL THE
3      * SCREEN VERTICALLY.
4      * USES A LOOKUP TABLE.
5      *
6      SCROLL EQU $FB
7      SCHE EQU $FA
8      DESTLO EQU $F9
9      DESTHI EQU $F8
10     LINE EQU $FE
11     TABHI EQU $1100
12     TABLO EQU $1100
13     *
14     STA $C000
15     STA $C001
16     STA $C002
17     STA $C003
18     SCROLL EQU $FB
19     LOOP1 EQU $FB
20     STA $C000
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1000   STA $C000

```

— END ASSEMBLY —

TOTAL BAYBROS 0

66 BYTES GENERATED THIS ASSEMBLY

Figure 2.
2 byte wide
colored letter.
Note use of
alternating
even/odd bits.

1st byte				2nd byte			
(7)	(6)	(5)	(4)	(7)	(6)	(5)	(4)
50							
14							
05							
55							
35							
05							
05							

na problem, would be to have two separate fonts — one with the odd bits set, the other with even bits set. In general, this approach isn't worth the space.

I am indebted to Ernie Brock, author of *Pascal Graphics Editor*, for providing me with a wealth of information on character graphics and color control.

Ups and Downs

Scrolling is just a specialized form of byte manipulation. To make the screen scroll down, the bytes in the next to last line are moved to the last line, the bytes from the third from last line are moved to the next to last line, and so on. If required, new data is brought in to fill the vacated top line.

A downward scroll must start at the bottom and work up. If the procedure started at the top, the result would be duplication of the top line all the way down. First, the top line would be moved to the second line, then the second line (which contains the same values as the top line) would be moved to the third line, and so on.

To demonstrate the process, Listing 4 contains a short program that scrolls the whole screen downward. After each move, the top line is replaced with 99's. In the end result is a blank screen. To scroll horizontally, the same basic technique is used, but rather than move each line up or down, each byte within a line is moved over.

Because of the odd/even color problem on the Apple, a scroll of one byte will produce an image that

Listing 5

```

10000 80 50 10 0
10001 80 52 10 0
10002 80 54 10 10
10003 80 57 10 11
10004 82 00 10 12
10005 80 10 11 13
10111 87 F8 14
10112 80 60 11 15
10113 85 F9 16
10114 80 27 17
10115 81 F8 18
10116 40 19
10117 88 20
10118 81 F8 21
10201 08 22
10211 91 F8 23
10221 88 24
10231 00 F7 25
10241 88 26
10251 91 F8 27
10261 88 28
10271 80 29
10281 00 80 30
10291 40 30 31
10311 10 30 32
10331 20 10 33
10341 60 34

```

```

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
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25
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31
32
33
34

```

```

10000 80 50 10 0
10001 80 52 10 0
10002 80 54 10 10
10003 80 57 10 11
10004 82 00 10 12
10005 80 10 11 13
10111 87 F8 14
10112 80 60 11 15
10113 85 F9 16
10114 80 27 17
10115 81 F8 18
10116 40 19
10117 88 20
10118 81 F8 21
10201 08 22
10211 91 F8 23
10221 88 24
10231 00 F7 25
10241 88 26
10251 91 F8 27
10261 88 28
10271 80 29
10281 00 80 30
10291 40 30 31
10311 10 30 32
10331 20 10 33
10341 60 34

```

```

10000 80 50 10 0
10001 80 52 10 0
10002 80 54 10 10
10003 80 57 10 11
10004 82 00 10 12
10005 80 10 11 13
10111 87 F8 14
10112 80 60 11 15
10113 85 F9 16
10114 80 27 17
10115 81 F8 18
10116 40 19
10117 88 20
10118 81 F8 21
10201 08 22
10211 91 F8 23
10221 88 24
10231 00 F7 25
10241 88 26
10251 91 F8 27
10261 88 28
10271 80 29
10281 00 80 30
10291 40 30 31
10311 10 30 32
10331 20 10 33
10341 60 34

```

— END ASSEMBLY —

TOTAL SPACES: 0

35 BYTES GENERATED THIS ASSEMBLY

alternates between colors with each move.

Listing 5 shows a program that scrolls the screen horizontally. In this case, the byte that moves off the edge is

replaced on the other side. Note that execution time could be improved by using separate source and destination pointers rather than manipulating the register so much.

In many cases, you won't want to scroll the whole screen. Many games have a small area scrolling across the bottom. In such cases, where the scene being scrolled is larger than the screen, an image of the area is kept elsewhere in memory. For each screen line, there is a data line containing the full landscape image for that screen line. In this way, a varying landscape can be scrolled across the screen. A variable is kept pointing to the portion of the data which is currently the start of a screen line. To scroll the image, the pointer is changed, and the bytes for each line are taken from the data and put to the screen.

You may have noticed that the full-screen scroll is not very fast. When speed is required, there is another method available, using dedicated code. Rather than use indirect indexing, this method contains a sequence that specifies each memory location in the scrolling sequence. The advantage of such a method is high speed. The problem is that the code is



Graph Paper, continued...

rather long. For a full screen, the code would contain 192 loops and 192 stores. A segment of such a routine is shown in Listing 6. In general, this type of dedicated code should be used whenever speed is essential.

Code of Many Colors

We have already seen how the six basic colors are obtained on the Apple. Alternating dots produce color, sequential dots produce white, and an absence of dots results in black. But many other colors can be produced on the Apple by combining colors.

For instance, suppose you turn on every fourth pixel of a line. If you repeat the process on the next line, the result would be alternating colored and black vertical stripes. This, however, is not an interesting blend.

But suppose the lines were staggered. The first line starts on bit 0 and sets every fourth pixel. The next line starts with bit 2 and again sets every fourth pixel. The third line begins at 0, the fourth line at 2 and so on. Now, the colors blend to produce a darker shade of the original color.

This is the general method for obtaining those "extra" colors. Such patterns can be stored as a series of bytes, then be moved to the screen, or

Listing 6.

```

GRAPH
      1  * SIMPLE PORTION OF
      2  * A DEDICATED SCROLLING
      3  * ROUTINE
      4
      5  POOR: 00 27 05  START  LRV  #227  * 40 BYTES PER LINE
      6  POOR: 00 00 24 05  LOOP   LSR  #240H, Y  * 2ND LINE
      7  POOR: 00 00 20 07  *      STX  #200H, X  * 1ST LINE
      8  POOR: 00 00 28 08  *      LSR  #280H, Y  * 3RD LINE
      9  POOR: 00 00 24 09  *      STX  #240H, X  * 2ND LINE
      10
      11  *
      12  * THIS CONTAINS FIVE 192 LINES
      13  * AND BYTES.
      14  *
      15  POOR: 00 15 05  *      STX  #05
      16  POOR: 00 02 14  *      STX  #14  DONE
      17  POOR: 00 02 17  *      STX  #17  LOOP
      18  POOR: 00 18 05  *      STX  #18  DONE
  
```

--- END ASSEMBLY ---

TOTAL BYTES: 0

71 BYTES GENERATED THIS ROUTINE

be ANDed with the screen, to produce colorful effects.

For instance, the pattern described above would be \$11, \$22, \$44, \$08, repeated to fill the first line. Then, for the second line, the sequence would be \$44, \$08, \$11, \$22, etc. If you want to fill an area, you just store the bytes to

the screen. If you want to color an object, you AND it with the color bytes.

That's about all that will fit this month. Next time, we'll get into full animation with pre-shifted shapes. We'll cover the various methods being used in arcade games. □



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e cart...apple cart...apple

Earlier this year, we received many letters because a game program we published contained a bug. The problem involved an incorrect method of reading the Apple II keyboard. Most of the letters contained incorrect fixes for the bug. Maybe we should take a look at the problem.

We want to write a program that does not hang around waiting for keyboard input but that uses keyboard input whenever it becomes available. The Apple can tell us whether or not a key has been pressed recently if we cooperate.

One memory location is set aside to hold the last key pressed. Another is reserved for the program to tell the hardware that the last key has been read. The first location is also used by the hardware to tell the programmer that there is a new key to read.

Our strategy is to read that first location frequently to see if a new key has been pressed. When a new key is ready, we must do two things: save the key value in another location and tell the hardware that we have read the key.

In Basic, we use the PEEK function to learn whether a key is available. If the value of PEEK(-16384) is greater than 127, a key has been pressed. We will use the variable KD, short for key data, to denote this address.

When a key is ready, the function PEEK(-16384) yields the ASCII code for the key. The CHR\$ function turns an ASCII code into a single-character string. We will assign the character string to the variable KS.

Once we have determined KS, we must clear the keyboard so that more keystrokes can be recorded. We POKE a value into location -16368 — any

Michael Coffey

value. We use KC to stand for the address used for keyboard clearance.

Listing 1 is a program that reads the keyboard and maintains a special cursor on the screen. The program will keep the cursor character in KS, call subroutine 2000 whenever a key is pressed, and call subroutine 3000 on each loop when no key is pressed.



Numeric Keypad.

Subroutine 2000 simply displays the new value of KS. Subroutine 3000 displays an underline cursor and backs up one space. If you remove the backspace function (CHR\$(8)), you will get an idea of how many times the loop runs between keystrokes.

The program works for all literal keys, but some control keys can make the screen look strange. The main loop is a good starting point for any keyboard processing program. The subroutines should be adapted for your specific purposes.

Incidentally, the technique of repeatedly checking a keyboard or other

input device is called polling. You now know how to do polled keyboard input. Congratulations.

Repeater

Speaking of keys, we recently received a small board that converts an Apple keyboard into one with automatic repeat on all the keys except Reset. The Repeater, though hard to spell, is easy to use.

When you hold down a key, it will repeat itself to the Apple. You can adjust the length of time the key waits before repeating. If you make the period very short, you will end up with keybounce; if you make it very long, guest typists will never notice your modification. We like to make it just long enough to avoid accidental repeats.

Besides the automatic feature, you get a fast repeat feature. Just press the repeat key and the key will repeat itself much faster than usual. Your software will usually be able to keep up with the keyboard in fast repeat mode.

The board must be sandwiched between the keyboard and the keyboard encoder board. Consequently the bottom of the computer must be unscrewed and removed. Apples with old style keyboards can not use this modification.

The Repeater comes with very explicit instructions and is a good buy at \$24.95.

Numeric Keypad

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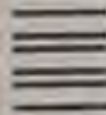
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Repeater.

The keypad is easy to install if you don't mind pulling the computer apart. First, you must remove the bottom plate of the Apple, carefully unplugging the standard keyboard. Next, plug the new keypad into the motherboard and plug the standard keyboard connector into a new circuit board that comes with the numeric keypad. Replace the bottom plate and you are ready to compute again.

The 5' cable should be threaded through one of the slots in the back of the Apple. A nubby fitting on the cable prevents it from being yanked out of the computer by accident. The unit measures 8.25" x 4" x 1.5" and weighs only a few ounces.

The Numeric Keypad provides a slightly more distinct feedback than the standard keyboard, has bumps on two of the keys to aid in positioning your fingers, and is otherwise similar to the Apple keyboard.

The 24 keys are arranged in three groups. The central group includes the digits 0-9, the decimal point, and a 00 key. To the left of the digits is a group of VisiCalc editing keys including ESC, both arrows, and a space bar equivalent.

To the right of the digits The Keyboard Company has mounted a minus key, both parentheses, and the numeric operations -, /, +, and *. The last key on the lower right is labeled PRINT and produces a question mark when pressed. See Figure 1 for a more precise layout of the keys.

As far as we can tell, the keypad interferes in no way with the operation of any Apple II software. The advantages are obvious and well worth the price to anyone who spends more than a few hours a week typing numbers.

Magic Keyboard

One of the wildest keyboard modifications we have seen comes from Southern California Research Group. Magic Keyboard enables you to rearrange the keys on your keyboard. If you want to study keyboard layout technology and psychology, this one is for you.

This 2.5" x 3" board must be placed in the keyboard socket on the Apple motherboard. The cable from the keyboard can then be plugged into the Magic board. This means that you have to remove the bottom plate from your Apple again.

Before putting things back together, you must make a few choices. You can choose an alternate alphabetic layout and a numeric layout. The instructions detail the available options: Dvorak standard, left hand only, right hand only, and other layouts are all built in.

After installing, you will be able to shift between regular QWERTY layout

Listing 1

```
1000 GZ = -16340
1010 GZ = -16354
1020 GZ = 11
```

```
1000 IF PEEK(40) = 127 THEN GZ = -
      CHR$(PEEK(40)) + CHR$(40)
1010 GOTO 2000
1020 GOTO 1000
1030 GOTO 1000
1040 GOTO 1000
1050 GOTO 1000
```

```
2000 PRINT GZ: RETURN
3000 PRINT CHR$(223) + CHR$(0):
      RETURN
```

and the proscribed alternate layout with the flick of a switch. The press of a button will shift you between the alphabetic and numeric layouts. The switch and the button are both mounted on a little pad that can be stuck in the Apple or any other convenient surface.

We tried the Dvorak layout and found that we did not have enough time to learn it. As workers that are faced with many different keyboards, we can't see any payoff for us in learning a new one at the moment. I encourage layout experimentation and hope for the day when all keyboards are programmable.

Firms Mentioned in this Column

High Order Micro Electronics
17 River St.
Chagrin Falls, OH 44022
(216) 247-3111

The Keyboard Company
7151 Patterson Dr.
Garden Grove, CA 92641
(714) 891-5831

Southern California Research Group
P.O. Box 2231
Goleta, CA 93118
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outpost: atari



The Upstart Atari

June 4, 1981. *The New York Times* ran a relatively enlightened feature on the microcomputer and its future in the home. One of the "experts" cited in the feature stated the following: "there is almost no sense at all in buying a computer other than a PET, Radio Shack, or Apple." A bit further down the page, in a separate but allied article, the quote appeared again, this second time without the word "almost." The article referred to these companies as "the big three."

At the time, I was glad to see that the *Times* had discovered microcomputers, but was chagrined by what I saw as expert narrow-mindedness. Still, it came as no surprise to me. I had acquired quite a stiff upper lip by that time. You see, I am an Atari owner.

I remember when I first began shopping seriously for a micro, right about the time the first Atari was shipped. I had a great deal of trouble getting anyone to talk about the machine. Sales staff seemed so resentful in one computer store, I wondered aloud why they even carried the thing. A salesperson exclaimed to me, through a sneer, that he did not expect it would be carried for long.

Even as recently as a year and a half ago, finding an article concerning the Atari in a computer magazine was a triumph. The machines remained a mystery, even to those who owned them. Documentation and software were scarce. I was told by more than one learned microguru that I had made an expensive error. They predicted nothing but early death.

This was not to be. Despite the bad press and initial lack of documentation and software, the Atari was gradually discovered to be a superior machine: a

John Anderson

"next-generation" micro, with ROM cartridge capability, a replaceable operating system, sophisticated color graphics capability, and four-channel sound.

Despite initial snobbery and snubbery, buyers began to opt for a good machine at a good price. By Christmas 1981, the Atari was being sold faster than it could be manufactured.

How did the competition respond to the introduction of the Atari? With the introduction of Atari lookalikes. Studying these, I realized Atari must have done something right, to have nearly everybody else shouting "me too!" within a year or so.

The Atari has been called a game machine, and games have certainly sold their share of units. Ted Nelson took a look at *Star Raiders* on a video projection system and proclaimed that the Atari Personal Computer was the "most extraordinary (microcomputer) graphics box ever made." Yet in addition, the Atari could do anything the "big three" could do, and then some. Many prospective purchasers found in the Atari a double bonus: a chance to have a "serious" microcomputer, while owning the greatest game machine around.

And, it was friendly. It is easier to do things right on the Atari, and more importantly, harder to do things wrong. The jargon terms machines like this "user-friendly." Never before had a computer been introduced that was so easy to use. Until the Atari came along, you couldn't expect to take a micro out of its box, plug it in, and have it work.

In the operating system of the machine is a powerful, built-in screen editor, which makes the mechanics of programming much less formidable on

the Atari than on other machines. I know for a fact that this, combined with the syntax-checking function of Atari Basic, allowed me to learn Basic programming at a much faster pace than would have been possible with any other microcomputer. These features simply allow the user to recover more gracefully from his own errors, thus vastly increasing the utility of the machine as a learning tool.

Then there is the cost. I literally "paid the price" to be the first on the block with an Atari 800. Now, because of the popularity of the machine, prices have dropped dramatically. A bit of careful shopping can result in a basic unit for under \$700. For this price, you receive an 800 with 16K of RAM and Atari Basic. The model 400 is down to about \$250.

The computers have a built-in RF modulator, and so can be hooked directly to a home TV. A basic unit isn't worth much without cassette or disk storage devices, which constitute an additional expense, however the Atari disk drive has also been heavily discounted, and can be found for under \$450. A 48K disk-based system can be put together for under \$1400, and that is a good bargain at today's (and tomorrow's) prices.

As for the capabilities of such a system, let me first insert here a warning to those who may be unfamiliar with the molling and sweaty world of microcomputing. I feel strongly, as do other Atari owners, that a major part of what a microcomputer must handle superlatively is color graphics and sound. I take this to be a self-evident, foregone and unimpeachable tenet, and will make no effort to argue for or defend myself upon that point. If you do not concur, read on only at your own risk.

The 6502 microprocessor chip is the central processing unit of all current Atari machines, as it is for two of the "big three" machines. However in the

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[illegible]

Figure 1.

Adam, the 6'9½" clip is tucked up by three others, and thereon lies a big difference.

One of these chips, called Antic, is itself a microprocessor. It is capable of an exotic potential known as "direct memory access," or DMA. Antic works in tandem with another chip, the GTIA or CTIA, to handle the video display, thus taking the weight of keeping the video screen "lit up" from the i802.



This really is a friendly system. L.B.F.

The CPU can go on to other important jobs.

I could attempt to outline each of the capabilities of these chips: 256 colors, up to 16 shades of a single color, 320 x 192 pixel resolution, player-missile graphics, modifiable display lists and character sets. However there really are only two ways to experience their power: watch an Atari graphics demo, or play a quality Atari game. The new GTIA chip, which replaces the CTIA, extends this power yet further.

Still another chip, called Pokey, generates, among other things, four channel sound. This sound can range from pure tone to many levels of distortion, allowing for music as well as sophisticated and complex sound effects generation. Sound is routed through the TV speaker, and so volume control is as simple as the flick of a knob. Sound can be routed just as simply in your stereo. Nearly all music composition and game playing in my home takes place through headphones.

The Atari is not without its problems. Much of the software written for it doesn't come close to truly utilizing its capabilities. It seems as if many programmers are having trouble realizing what power the Atari puts in their hands.

and how best to use it. Dual density drives, 80-column capability, and truly professional word processing packages are only just now making an appearance.

But relief is in sight. It was a trickle at first, but third party software began to pour in. The trickle became a gush, and the gush became a torrent. Third party hardware followed soon after. The industry, realizing its initial underestimation of the machine, is coalescing.

A variety of talented minds are working with the Atari, investing it with a variety of new capabilities. The machine offers one of the most exciting frontiers in the microcomputer industry today.

Incidentally, the big three will shortly have to move over. I predict by the end of this year Atari will be the number one microcomputer in its class, both in monthly sales and total units.

Multicolor Characters

Figure 1 is a short program with a very neat result: a multicolor character set in graphics 0. The idea goes back quite a ways: I remember first having seen it in *3-D Supergraphics*, from Paul Lotus. A recent example appears in the assembly language tutorial *Page 511*, from Synapse Software, which uses quite a well done font.

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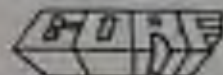
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Outpost: Atari, continued...

The technique involved in creating multirow characters is called *artifaking*. This is the same phenomenon that sometimes causes ugly glitches in graphics displays. By skipping adjacent pixels, red or blue characters can be formed, and artifaking can be used constructively.

The approach has its limitations. Because the default character size on the Atari is 8 x 8, skipping adjacent pixels results in a character three pixels wide. It is hard to create a font three pixels wide and at the same time keep M's and M's from looking alike, or support lower case.

In order to compensate, I made the first time scan line taller than the default value, and stuck to upper case. Still, I think you will agree the results are remarkable considering the constraints of the approach, and well worth taking the time to type.

Lines 10000 through 10020 define the point in memory at which we will start our redesigned character set. Lines 10030 and 10040 clear the screen, entering it black, so that the articulated character set will be clear. I suggest the altered set always be used on a black background.

Lines 10050 and 10060 set up the variables we will use to load the original character set into RAM, and later for overwriting the redefined characters. Line 10070 sets the character set pointer to the beginning of the RAM set. Line 10080 is placed there so you can watch the transformation take place; you can roll this line if you so desire.

Lines 10090 through 10110 load the entire original ROM character set into RAM. Then line 10120 replaces the upper case A through Z with values occurring up ahead in data statements. Likewise line 10130 replaces lower case a through z with newly defined character values.

The new upper case and lower case fonts are the same, with the exception of a one clock horizontal shift. This means that the upper case A through Z will be one color, and the lower a through z another. Because of differences in the way attracting is handled by the GTIA as opposed to the CTIA, a GTIA machine will have, as a result of running this program, a blue upper case and red lower case, while a CTIA machine will have a red upper case and blue lower case. Not to mention what happens when printing inverse characters. Try it! All other characters, as well as numbers, will remain as default.

You might now incorporate this as a subroutine in other Basic programs (remember to stick a RETURN in there).

```
18 = "PLASMIC TESTING CONTROL" CCL (D) THREE
20 FOR T=1
20 FOR M=1 TO 10000000
40 RND=705.0
50 FOR N=1 TO 10000000
60 RND=20
```

Figure 2

somewhere, and keep the program from hitting line 99000 other than through that initial GOSUB).

Slacken Leemon, on whose program, *Intuit*, I designed the font, reminded me that the display list could be modified to display the fonts in any color. I may take up this challenge in a subsequent Output. For now, I will leave it to you. List the program in the modified set; you will see that it can even function as a programming tool.

Peking Around

As a result of my comments about memory locations in the November column, I got a slightly indignant letter from Becky Johnson, at Educational Software (formerly Santa Cruz Educational Software). She reminded me that their publication *Master Memory Map* had sold more than 10,000 copies at \$6.95. Well I admit I hadn't seen the publication at the time, and though it is still not a truly definitive list, it has got to be the closest yet. If you wish more information, you can contact them at 4564 Cherryvale Ave., Soquel, CA 95073. (408) 476-4901.

In the meantime, here are some more interesting locations to keep you busy:

Disabling the break key. POKE 16361 and POKE 53774,64 to disable the break key. Very handy to keep users from interrupting or getting into a program.

Disabling DMA. PEEK(559), then POKE 559,0. This will shut down Antic, allowing the 6502 to speed execution dramatically. POKE 559 with value initially PEEKed to re-enable screen display. Also handy as a "curtain" in ever-

treating the screen during display initialization or other potentially distracting moments. This is an appeal, for example, to reenter graphics mode and setting color registers to black.

Forcing a text interface into graphics II: POKE 710,4 This will force all normal text into a text window in the graphics mode. Printing to the upper part of the screen must be accomplished with PRINT #6 statements. Could be handy in writing text adventures (maybe even with the multiviewer font). To return to default, UNPOKE 701,4.

Flashing characters. Set up a loop wherein the value of location 735 varies from the normal, 2, to 1. Figure 2 is an approach to flashing characters.

It is a nice aluminum getter in program. We will also look at more sophisticated means of obtaining floating characters in an upcoming column.

Checking for Expressos. POKE 764,255, then INPUT(764) for internal keycode. Handy to check for any or a specific keypress. Can also be used as "press a key" through software, for example, POKE 764,12 will RETURN automatically.

To enable cassette recorder: POKI:54018.52 to turn cassette play on, POKI:54018.59 to turn it off. (Recorder must, of course, be set with cassette in place and play key pressed). Use in sync recorded sound with program.

Next month we'll look at some new hardware for the Atari from third-party sources, new game software, and present a little card generator program. Until then, keep your computing creative!



Happy, the spokesman said it would be two weeks after we come home. You can't just sit here!



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It's very hard to believe that I have been here for a year, but it's very true. I expect to be here for the next year too, provided I am not forced to go on strike for better working conditions or more money. I am sure such an action can be averted; my attorneys are working around the clock with Creative's management team to thrash out an agreement. I hear PC is looking for writers...

Last month, I ran out of space. This month, I am finishing up with personal finance packages and a few other odds and ends of general interest. First, however, I have to tell you about something very, very exciting.

I consider myself very lucky, and very privileged, to have been given a demonstration copy of a new piece of software for the IBM Personal Computer. The program is from Microsoft. It is Bruce Artwick's *Flight Simulator*.

Mr. Artwick is the brain trust behind the SubLogic flight simulator, a program which is available for Apple II and TRS-80 computers. The IBM version is not merely a cut above those; it is an order of magnitude beyond them. It is fantastic. It is a sight to see, and a trip to fly. You absolutely must see it, and by the time you read this, your local dealer should have a copy along with an in-store demonstrator. To run this program, you need a 64K, single disk system with the color/graphics adapter. You also need \$50 to buy it. If you have ever wanted to fly, you'll never regret the price.

Next month, *Creative* will carry my in-depth review of the simulator. I had hoped to have it ready for this issue, but I have been using a prototype and it lacks many of the features that will be in the final version. Of course, you may infer from my tone how I feel about the program, so you might not need the review, eh?

Will Fastie

Oh, by the way, for those of you who do not know what I'm talking about, the flight simulator is a program that puts you in the cockpit of a light plane, with a full instrument panel and an out-of-the-window display of the world. You are the pilot, and you fly the plane. Believe me, you really do.

Personal Finance Programs

January is the month many of us begin to think about taxes and our budgets for the forthcoming year, especially if the IRS has mailed out tax return booklets with their usual promptness. I can always be found under a mountain of paper, sorting stubs, calculating interest, and wondering how I could have let my records get into such a state of disarray.

Last year was particularly bad because I procrastinated while I fiddled around with the notion of writing a complex record-keeping system for my personal use, one tuned to my special needs. I gave up, not because I couldn't do it but because I was sure some responsible programs would pop up that I could buy.

That was not to be. It has been only in the last three months or so that personal financial programs have found their way to the IBM PC market, perhaps because of a perception that the consumer acceptance of the PC did not represent a significant enough market opportunity. Apparently, that perception is changing because five companies have provided home finance programs for review,

and there are several others in the works.

With the five programs in front of me, I had only to decide how best to evaluate them. Just what criteria are important, and on what basis should a consumer make a choice between these products? For me, there are just two criteria, and everything else is a minor detail.

The first consideration is functionality. Now I don't mean features: a program does not have to include every possible bell and whistle to be considered functionally complete. Functionality means that the software performs as specified, and that that specification meets a fundamental requirement, as determined by you, the buyer.

Is the package going to solve your problem, and will it do so to the extent that it performs useful work for you? And if the program passes that test, do the other features provided, the ones that are beyond your basic requirements, enhance the product, or are they just eye-catching, without real value and thus unlikely to be used?

These five packages cost from \$100 to \$200. More important, you will spend a great deal of time with the one you choose if you use it as intended. You owe it to yourself to examine the alternatives carefully, and make a reasoned choice. Make sure the function makes the investment worthwhile.

The second point is human engineering. You will hear a lot about that from me, and I consider it one of the major issues in computing today. You have a right to expect a program with which you must become intimate to be well engineered.

You should not tolerate a program that does unexpected things, fails, does not explain itself, provides more

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than one way to accomplish the same thing, or always expects you to know exactly what to do next.

You should expect the program to deal with any error encountered, provide you with information if you need it, provide you with assistance if you need it, and let you back out of any situation gracefully, all the while telling you what it is doing.

You should always be able to tell at a glance if the program is waiting for you or working. You should always have the feeling that the situation is under control and that the program is protecting your interests (and data).

Can you easily tell that a program is well engineered? Yes, usually you can, just by spending a little time at the computer trying it out. And I don't mean running a demo version either, I mean trying the real thing. You will feel it and see it. You will know that you and the program can work together and that the program will not be at odds with you. Sound like dealing with another person? Well, not quite, but it is an interaction. Expect a program to be well behaved, just like the kind of person with whom you enjoy dealing.

Why am I spending so much time harping on this subject? (See, I really do know what you are thinking.) Because it is important for programs in general, because it is especially important for a program with which extended interaction is required, and because I am generally disappointed with the human engineering of these five finance programs.

The five programs I tested are listed in the various tables accompanying this column. I think the tables provide most of the information from which you can develop your own opinion. Because all the programs provide an acceptable degree of functionality, an examination of the human factors provides considerably more insight. That's what I want to concentrate on.

Of the five programs, one is a clear leader, three fall in the middle, and one is a clear loser. I'll not keep you in suspense: *Money Maestro* is by far the easiest to use, the most forgiving, and the most carefully engineered. *Home Finance Program* is the loser. *Financier*, *PC/FPP*, and *Home Accountant Plus* are acceptable.

As a first clue as to why *Money Maestro* is on the top of my heap, consider that it is the only one of the five that can be invoked by typing its name, even though the use of a .BAT file under IBM DOS makes such an invocation easy to provide for any program.

Let's look at these programs in reverse order.

Home Finance Program

What I have to say about this program is very limited, because I spent the least amount of time with it. The reason was simple. This program failed in two ways in less than 20 minutes of use, and I consider that so unacceptable that I stopped wasting my time.

The first problem popped up when I tried to enter a comma in the middle of a text string. The text being entered was the description of a check, and the entry was "J. W. Rouse & Co., Inc." Now that seems quite reasonable to me, but the program responded with "Too many data items. Proceed from start," the Basic message emitted when too many entries have been made to an INPUT statement. I could not find a warning about using commas in text input in the manual, in either the section pertaining to the function I was testing or other sections.

The second problem was a crash: in other words, the program stopped running. When this happened, the program returned to Basic, and a standard Basic error message was emitted. These messages give the line number of the error, but unfortunately, this program is protected, so the average user cannot look to see just

what is wrong. After this crash, I reloaded the program.

An aside: Basic files can be unprotected. For \$10, Data Base Derivatives, 14 Bonnie Lane, Atlanta, GA 30328, will tell you how. It's simple. These folks were just quick to figure it out and I figure they deserve ten bucks a shot for the answer.

A couple of specific complaints. The manual was generally good. It contains clear instructions and is well formatted. However, it nowhere explained what the package included, and did not indicate what the second disk, labelled Data Disk was for. The bigger complaint is that the program does not take advantage of two diskette drives if the system has them. Instead, it requires that the user constantly switch between the program and data disk in drive A—something I consider very irritating.

Three in The Middle

Now we come to the three programs which are acceptable. In each case, they provide a set of functions which is reasonable for home financial management, and which operate tolerably well. General information about each package is in Table 1 and the functions performed by each can be found in Table 2.

PC/FPP by Best Programs is the least expensive of the lot at \$95. It is well-documented, with a nicely type-



set manual in traditional (by now) IBM style. It is printed with two colors, so explanations and examples are clearly differentiated. The program runs smoothly, and always presents what, easy to understand prompts.

Functionally, *PC/PFP* is complete. Practically, it is somewhat limited by the number of budget categories provided. It allows 45 categories, 5 of which are for income and the rest of which are for expenses and credit cards. For my personal finances, this is not enough. I had to lump things together in generic categories, making later analysis more difficult.

There is also a limitation of ten tax deduction categories — also a problem for me. Remember that for tax purposes I have a business operation, so I need a little more flexibility. The average consumer might do fine within these limits.

This package suffers mostly from a lack of consistency. This can be found quickly. Some replies to menu prompts require the entry of a number or letter followed by a RETURN (or ENTER, if you prefer), but some take action as soon as the letter is typed.

Because DOS and Basic are buffering keystrokes, a number followed by a RETURN when the RETURN is not required lets the RETURN pass to the next prompt. This can cause the program to go somewhere you weren't expecting. There are other examples of inconsistency.

On the whole, the program is well done, and a good value. It has one

strong feature called "split transaction," which allows a single check to cover two or more expenses in different expense categories. This is very convenient for dealing with credit cards.

The Home Accountant Plus from Continental Software is next up the price line at \$150. The program supports up to 100 budget categories and 5 checkbooks (a strong feature), can account for assets and liabilities, and can print a net worth statement. Although the program limits the data storage to 1000 transactions per disk, it allows multiple disks to be used.

It is also unique in that it can present graphs on either a text device (like the monochrome display) or a graphics device, and for the latter produces very nice looking graphs in full color.

The program seems to be the most fully featured of the five, and would have earned more of my attention had it not been somewhat difficult to use. At first, this seemed not to be the case. The program, for example, blinks items in a menu if they are the next required thing to do, and refuses to accept any command but that one.

The first time I ran the program it forced me to tell it about my system configuration, and how I planned to use it (e.g., which disk drives would be used for program and data disks). That looked pretty good, but the program fell down later during data entry.

Although clear instructions are provided on every screen display, the action you need to take is not always obvious. Also, sometimes the menu

is split, with part of it above the data entry portion of the screen and part of it below. The reason for that escapes me, and I found it confusing.

The document is extensive, an obvious attempt to do well, but I found it difficult to follow. I would have been helped by an index. The information is there, it is just a little tough to find sometimes.

The program can print checks, and comes with a sample and an order form from Neb Computer Forms, a nice touch.

The Financier from Financier (the first *i* in both is supposed to be an up-arrow) costs \$180. I consider it a little better than *PC/PFP* or *Home Accountant Plus* because it makes a stab at improved human interface. Unfortunately, it does not go all the way.

Again, we have a program with some strong features and good functionality. It also allows split transactions, except it is limited to nine expenses for a single check. A complete set of reports, both summary and detail, is provided.

Each category has a name and a code. In *The Financier* the code is four letters. The program can build reports based on the alphabetical nature of these codes. If all deductions for tax purposes begin with the letter D, they can be recovered by specifying a code range of D to DZZZ. But that reduces the mnemonic value of the codes by eliminating a letter.

Furthermore, it forces extremely careful advance planning to assure that codes which logically relate to

Table 1. Personal Finance Package General Information.

Product Name	Home Finance Program	PC/HFP	Home Accountant+	Financier	Mummy Maestro
Manufacturer	Design Data	Best Programs	Continental Software	Financier	InnoSys
Price	\$100	\$95	\$150	\$180	\$200
System Required	64K, 1 disk, DOS, Basic	64K, 1 disk, DOS, Basic	64K, 1 disk, DOS, Basic	64K, 1 disk, DOS, Basic	64K, 1 disk, DOS, Basic
Display Width	80	80	40/80	80	40/80
Written in	Basic	Basic	Basic	Basic	Fortran
Functionality	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Human Interface	Needs improvement	Acceptable	Sometimes confusing	Acceptable	Excellent
Documentation	Satisfactory	Very good	Complete, but hard to use	Good	Poor because not written for PC
Overall Impression	Unacceptable as tested	Satisfactory, good value	Satisfactory	Satisfactory, some excellent features	A little expensive, considering features

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IBM, continued...

each other also relate together alphabetically. That is irrational, because no such relationship exists naturally.

The strongest feature of this product is its ability to list the categories whenever it asks you to enter one. That gives you a way to refresh your memory without having to have a list of all the current categories at hand. That is very good. But it is also limited.

The listing shows only the codes, not the description. If a code is particularly cryptic, and some are bound to be, you might still not know what it means. Also, this feature works only when entering budget codes and does not work for tax codes. The listing is obtained by depressing the RETURN key instead of a code. Since tax codes are optional entries in transactions, RETURN is a legal response and does not mean "tell me the options."

This is pretty much the state *The*

Financier took. It is helpful in its current form, but it could be so much better.

The four programs mentioned so far have one thing in common. They are written in Basic. They impress me as programs written by financial experts, even people who have a notion of how they would like to see a program work. However, they do not impress me as programs written by professional programmers or computer scientists. And Basic provides one other unfortunate side-effect: the programs are not very fast, a problem for any interactive program.

Money Maestro

This program, on the other hand, does impress me as a professionally implemented system. Above all other things, this InnoSys product runs smoothly and is extraordinarily well

behaved. Of the five programs, it is the only one that can be operated successfully without reading the manual.

The power of the human interface in *Money Maestro* is that it listens carefully to what you type and deals with those inputs in a context. Furthermore, the program can provide help at any time if a question mark is typed, and the user can gracefully withdraw from any point simply by pressing the Esc key.

The help feature is super. For example, when entering a transaction, a budget category must be entered. If you are not certain which one you want, hit ? and *Maestro* tells you that it wants a category. It also tells you that it will list all the ones it knows about if you'd like. So you do, and you find one you like. At that point, you can use Esc to pop back to the original question, or you can just enter

Table 2. Personal Finance Package Features

Product Name	Home Finance Program	PC ¹ /HFP	Home Accountant ²	Financier	Money Maestro
Accepts upper and lower case?	Yes	Yes	No	Yes	Yes
Number of budget categories	14 pre-defined, 10 subcategories in each	46	100	12,767 or limit of disk	Approx. 200
Transaction storage per 160K diskette	unknown	1400 (200 per month)	1000 multiple disks allowed	1200-1500 multiple disks allowed	Approx. 1250
Credit card management?	No	Yes	Yes	Yes	Yes
Split transactions?	No	Yes	Yes	Yes	No
Forecasting?	Yes	No	Yes	No	No
Reports					
Printed?	(1)	Yes	Yes	Yes	No
Binding margin?		No	No	No	No
Check register?		Yes	Yes	Yes	No
List of codes?		Yes	Yes	Yes	Yes
Income statement?		Yes	Yes	Yes	No
Balance sheet/net worth?		No	Yes	Yes (2)	Yes (2)
Cash flows?		Bar graphs income and expense summaries	Screen graphs	No	No
Budget performance?		Yes	Yes	Yes	Yes
Tax report?		Yes	Yes	Yes	Yes

(1) Home Finance Program does not provide a report function. Hard copy of displayed data may be obtained with the PC PrintSc function.

(2) Function available if budget codes are properly set up. Program does not provide function automatically.

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About the author:

Stephen J. Rogowski is a noted computer lecturer, author of more than a half-dozen books and 50 articles on computing, as well as a licensed pilot and FAA certified ground instructor.

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the code immediately. The program knows that you mean for the code to be used in the transaction. If you were just listing all the categories, which happens to look the same, the program would ignore an entered code.

But there is more. When asked for a budget category, you don't have to give the code number. You can give the name or just the first few letters of the name. If *Maestro* can find something that matches, it automatic-

ally assumes that is what you want (although you can use Esc to back it out if you were wrong).

If there is more than one category which matches the entered name, *Maestro* tells you that your name was "ambiguous." A little stuffy, but the program immediately pacifies you with a list of all the matching categories, showing both code and description, and asks you to choose one.

On Disks and Diskettes

I have become somewhat cramped on my 160K single sided disks, and I am beginning to feel that an investment in double sided disk drives is warranted. My search for a way to convert to the bigger disks as minimal cost has turned up an interesting possibility.

Many companies sell the bigger disk drive. They are available from IBM for \$650 and, of course, IBM will maintain and support them if you buy that way. However, the price of the bare disk drive on the open market ranges from \$275 to \$325. That makes the IBM deal look awful. I have even considered the fact that for two years worth of maintenance fees I could afford to junk a failed drive and replace it with a new one.

Either way, I would still be stuck with my old drives. IBM does have a trade-in policy, but it expires January 31, 1983.

You may remember that I bought my second drive from VR Data. This company will take your 160K drive (IBM or other as long as it is a Tandem 100-1) and \$199 and send you a Tandem 100-2, the double sided version. VR Data also sells the bigger drives for \$399.

VR Data resells the smaller drives in the TRS-80 market, and there might be some deals lurking here for owners of Model I or III computers.

As for disks, I have now had the opportunity to use several different brands and I thought I would report on my experience to date. I use Radio Shack diskettes (catalog number 26-0305, \$39.95 in boxes of ten) extensively, and I have had not a single failure of any kind.

The DOS FORMAT program has never found bad sectors on a Radio Shack disk. Furthermore,

my friend Tom uses them in his double sided disk drives, even though Radio Shack only certifies the disks as single sided. He has also had no difficulty. Tom, Rich, and I have used about 120 of these disks without problem.

I have purchased a few Dyan disks (104/1S, 104/1D). I am really sorry to have to say that they have been nothing but trouble. I have had about a 50% fallout rate with them, and a few have been very difficult to format. I say I'm sorry because I have used Dyan disks (and other Dyan media) in the past with extraordinary success, to the extent that I would buy only Dyan 8" disks. I don't know what's going on here.

Verbatim disks are in use on the PC in my office and in a few other small systems, and they have been excellent. I would actually prefer to buy Verbatim over Radio Shack, but I have a harder time finding them in small quantities and then they are more expensive by about \$5. Radio Shack is so convenient.

Two other brands are frequently found in software I receive for review. They are Memorex and Elephant. Both seem to hold up pretty well, although my use of them has not been hard. Elephant disks are certainly inexpensive.

Whatever disks you decide to buy, keep track of them carefully so that if they start to fail you can identify the lot. Then find all the disks purchased with that lot and use them for less critical storage requirements. Cycle backups are a good idea in general, but if you are having any media problems you should religiously duplicate your data. And don't forget to register a complaint with whoever sold those disks to you in the first place. □

Make all the mistakes you want with this program. You can always back up, and you can always yell for help. The prompts are very descriptive, and the displayed instructions are clear.

The program has two operational modes. While you are learning the system, and before you know any better, you will just answer all the questions as they are asked. However, you can use an expert mode which allows answers to be given in advance, thus avoiding prompts. This is very clever, and very easy to learn. But if you forget, you can just revert to answering all the questions. Have it your way.

There are many more examples of this attention to the human interface in *Money Maestro*. I particularly like the way it handles the printing of checks. However, the program is not without its problems. First, it is not as functional as its competitors and it carries a higher price tag, \$260.

In particular, it does not handle split transactions and does not allow transaction data to be modified once entered. Second, the manual is poorly done, and has not been revised for the IBM version. It is still in its CP/M form, and it won't make much sense to an IBM owner. Third, neither the program nor the manual provides a mechanism to get the data files on a separate disk. To the naive user, it would seem as if the data had to be on the same disk as the program. Finally, the reports are not paginated, do not output form feeds to leave the paper lined up, and do not provide a margin for binding in a three-ring binder, the most likely binder to be found in a household. (None of the other programs provides a margin either.)

InoSys is currently revising the manual, a difficult task because the program is supported on Apple, CP/M, and IBM systems. The company expected to have the new document ready by the time you read this. A revised and extended version of the program is due out sometime early next year.

One final point. The *Maestro* data files are kept in an ASCII format that is very easy for Basic to read. That means you can build your own programs to provide specially formatted reports or other functions you might want that the program as delivered does not. The format of each of the files is described in detail in the manual.

Question: which program wins?
Answer: none of them. After having

tried all the programs, I am not convinced that my accounting work will be eased or reduced. My manual system is rather efficient; for example, I have not had a checkbook reconciliation error in years.

Furthermore, any program I use has to be usable by my wife, who will not tolerate unnecessary work and will not spend the time to become an expert operator. So for her, *Money Mastery* would be best, but it is not a total solution for our needs.

Ah, well, maybe I will write my own after all.

New Products

As time goes on, the size of this section of the column will shrink. The reason is lead time and space, so much of the former and too little of the latter. Most of what I can talk about here will probably already be known to most of you, either through ads or because you have seen the things in stores. What I will carry are items I think have particular interest, or ones that are unique.

IBM has announced SNA 3270 Emulation and RJE support (\$700), click up one for me! and IBM 3101

emulation (\$140), as well as Version 2.0 of the Asynchronous Communications Support package (\$60).

An SDLC Communications Adapter (\$300) had also been announced, along with a cable (\$75). These products, mentioned by IBM as "intentions" at the time the PC was announced, are important additions that allow IBM to continue their penetration in their own large accounts.

In the same vein, Persys Inc. announced PC/HASP, a multi-user remote job entry HASP workstation

My Favorite Full-Screen Program Editor

A new full-screen program editor has been announced by Saville Software International (SSI), of Orem, UT. The \$195 program, called *P-Edit* (pronounced pee-uhd), is my favorite editor, and the one I could not tell you about until now.

SSI has been in business for several years building software products for Data General computers. Although I have tried *P-Edit* on a DG system before, I had not used the program extensively until it became available on the IBM PC. What a mistake! I am now in the process of acquiring it for my DG system at work.

For any software product, and especially for interactive programs, there are two qualities that will distinguish it from the rest of the pack. I have mentioned them in the body of the column; they are good functional match with your requirements, and good human engineering. *P-Edit* has both.

P-Edit has all the features a programmer needs, and more that a programmer wants. Editing is simple, but the program can be taught to perform very complex procedures with SSI's macro facility. The better editors (*EMACS*, *Vi*, etc.) have similar facilities, but they are not as easy to use as *P-Edit*'s.

A procedure is defined by *P-Edit* by manually performing it once. *P-Edit* records the sequence, and can store it temporarily, or permanently if a name is provided. The procedure can then be invoked at any subsequent time. Temporary macros are particularly nice because they are deleted at the end of the editing session. Often there are procedures that are unique to

a particular file, and only need to be performed once.

The best part of *P-Edit* is the human engineering. Although I think there is room for improvement, *P-Edit* is very easy to use and understand, and very forgiving of errors. It is function key driven, meaning that keys are depressed to invoke functions, as opposed to typing commands or keying code letters.

SSI provides a "template," a paper (I wish it was plastic for durability) form that sits above the keys and identifies which functions are invoked with which keys. *P-Edit* uses primarily Alt-F1 through Alt-F10 (the top row of keys), and also makes use of a few of the left-most function keys.

The most outstanding feature is cursor positioning, which can be performed on the cursor pad very rapidly. Arrow keys move the cursor one character in the direction indicated. They can also be preloaded with a depression of the Home key, which moves the cursor to the top, bottom, left, or right of the screen in the direction indicated. A double depression of Home followed by an arrow moves the cursor to the top or bottom of the file being edited, or the leftmost or rightmost character in the line. This sounds complicated to explain, but it is so easy and natural to use you can only be amazed.

Other features of *P-Edit* include horizontal scrolling to accommodate line widths of over 80 columns, powerful (but a little different) block movement functions, fast (not the fastest) scrolling through the text, and files of arbitrary

length. All this in a program which is 10k long and requires only 40K of memory to operate.

One feature not included in *P-Edit* is split screen editing, or multiple windows. This feature usually allows more than one file to be edited at the same time so that a section of one file can be moved or copied into another. Strangely enough, this would be a relatively simple thing to add to *P-Edit* because memory is not a problem for the program—I guess SSI doesn't see any value in the feature.

Multiple editing is a nice "gimmie" feature which, in my experience, is rarely used. *P-Edit* certainly allows other files to be inserted in the text being edited, so the function can be had by doing several independent edits. Split screen editing, giving the ability to look at one section of the file while editing another, is a feature I do wish SSI had included, but the program scrolls through the text rapidly enough to offset the lack of that function.

Finally, *P-Edit* is the tip of the SSI iceberg. SSI's main product for Data General systems is *Word-Perfect*, a terrific word processor. I don't know when it will be ready (I hope soon), but SSI is currently working on the IBM conversion. I have to reserve judgment until I have a chance to review the product, but if they don't make any mistakes they will have the premiere word processor on the small systems market and, of course, it will run on MS-DOS, making it easily available on a vast number of the new generation of micros. □

IBM, continued...

emulator. The package costs \$995 and requires Persyst's DCP/88 Communications Processor card. This device uses an 8088 and up to 64K of on-board RAM, and can support line speeds up to 50 kilobaud. When not being used to run PC/HASP, the board can be used as an outboard processor. Price of the DCP/88 was not available at press time.

By the way, Persyst also manufactures add-in memory and multi-function cards. Their Spectrum series is particularly interesting because it is the only card I know of that provides two communication ports. Their 256K board with two ports is \$985. A printer port is also available on the same card, and Persyst now offers an electronic disk simulator called Insta-Disk packaged with their boards or separately for \$49.95.

Cartis Manufacturing Company, Inc. offers the P.C. Pedestal. This \$79.95 item is a very attractive stand that attaches to the bottom of the IBM Monochrome display, allowing it to be tilted or rotated for the optimum viewing angle. Slots, visible in Photo 1, assure adequate cooling to the display. A display extension cable set, which allows the display to be located farther away from the system unit, is also available for \$49.95. I have one of these units, and it is very nice indeed. It is of very high quality. The cables are very well built. The color of the stand matches the IBM perfectly. Frankly, if you decide to move the system unit away from the keyboard and display, this item is a must because the display is too low if it is not sitting on the system unit.

Nai Hellman III, Incorporated, has announced several accessories for the IBM PC. Their keyboard cover (\$12) is made of rigid, smoked plastic and fits neatly over the keyboards of IBM and several other computers and terminals. A clever little disk cover (\$8)

protects the disk drive area from dust. A manual rack (\$24) holds six IBM manuals. Finally, a carrying case (\$120) secures the keyboard, system unit, disks and manuals for transport. Photo 2 shows the items.

Columbia microSystems, Inc. announced the CMS 1600-IBM disk subsystem for the PC. The product provides two 8" double sided, double density disks in a thin (2.5" high) cabinet for a storage capacity of 2.4 megabytes. The unit is compatible with the



Photo 3: Columbia microSystems CMS 1600-IBM 8" diskette subsystem

standard IBM single density format, according to the manufacturer. The price of the system is \$1750. With controller and software, the price is \$2085. The unit can be seen in Photo 3.

Personal Data Systems, Inc. has announced the PACK-HDR-R disk drive, using the SyQuest 306 removable cartridge drive. The hard disk unit has a formatted capacity of 5 Mb with an average access time of 75 milliseconds. The price of \$1795 includes a software interface to PC DOS or CP/M-86. Disk Cartridges are expected to be in the \$35 price range.

The drive mounts in the system unit where diskette drive it would normally go. I consider this product significant because it provides a considerable degree of flexibility over a conventional non-removable hard disk, and the price is aggressive.

Orchid Technology has announced two new products. The start-up firm offers a graphics card for the IBM Monochrome display for \$495. Graphic resolution is 720 horizontal by 320 vertical. The card also includes the Game Adapter, and compiles software support for Basic, Pascal, Fortran, and other high-level languages.

The second product is exciting. Called PCnet, the \$699 product allows the integration of a local area network. Using baseband technology, the device operates at speeds up to 1 million bits per second over a distance of up to 7000 feet. An addressing scheme which allows 64,000 addresses assures virtually unlimited expansion of the network. Operating software is provided which allows resource sharing of devices such as printers or hard disks.

Forth, Inc. has broken the mold and is now offering a new version of Forth called personalForth. The new product is Forth Inc.'s first mass market product and carries a price of \$300. The list of features sounds impressive, including multi-tasking, screen editor,



Photo 2: Accessories from Nai Hellman III, Inc.: a) Keyboard Cover; b) Diskette Cover; c) Manual Rack; d) Carrying Case.



Photo 1: P.C. Pedestal, from Cartis Manufacturing.



*Photo 4: Bench Collection Furniture:
a) Model A Desk; b) Model A Printer
Stand; c) Model B Desk with optional
CPU Shelf and extra glass door;*

*d) Model T Table with optional CPU
Shelf.*

IBM DOS file handler, a special "turnkey" compiler, new documentation, and 8087 support (software emulation of the 8087 is not provided). The program requires as little as 48K of memory and supports either type of display, two diskette drives, and the printer.

The Bench Collection has announced Electroniture, a series of computer furniture products. Pictured in Photo 4 are four products relating to the IBM PC. All the furniture is made of solid oak and has been designed with the comfort of the user in mind. Price of the Model A Desk is \$895. I have seen a color photograph of one of the products and it looks beautiful. My table (remember my table?) is oak too, but I think Sandy would prefer one of these. □

Firms mentioned in this column:

Microsoft Corporation
10700 Northrup Way
Bellevue, WA 98004
(206) 828-8600

Design Data Systems Corporation
5270 N. Park Pl., N.E.
Cedar Rapids, IA 52402
(319) 373-1571

Best Programs
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Alexandria, VA 22301
(703) 548-3663

Carnival Software
11223 S. Hindry Ave.
Los Angeles, CA 90045
(213) 417-0031

The Dyna-Logic Hyperion Portable Computer

The Hyperion Portable Computer is a new entry in the portable computer marketplace that I consider very significant because of Dyna-Logic's claim of total IBM PC functional compatibility. I've mentioned the details in a previous column, but I failed to include the photograph. Here it is.



*Photo 5: The Hyperion Portable
Computer from Dyna-Logic Info-
Tech Corporation.*

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Westboro, MA 01581
(617) 366-0950

InnoSys Incorporated
2150 Shattuck Ave.
Berkeley, CA 94704
(415) 843-8122

IBM Corporation
System Products Division
Entry Systems
P.O. Box 1328
Boca Raton, FL 33432

PerSys, Inc.
22957 La Cadena
Laguna Hills, CA 92653
(714) 859-8871

Curtis Manufacturing Company, Inc.
One Curtis Rd.
Winchester, NH 03470
(603) 239-6807

Nai Hellman III, Incorporated
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South Gate, CA 90280
(213) 773-3576

Columbia microSystems, Inc.
110 N. Tenth St.
Columbia, MO 65201
(314) 875-8900 or 443-8255

Forth, Inc.
2309 Pacific Coast Hwy.
Hermosa Beach, CA 90254
(213) 372-8493

The Bench Collection
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Santa Rosa, CA 95401
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Satellite Software International
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VR Data
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Folcroft, PA 19032
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Ottawa, Canada K2H 6T7
(613) 226-1383

Dichid Technology
1084 Hillview Dr.
Milpitas, CA 95035
(408) 943-8660

Personal Data Systems, Inc.
1110 Wrigley
Milpitas, CA 95035
(408) 362-7080

the other side...the other si



There are, maybe, some 500 IBM PC users in Britain. Not one has bought the kit from IBM.

That in itself is only slightly strange. Where things start getting weird, however, is in the various silly battles that are going on, with people taking over their own users in an effort to flatter, court, woo, and even intimidate IBM.

What companies say in public (that is, when a journalist asks and what employees in the company say to each other, don't often match. IBM's way round this is to say nothing to journalists. Other people, however, talk to IBM and then they talk to journalists, and from that, quite often, one can glean some idea of what is going on.

Not this time. From the leading software producers in Britain, you can be told alternately that "IBM will not launch the PC in the UK, ever" or that "IBM will launch tomorrow." I could eat for a week if I got a free lunch for every time I've been told that. So what—it's always like that when IBM prepares a new product.

This time, however, it is a good deal slier. Like: "We have a wide range of IBM branded software" is Peachtree employee talking! "which has all been re-written to UK standards of accounting and business practice, but I'm afraid we couldn't sell it to you, even if you had a PC."

The reason? Apparently IBM will not grant Peachtree UK a dealer licence to sell the PC if Peachtree supplies software to IBM PC users who buy direct from the States.

No, I don't believe it either, and my contacts inside IBM (who don't talk to journalists) are equally at a loss to explain this one. After all, if you could guarantee to have some ready-debugged software

Guy Kewney

for your machine, with a couple of months' user maturity, ready when you launched, even Osborne might launch a 16-bit machine.

The people IBM really are getting hot under the collar about are those who take very large advertising spreads in the trade papers, using phrases like "official dealer" who haven't even (my contacts who don't talk to journalists) phoned IBM to ask if, one day, they may be dealers.

My own feeling is still to wonder at the enthusiasm for such a high-priced bit of hardware with so few special features, with nothing much to run beyond VisiCalc and a translation of Wordstar—and if you're a fan of the PC, remember that you will have to spend the equivalent of over \$5000 to get one here, at least until IBM announces the price.

Software for the IBM still comes through very slowly. Software for "any Z80 based machine that runs standard CP/M," however, continues to pour through the faucets. The latest is virtual APL.

Virtual APL

It is always a bit hard to start writing about APL to anybody who doesn't use it, because APL users don't just use their language, they worship it, write diaries in it, and define anything from trade exhibition stands to printed circuit boards, as well as merely writing programs in it.

To the serious APL freak, however, the limitation of using the language on micros will always be the smallness of the workspace—the well-known Micro-APL.

For instance, offers about 22K is a standard 64K memory map.

At the APL '82 conference in Heidelberg, at which IBM made part of the headlines by releasing APL II, a small British firm called Sigma Software Unit produced a £225 sterling interpreter which offers a megabyte of workspace. Not unilaterally, they caught the other half of the headlines.

VIZ-APL, as Sigma's product is called, is to be marketed in the US by EASI APL Systems Inc., a "recursive" acronym since it includes itself. It achieves the magic by the old trick which IBM invented, of using "virtual memory," but does it on diskettes, which is quite a new trick.

Director Geoffrey Baughton of Sigma says that the interpreter got "the best beta testing you could imagine at Heidelberg, with all the world's top APL enthusiasts doing their best to catch it out."

Apparently the speed of VIZ-APL is comparable with normal Micro-APL unless you do a lot of backward and forward jumps in your program. So don't do it.

More On the BBC Micro

On the British hardware front, the British Broadcasting Corporation's micro has just ended a ten-month lull by moving instantly into plot.

Acorn, the builders, are tearing their hair out, since the machine has been in such short supply (people waiting six to eight months before finding that their credit card application has been cancelled because they had moved in the interim) that just nobody will believe their advertising campaign saying the thing is available.

Acorn is also about to get a severe

shock, if and when the user grip takes it to court for trying to charge £100 for the operating system upgrade ROM.

The initial manual had more page omissions than pages, and the original Machine Operating System was rather similar in design concept. It wouldn't run disks until July, and only now are users starting to get the necessary firmware to do this.

Not unnaturally, users feel that the original machine, as supplied, fell short of epic, and they don't see why they should have to pay for the privilege of getting what they ordered in the first place.

I think Acorn would agree, except for the fact that version 0.1, now replaced by 1.0, is not the last version in need replacing. Version 1.0 is being burned into EPROM, pending the final ROM design (nobody can say when). And the EPROMs are slower to produce, more costly, and set a nasty precedent, if Acorn supplies them free.

Over The Rainbow

By the time you read this, the ROMs may be ready. Also by the same time, the Rainbow may be seen in the offices of lovers of Digital Equipment CP/M.

The world's second largest computer

company (as it has been for about nine months, now) has immensely impressed the market with the cleverness of a system which can run both the new fangled, fancy, non-existent 16-bit software, and also, in case you actually want to do any data processing, the old style, reliable CP/M-80 8-bit stuff.

The world's second largest (sic, etc.) has signally failed to impress, however, with its understanding of this remarkable beast.

At the Personal Computer World Show in London (the biggest micro show in Europe) last month this issue the project manager was to be seen frowning over one of the disk drives.

"Let's get this right," said he, "I can see what files are on the second disk, can't I? What do I type?"

You type (all together now): DIR, space, B, colon, return.

"Ah, I see, DIR, space, B, then, what did you say?"

I guess like DEC's plan to sell the Professional as a "truly friendly" machine, but it's one thing to try something out and find it wanting, and it's quite another thing to decide that you know better anyway, and needn't even find out. That company's plans to "restructure this market" sound suspiciously like getting the world into sleep with DEC.

And they obviously are simply not aware of the difference between a friendly machine without any software, and a rather fragile and unhelping CP/M beast that comes free with a tin of the stuff.

Espionage

Finally, your visit to Europe this winter, on behalf of the secret intelligence people: You will want, naturally, to blend unobtrusively into the background. Briefing will fit you up with an identity with a nice name like Smith or Schmidt rather than John Doe. Your American accent will pass unnoticed, since most Europeans speak English with that flavor.

The only problem, is: What cover? What occupation should you assume?

I have the answer. You should not, in 1983, pose as a refuse collector over for a symposium, nor as an automobile tycoon looking for an Irish factory to launch a stainless steel windtunnel. No, the thing to be is an American software catalogue operator thinking of setting up a warehouse near London Airport.

I didn't know there were so many software catalogue outfits in America until they all came over here to research the market. If you already run one, and were thinking of starting up in Europe, forget it, obviously. But at least, you've missed the crash. □

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Personal Electronic Transactions



I am sure you have heard of the Commodore-64. This month we will take a closer look at Commodore's newest machine.

The 64 comes in the same case as the Vic with the case color changed to a neutral grayish-brown. The keyboard is quieter and has contrast keys and a lighter touch. This is the best Commodore keyboard that I have used. Also, the power supply is outside of the 64, greatly reducing the temptation to use it as a portable heater. (These improvements are also on the recent Vic's.)

64 Hardware

The 64 has two joystick ports, which can also use paddles, and one of which can also handle a lightpen. Like the Vic, the 64 has the RS-232 port combined with the parallel port. But, the memory expansion slot is really different from that of the Vic, so none of the Vic cartridges will work on the 64. An RF modulator is built into the 64, allowing easy TV hookups.

Inside are two new chips to handle the superb graphics and sound capabilities of the 64 and 65535 bytes of memory. When you turn it on, the 64 uses an 8K Basic ROM operating system, giving the user 28911 bytes free for Basic programming. It really does come with 64K of RAM, but the RAM must be selected by POKEing into a control register.

The screen has 25 lines and 40 columns with a border. You can select from

Marc-Thomas Clifton

16 colors for the border, screen, and characters. (Eight character colors can be selected directly from the keyboard.) The 64 turns on in a color combination that is similar to the Atari and which is almost illegible on many monitors.

64 Software

There is already one known bug in the Basic operating system of the 64. Basic cannot handle an SPC or TAB function as the first parameter of PRINT#. For example, PRINT#1, SPC(10) will give a SYNTAX ERROR. To fix this bug, put two quote marks before the SPC or TAB. Example: PRINT#1, "TAB (15). Commodore failed to include any commands to handle graphics, sound or disk operation—just another rehash of Basic 3.0. (I would welcome a cartridge which provides these extensions.)

Border And Screen Color

See Figure 1 for a listing of interesting registers to POKE. First, let's make the screen more readable. Lookup the color chart in Figure 1, and find the numbers corresponding to green and gray#3. POKE the border register to green and the screen register to gray#3. (POKE 53280,5;POKE 53281,15) The program in Listing 1 goes through all the border and screen colors. When you run it, notice which color combinations create legible text.

Elemental Sprites

A sprite is a graphic character that you can make into any shape or color you want. The sprite is made up of 21 rows of pixels (divided by 24 columns (see Figure 4)). The 64 can have up to eight sprites on the screen at once, each with independent position, color, size, and shape.

First, let's draw a picture of a sprite, and then figure out how to put it into a form that the 64 understands. Notice in Figure 2 that the columns are divided into three sections, each containing eight squares. Each of these squares represents a bit and each section of eight bits is called a byte.

So, to draw the first row of Figure 4 into the 64 requires three bytes. The second row takes up another three bytes, and so on, until row 21. So all told, a sprite takes up to 21*3 bytes, or 63 bytes. Now, even though we are picturing the sprite has 21 rows, when we put it into memory, all the bytes are in sequential order. Figure 2 shows how the first two rows are translated into memory.

What values go into memory? Let's look at an individual byte. A byte has a numeric range from 0-255, which in binary, is either all the bits off (0), or all the bits on (255). Table 1 shows the decimal value for each of the bits, counting from right to left.

The decimal value is calculated by raising 2 to the power of the bit number. (This is why we start with Bit 0, $2^{10}=11$). If you have more than just one bit set in a byte, the value of the byte is determined by adding the decimal values of Table 1 that correspond to each bit

Marc-Thomas Clifton, P.O. Box 562, Palo Alto, CA 94302.

turned on. Each bit that is on in the byte corresponds to the pixel appearing on the screen after you have drawn the sprite.

For example, if you wanted the first row to be a solid black line, you would assign the first three bytes the value of 255, which in binary has all the bits on. If you wanted every other pixel on, you would give the byte a value of 170 which in binary is 10101010. (What value would 01010101 be?)

The program in Listing 2 puts a sprite on the screen. Look at the DATA statements, and compare the values of each byte with the pattern of the pixels in Figure 4. After adding up the value of each section in Figure 4, you should get the number in the data statement that corresponds to the row and column of the byte.

After calculating the decimal values of the 63 bytes that make up the sprite, we must decide where to put the bit pattern in the memory of the 64. The sprite pointer register (see Figure 5) tells the 64 where you put the data for the shape. The data address can be found by taking the sprite pointer value and multiplying it by 64. So if we give the sprite pointer a value of 13, the memory location into which we put the sprite will be 13×64 , or 832.

Now let's choose a sprite to work with. By POKEing the spritelptr register to 13, the 64 will look for the shape of sprite0 starting at address 832, so the next thing to do is put our data into memory. Lines 1000-1065 in Listing 2 POKE the data appropriately. Now, we have drawn a sprite, found out how to convert it into numbers, POKEd it into memory and told the 64 where it is found in RAM.

The last two things that we must do are to tell the 64 that we want spritelptr

Decimal	Binary
Bit 0: 1	00000001
Bit 1: 2	00000010
Bit 2: 4	00000100
Bit 3: 8	00001000
Bit 4: 16	00010000
Bit 5: 32	00100000
Bit 6: 64	01000000
Bit 7: 128	10000000

Table 1

Listing 1

```
10 FOR I = 0 TO 14: FOR J = 0 TO 14
20 POKE 53280, J: POKE 53281, I
25 FOR K = 1 TO 150: NEXT
30 GOSUB 50
40 NEXT J, I
45 END
50 POKE 53280, J: POKE 53281, I
55 PRINT "THE BORDER COLOR VALUE YOU JUST SAW WAS:" J
60 PRINT "THE BACKGROUND COLOR VALUE YOU JUST SAW WAS:" I
65 RETURN
```

Figure 1

Register Name	Register Value
Spritelptr column position	53248
Spritelptr row position	53249
Sprite1 column position	53250
Sprite1 row position	53251
Sprite2 column position	53252
Sprite2 row position	53253
Sprite3 column position	53254
Sprite3 row position	53255
Sprite4 column position	53256
Sprite4 row position	53257
Sprite5 column position	53258
Sprite5 row position	53259
Sprite6 column position	53260
Sprite6 row position	53261
Sprite7 column position	53262
Sprite7 row position	53263
Sprite control register	53269
Sprite row expand register	53271
Sprite column expand reg.	53277
Sprite-Sprite collision detect	53278
Border color	53280
Background color	53281
Sprite0 color	53287
Sprite1 color	53288
Sprite2 color	53289
Sprite3 color	53290
Sprite4 color	53291
Sprite5 color	53292
Sprite6 color	53293
Sprite7 color	53294
Sprite0 pointer	2040
Sprite1 pointer	2041
Sprite2 pointer	2042
Sprite3 pointer	2043
Sprite4 pointer	2044
Sprite5 pointer	2045
Sprite6 pointer	2046
Sprite7 pointer	2047



"You've got one of the most expensive high-speed WABs, Harry. Don't tell me you can't remember where you were last night!"

PET/VIC, continued...

displayed on the screen and to give it a row and column position. In Figure 1, the sprite control register is used to determine which sprite is to be on the screen.

There is only one register to handle all eight sprites, so each bit in the register is assigned to a sprite. Figure 3 gives the layout of the sprite control register. To turn sprite 0 on, bit 0 of the control register must be set to 1 by POKEing (sprite control register), 1. (See line 70 in Listing 2.)

The `sprite0` column position and `sprite0` row position registers are used to place the sprite on the screen. The position of the sprite can be from 0-255 in both the column and row position. The number you POKE into the registers corresponds to the number of pixels across and down starting at the upper left-hand corner of the screen.

To put the sprite in the middle of the screen, POKE (sprite0 column position), 160 and POKE (sprite0 row position), 120. (See line 40 in Listing 2). Type the program in and run it. The sprite will appear in the middle of the screen. Now we can concentrate on moving it, and changing its color and size.

Note: whenever I say POKE (sprite0 color register), 3 or any similar statement, the label `sprite0` color register must be replaced with the actual value of the `sprite0` color register, or whatever register is in the parentheses. Remember, Figure 1 is the list of all the registers used for sprite manipulation.

First, let's explore moving the sprite in a horizontal direction. Currently, the column position is 160. Try changing it to 159 by POKE (sprite0 column register), 159. Did you see the sprite move over a little? To move the sprite smoothly from left to right, we can write a loop that decrements the column position by one, and has a small delay loop so the sprite doesn't zip across the screen. Try this:

```
FOR I = 159 TO 20 : POKE 53248, I
FOR J = 1 TO 100 : NEXT J
```

Watch the sprite move across the screen. By adjusting the maximum value of `I` (currently 100), you can make the sprite move faster or slower. Now try moving the sprite vertically. (Hint: it is exactly the same loop, with one number changed.) Now, for our color demonstration, please put the sprite back into the middle of the screen.

Each sprite has a color register which you can use to give it any one of the 16 colors. Each sprite can have a color independent of any other sprite. Find the `sprite0` color register in Figure 1, and experiment by POKEing into it values from 0 to 15. Notice that the number you POKE into the color register and

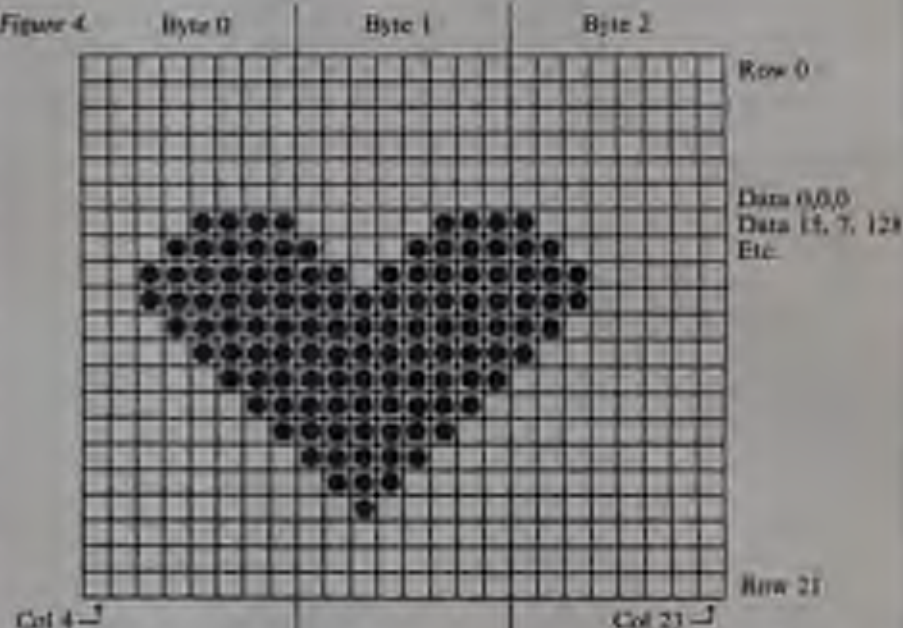
Figure 2.

```
row1,col1 : row1,col2 : row1,col3
row2,col1 : row2,col2 : row2,col3
... row1,col1:row1,col2:row1,col3:row2,col1:row2,col2:row2,col3...
```

Figure 3.

Sprite Pointer register value: (10-20)	table address
10	640
11	704
12	768
13	832
14	896
15	960
16	1024
17	1088
18	1152
19	1216
20	1280

Figure 4.



the color of the sprite correspond to the chart in Figure 5.

By now, you might also note that the sprite did not scroll off the screen as normal text does, nor did it appear when you cleared the screen. In fact, you can write over the sprite, and the 64 will try to merge the two together. There are two ways to remove a sprite: POKE everything back to zero, or reset the machine.

The 64 can also expand the sprite to double size, in both horizontal and vertical

positions. Look up the values for the `sprite0` column and row expand registers. Now POKE (column expand register), 1. Our sprite has just grown taller. Let's try getting it more normal looking: POKE (column expand register), 0; POKE (row expand register), 1. It's stretched the other way. Let's see... to get the sprite so lengthen, try the first POKE again. There, now it's back the size it used to be. (It's up to you to look up the actual numbers this time.)

ler to 0, otherwise the 64 will think that the sprites are still colliding. The collision register is 0 when there are no collisions. The program in Listing 5 uses collision detection; one sprite (a large box) contains another sprite (a bouncing ball). Whenever the ball hits one of the walls, it sets the collision detection register, and new direction for the ball is chosen.

How The Programs Work

The programs in Listings 4 and 5 were suggested to me by Gregory Yob, and I thought they were excellent demonstrations, so I decided to code them. Space is limited, so these notes are rather terse.

These programs are just a sample of what can be done with sprites. I would enjoy hearing from you if you create any interesting designs, pictures, or animation.

If you write to Gregory Yob, he will pass your letters on to me.

Listing 4

Line 5 reserves variable space for eight pairs of xy coordinates, 0-15.

Line 6 reserves variable space for eight separate rates in which the sprites travel in the circle.

Line 7 defaults the number of iterations to 229.

Line 10 sets up the 64 with a green border and black background.

Line 15 clears the screen and chooses a character color.

Line 20, + is the start of sprite register variable.

Line 21 turns off all sprites.

Listing 5

```
5 DIMS(10)
6 DIM I(7)
7 CY=229
10 POKES3280,B:POKES3281,0
15 PRINTDHRN(147):DHRN(159)
20 V=32248
21 POKEV+21,0
22 INPUT "R OF ITERATIONS PER CYCLE="CY
23 IF CY/6.26666666
24 PRINTDHRN(147)
25 TRL=13128H+TRL+64
31 POKEV+23,255:POKEV+29,255
35 FORI=2040TO2647:POKEI,TRL:NEXT
40 FORI=21046:POKEV+1,1-36
45 GOSUB85
46 POKEV+21,255
50 FORI=0TO62:READJ:POKEPH+1,J:NEXT
60 K=0:IF CY=0V=1786GOSUB85:END
62 FORI=147DOSTEP-2
63 I(1/2)=I(1/2)+J*(1/2)+1/2/37
65 B(1)=50+81N(1/2/21)+140
70 B(1)=1+50+5081I(1/2/21)+120
71 POKEV+1,B(1):POKEV+1+1,B(1+1)
75 NEXTI
80 GOTO 34
85 FORI=0TO142STEP2:POKEV+1,160:POKEV+1+1,170:NEXT:RETURN
1000 DATA 0,0,0,0,0,0,0,0,0,0
1005 DATA 0,255,0,3,129,192,6,9,48,12,0,24,24,0,12,48,0,6,48,0,6,48,0,6
1010 DATA 48,0,6,48,0,6,24,0,12,12,0,24,6,0,48,3,129,192,0,255,0
1015 DATA 0,0,0,0,0,0,0,0,0,0
```

Listing 5

```
5 DIMS(10)
6 POKES3296,0:POKES4277,190:POKES4278,248:POKES4279,17
7 POKES4272,271:POKES4276,17
10 POKES3280,B:POKES3281,0
15 PRINTDHRN(147):DHRN(159)
20 V=32248
21 POKEV+21,0
25 TRL=13128H+TRL+64
31 POKEV+23,255:POKEV+29,255
35 POKES2040,TRL:POKE2647,TRL+1
40 POKEV+39,41:POKEV+40,17
45 GOSUB85
46 POKEV+21,3
50 FORI=0TO124:READJ:POKEPH+1,J:NEXT
55 GOSUB95:GOSUB120
60 POKEV,B(1)+32
61 POKEV+1,B(1)+Y2
65 POKEV+2,B(2)+X1
70 POKEV+3,B(3)+Y3
75 GOSUB150
75 IFPEEH(1)+30)=0THENS(2)=B(2)+X1:B(3)+X1:B(3)+Y1:B(1)=B(1)+X2:B(1)
  =B(1)+Y2:GOTO34
76 GOSUB95:POKEV,B(4)+X2:POKEV+1,B(5)+Y2
77 POKEV+2,B(12)+X1:POKEV+3,B(13)+Y1
84 POKEV+30,0:GOTO 155
85 FORI=0TO2STEP2:POKEV+1,160:POKEV+1+1,170:B(1)=160:B(1+1)=170:
  NEXT:RETURN
90 POKES3296,17
91 FORI=1TO7:NEXT:POKES4296,0:RETURN
95 X1=4*AND(1)-2
100 IFABS(X1)<.6THENSPE
105 X2=4*AND(1)-2
110 IFABS(Y1)<.6THENS100
115 RETURN
120 X2=2*AND(1)-1
125 IFABS(X1)<.6THENS120
130 Y2=2*AND(1)-1
135 IFABS(Y1)<.6THENS130
140 RETURN
150 IFB(1)<60THENS(1)=60
155 IFB(1)>200THENS(1)=200
160 IFB(2)>240THENS(2)=240
165 IFB(3)<20THENS(3)=20
170 RETURN
1000 DATA 255,255,255,128,0,1,128,0,1
1005 DATA 128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,128,0,1
1010 DATA 128,0,1,128,0,1,128,0,1,128,0,1,128,0,1,128,0,1
1015 DATA 128,0,1,128,0,1,255,255,255
1020 DATA 0,0,0,0,0,0,0,0,0,0
1025 DATA 0,0,0,0,0,0,0,0,0,0
1030 DATA 0,0,0,0,0,0,0,0,0,0
1035 DATA 0,0,12,0,0,12,0,0,0,0
1040 DATA 0,0,0,0,0,0,0,0,0,0
1045 DATA 0,0,0,0,0,0,0,0,0,0
1050 DATA 0,0,0,0,0,0,0,0,0,0
1055 DATA 0,0,0,0,0,0,0,0,0,0
1060 DATA 0,0,0,0,0,0,0,0,0,0
```

Line 22 asks the user for the number of iterations; pressing carriage return defaults to 229.

Line 23 is a ratio.

In line 25, the character table address is 13128; physical memory location is 13764.

Line 31 expands all eight sprites in both horizontal and vertical directions.

Line 35 tells the 64 the location of the sprite data tables (they are all in one place).

Line 40 gives each sprite a different color (cyan through light red).

Line 45 is a subroutine which puts each sprite in the middle of the screen.

Line 46 turns all eight sprites on. Line 50 reprograms them by POKING data into them.

Line 61 checks if the cycle is complete and if so, ends the program.

Line 62 is the main loop that moves all eight sprites.

Line 63 changes their polar coordinate position.

Line 65 updates the horizontal coordinate.

Line 70 updates the vertical coordinate.

Line 71 tells the 64 the new positions.

Line 75 continues with the loop.

Line 80 goes back to the beginning of the loop.

Line 85 is the subroutine that centers all the sprites on top of each other.

Lines 1000-1015 contain all the data required for the shape of a circle.

Listing 5

Line 2 reserves variable space for two sprites, each with a horizontal and vertical location.

Line 5 programs the 64 to play a tone.

Line 9 programs the 64 for a tone frequency.

Line 10 sets the 64 up with a green border and black background.

Line 15 clears the screen and changes the character color.

Line 20 is the start of the sprite registers.

Line 21 turns off all sprites.

Line 25 defines the start of the sprite

data table in memory.

Line 31 expands the first two sprites.

Line 35 sets the 64 where the sprite data table is for sprites 0 and 1.

Line 40 programs the sprite to a purple box and light green ball.

Line 45 puts the sprites in the middle of the screen.

Line 46 turns the sprites on.

Line 50 defines the shape of both sprites.

Line 55 chooses a random velocity for both box and ball.

Lines 60-70 move the sprites.

Line 73 checks if the box has reached one of the edges of the screen; this limits the movement of the box to within a predefined area.

Line 75 checks for a collision; if the two sprites haven't collided, the program continues to move them.

Line 76 causes a beep to be emitted, and the box to be put back to its original location if they have collided.

Line 77 puts the ball back to its original location.

Line 84 resets the sprite collision registers to an "uncollided" state and goes back to choosing a new velocity for both box and ball.

Line 85 positions the box and ball in the middle of the screen.

Line 90 is a subroutine which emits a beep by turning the volume on.

Line 91 after waiting a little while, turns the volume off and returns to the main flow of the program.

Lines 95-140 are two subroutines used in choosing a velocity for the box and ball; the program checks if the velocity is too slow, and chooses another if it is.

Lines 1000-1011 contain the data for the box.

Lines 1015-1065 contain the data for the ball.



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rings...trs-80 strings...trs-8

At the 47th rising of the TRS-80 moon, we look out over the frosty landscape and catch sight of some comments on high-resolution graphics and hard disk drives, find out how to restore the silvery sheen of our keyboard surrounds, and examine the word/graphics Copier processor and a short program that determines the day of any given date.

High Resolution

High-resolution graphics for the Model III was first mentioned in the September 1982 column (p. 211), after I'd heard in London that it was forthcoming from Fort Worth. The second mention was in the October 1982 column (p. 284), in which I described the Mikographix Graphic System (\$369 for up to 512 x 192 pixels, recently renamed Mikegraphic and reduced to \$340), and Micro-Lab's Grafyx Solution (\$299.95 for up to 512 x 192 pixels), and said readers might want to wait for Radio Shack's offering.

Last September, Radio Shack's new RSC-8 catalog included several new products, among them high-resolution graphics for the Model III, at \$369.95 (plus installation) for 640 x 240 pixels (Figure 1). That comes out to about 65.11 pixels per inch horizontally, 36.23 per inch vertically, which does indeed sound like it could provide what the catalog calls "amazingly fine detail," for "sophisticated business graphs, tables, charts, maps, illustrations, geometric patterns—and animation!"

The package includes a 32K RAM board, manual and diskette with Graphics Basic and a library of assembly language subroutines. The Graphics Basic includes commands for drawing a circle,

Stephen B. Gray

arc, or ellipse; drawing a line between points; shading an area in one of several available patterns; turning an individual pixel on or off (with PRESET); putting the bit-pattern contents of an array onto the screen (useful for animation); and turning the graphics screen on or off.

The RSC-8 catalog says the Model III hi-res graphics package is "available 12/30/82." Maybe. Anyway, it offers almost 55,000 more pixels than either Mikegraphic or Grafyx Solution, for \$50 more than the first, and \$70 more than the second. However, let's wait to see how the Radio Shack hi-res software compares. Hyron Mamford's *Review* (Oct. 1982, p. 286) has 14 commands for Mikegraphic, and the software supplied with Grafyx Solution looks even better, with just about every one of the Radio Shack Graphics Basic commands, plus

some others that Fort Worth doesn't seem to have included: complement every point on the hi-res screen for an inverse display; draw a box whose diagonal's ends are at two given points; and copy the contents of the hi-res and text screen to a printer with graphics capabilities. (However, it may be possible to create an inverse display by using the POINT and PRESET commands). We'll see, as soon as I can get the Radio Shack hi-res graphics board installed in my Model III.

Note that the high resolution (640 x 240) provides exactly five times as many pixels in both the horizontal and vertical directions as does the standard resolution (128 x 48). Which would mean, if the hi-res graphics area is the same rectangular shape, with the same aspect ratio, 3:7, but only a fifth as large. However, looking very closely at Figure 1, you can see that the pixels are almost square (rounded, in the photo), which makes graphics easier to create. And one of Radio Shack's software people confirms that the hi-res pixel is indeed almost square, with a 4:5 aspect ratio. How come? Well, he says the hi-res graphics area may be bigger than the lo-res graphics area. We'll check that out later, after acquiring a hi-res board.

The 153,000 pixels take 153,000 bits of memory to store. If Radio Shack uses a 32K graphics memory board, that means it provides 32,000 times 8 bits, or 256,000 bits, which means there are 102,400 unused bits on that board. So why not just only 20K, or 160,000 bits of RAM memory, on the graphics board? According to a Radio Shack source, it may simply be more economical "to use the chips we chose," which must mean



Figure 1. High-resolution graphics, as offered for the Model III TRS-80, provides 153,000 pixels for fine detail.

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they need stick only one size of RAM chip, perhaps a 64K chip, for the hi-res board. Somebody will undoubtedly find a way to use the 102,400 idle RAM bits.

The graphics memory, by the way, is independent, and can overlay text in the regular video memory, so graphics and text can be combined in one display.

The assembly language subroutines are there only if and when you want to use the graphics commands from a language other than Basic, such as Fortran or Cobol. If you use only Basic, you'll never need those subroutines.

Hard Disk Drive for Models I and III

Forecasting some Radio Shack products isn't all that difficult. After all, the RSC-7 catalog included hi-res graphics



Figure 2: The hard-disk drive for the TRS-80 Model III or I TRS-80 adds 5 megabytes of storage.

for the Model II, with exactly the same resolution, and Graphics Basic commands as for what was to come later for the Model III (but at \$499).

It was only a matter of time before Radio Shack offered such a highly desirable item as hi-res graphics for the Model III. The RSC-6 catalog offered a hard disk system for Models II and I with 5.4 megabytes of storage for \$4495. Again, it was only a matter of time before a similar hard disk system was available for the Model III; the RSC-3 catalog has it, for the III (and I with an adapter), at \$2495 for 5 megabytes of storage (Figure 2). I had known quite some time before this writing that Radio Shack had ordered hard disk drives for the Model III (no, I didn't get the information from Fort Worth), but there was no point saying anything before now, because Radio Shack has enough problems without people calling up to ask when the hard disk drives are coming. The RSC-3 catalog gives all the details, plus an availability date of 11/15/82.

Incidentally, those prices for the hard disk drives are for the primary drives, which include a hard disk operating system. The secondary drives are less (\$3485 for the II, \$1995 for the III); up

to four hard disk drives can be attached to a Model I, II, III, or 16 TRS-80, for a total of 20 or over 30 megabytes of storage, depending on the model.

Why use a hard disk (also called a Winchester) system? You can eliminate most, if not all, of the tiresome business of having to put one floppy disk after another into your drives (except when it comes to backup disks). This may not be a big deal if you are a hobbyist, but for a business with many records, hard disks save a lot of time, not only because most floppy disk programs and data can be transferred to hard disk, but because they are then available much, much faster. On the Model II floppy disk drive, for example, the transfer rate is 500 kilobits per second. The Model II hard disk transfer rate is 4.34 megabits per second, providing what the catalog calls "extremely fast access to programs and data."

Aluminum Sprayed on Plastic II

The problem of the aluminum paint wearing off the keyboard of your TRS-80 if you rest your hands on it too much was mentioned in June 1982 (p. 217). The question was asked, "Has anybody found a spray-on or brush-on paint that matches the TRS-80's aluminum color?"

Michael B. Rowe, P.E., of Simplified Software Systems, which sells computers, accessories and software out of Hickory, NC, wrote:

"In one of your recent columns, you addressed the problem of the paint being rubbed off the TRS-80. Being in the software business, we use our machines constantly, and as a result we had the same problem. Our solution was arrived at by trying several different brands of aerosol-type aluminum sprays, and using sealed-plastic oven boxes for tests. What we decided on proved to be a satisfactory color match, and probably a better finish than the original. The procedure requires that you follow these steps carefully.

1. If the computer is out of warranty, remove the aluminum shell from the keyboard—*or*, in the case of the Model III, the whole top—as a unit. *Caution:* Be extremely careful when removing the top from the III to be sure you do not damage the neck of the CRT.

2. Use extra-fine (220 to 600 grit) sandpaper to slightly roughen the surface to be coated. Carefully remove all sanding dust!

3. Apply Krylon Dull Aluminum 1403, to the area to be coated, in several light coats rather than one heavy coat. It dries quite rapidly, so only 20 to 30 seconds is required between these light coats.

4. After the dull aluminum spray has dried for several minutes—preferably not more than four or five—apply several light coats of K-Mart brand Fast-Drying Spray Enamel in CLEAR U3773. This may result in slightly more surface sheen than the original, but generally blends nicely. On our Model IIIs we did not have to paint the whole top to get a satisfactory appearance.

"I might add that the black plastic keyboard bezel on both the I and III can be removed and recoated if necessary (someone got white paint on one of ours), using Martin-Senior Vinyl Color Spray #7977, Jet Black. Note that is Jet black, not Gloss black.

Before trying this on your TRS-80, you might want to work up a good spraying technique (slow and steady) on some scrap plastic or whatever. If you try the above solution, or have others, please let us know.

CopyArt Word/Graphics Processor

According to the ad, CopyArt provides "the new dimension in word processing," which is graphics; you can put words and pictures on the same screen or page (Figure 3). That is, if you have a Model I or III TRS-80, 48K of memory, and at least one disk. And CopyArt, which is \$149.95 from Seriatek Computer Products Inc. (4877 E. Speedway, Tucson, AZ 85712).

CopyArt combines a word processor very much like Radio Shack's Serqut, a graphics mode for using the cursor like a pen, drawing lines with the four directional arrows (similar to Etch-A-Sketch), a second graphics mode that

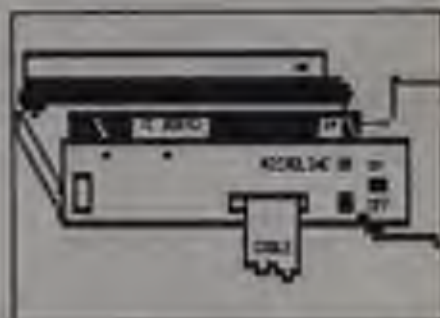


Figure 3: This partial illustration from the CopyArt manual, showing how to set up an Okidata Microline printer, was created with CopyArt.

creates large-size letters and numbers, and extensive printout capabilities. CopyArt was written with a special version of Simulek's ZBasic compiler, which is advertised as "the world's fastest TRS-80 Basic compiler," and which will be reviewed here at a later date.

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CopyArt Word Processing

If you have used *Script*, *CopyArt*'s word processing capabilities will be very familiar. Some are just about the same; many are new or improved, and only a couple are not quite as good as their *Script* counterparts.

As in *Script*, you use **CN=Y** for centering, **RL=Y** for justifying text, **LM=5** for left margin at 5, **RM=65** for right margin at 65, **HD=2** for using the next two lines as headings, **PZ=10** for starting page numbers on page 10, etc. As in *Script*, you can scroll text (roll the screen up or down the text), move to the top or bottom of text or to the left or right side of text using combinations of arrow keys and the shift key, and do global search and replace.

Moving text around is simpler: you just put any text to be moved into a buffer, move the cursor to a new position, and unroll the buffer, which places the text in the new position. With the down-arrow, you can move down a screenful at a time, instead of just a line at a time.

To emphasize text, you can simply put **SE=Y** in the format line (for single emphasis), which double-prints a line and thus makes it darker, or use **DE=Y** for double emphasis, which will quadruple-print a line and make it extra dark. To underline text, simply put a **U** at the beginning and end of phrases you want underlined.

Two of the best *CopyArt* word processing features are for deleting or inserting characters, and operate more as they do in commercial word processors. Press **D**, and everything to the right of the cursor moves to the left and disappears, as though swallowed up by the cursor. Press **I**, and blank spaces pour from the right side of the cursor.

A Directory feature calls up a menu allowing you to get a listing of all the various files on as many as four disk drives, or find out how much space you have left on a diskette.

Pressing the **H** key calls up help: four pages of display listing the various commands for word processing and printer format, plus some tips. As the manual points out, "To help you remember the various commands we've included a reference card." On the screen, that is fine, but I would still like a separate card, rather than having to call Help every time I need a simple word. For me, the lack of a reference card is the only serious problem with *CopyArt*. The index to the 104-page manual is quite good, but using a manual to look up commands takes too much time.

The only *CopyArt* commands that seem to work better in *Script* are two of the simplest: cursor movements left and

right, which don't operate as smoothly. Generally speaking, *Script* seems more professional and faster in operation than *CopyArt*.

CopyArt Line Graphics

Hit the break key and then **G**, and you are into graphics mode. Now you can use the cursor like a pen for an eraser, drawing lines (or deleting them). Hit **D**, and as you move the cursor with the arrow keys, it leaves a trail. Use **E** to get into erase mode. By switching back and forth from **D** to **E**, you create graphics. To move the cursor around without drawing or erasing anything, use **M**. To speed up the cursor, hit **F**. That's all there is to the draw-a-line graphics, but you can do a great deal with these four commands.

CopyArt Character Graphics

Hit **W** and **Y**, and you can create big graphic characters automatically, for

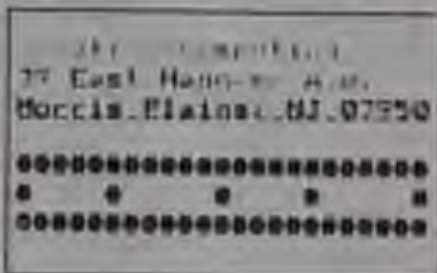


Figure 4. *CopyArt* can print with varying degrees of emphasis, underline, and can approximate graphics blocks with 0 and X.

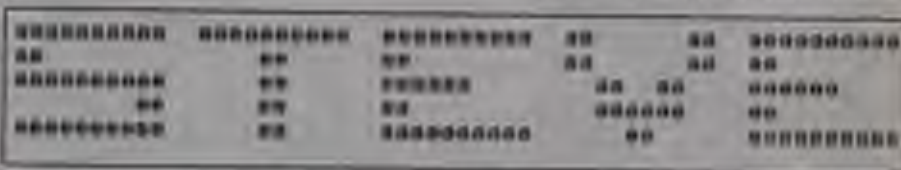


Figure 5. Using pseudo-graphics, *CopyArt* can print a good approximation of word letters.



Figure 6. These inverted characters were originally printed normally with *CopyArt*.

headlines or banners or whatever you need. The *CopyArt* disk includes a basic set of characters, including the alphabet and numerals, which you can display and print out in various sizes.

After you hit **Y**, you type in a letter, word or phrase at the bottom of the screen. You specify the height and width of the characters, whether you want them printed horizontally or vertically, and in black or white or inverted (white on black).

These characters can be printed out quite large, especially vertically, where you can print fairly long banners. If you have a printer such as the Okidata Microline or Epson—that supports the TRS-80 graphics character set, then your banners will be printed with letters of solid black.

On other printers, *CopyArt* uses "pseudo-graphics," by printing instead of a solid black rectangle (which is equivalent to a white rectangle on the screen) a **X** represented by a **O**.

Although at this moment I have three printers in hand, not one of them can print a graphics block. So I had to use pseudo-graphics to see what *CopyArt* can do. In the first example (Figure 4), I put a row of pipestrokes below *Computer's* address, with the first line printed normally, the second with single emphasis (printed twice), and the third using double emphasis (printed four times) and underlined. Although the four boxes were exactly the same size on the original, the printer is a pseudo-graphics approximation, with two sizes of boxes.

The second example (Figure 5) shows

TRS-80 Strings, continued...

my first name printed horizontally with small pseudo-graphic characters. The third example (Figure 8) shows horizontally, was originally printed vertically and inversely.

Actually, in that last example, three sets of the name were printed vertically. You can put a word on the screen, then move it over to the right using the **Insert** command to insert blanks, then put another word on the screen, push that into the middle, and add a third word alongside. Incidentally, as the manual notes, the *Copier* graphic characters are meant to be used as a framework; you can use the graphics mode to change the basic letters into almost any style you want. For example, once you have the characters on the screen, you might patch them so they look a little more like Old English type.

Advanced Copier

The imaginative manual has a section on some fancy features, such as killing the linefeed for creating new characters with overlines, turning off printing on as to print only a portion of a document, using *Copier* as an editor, and, if your printer uses special control codes, inserting them directly into text.

When you want to use a control code, you hit **6** and **C**. A message appears at the bottom of the screen:

Ctrl codes?

At which point you simply enter the code. The Cetronics T37, for example, will start underlining if it is given control code 14. So you type 14, and hit the enter key. Depending on the printer and the code, a character (sometimes a rather strange one not in the regular set) may or may not appear on the screen. It won't be printed out, but will affect the text following it.

```
10 CLG1 DIM N(12)
13 FOR X=1 TO 12: READ N(X): NEXT
15 FOR X=0 TO 6: READ D(X): NEXT
20 INPUT "ENTER MONTH, DAY, YEAR (MM, DD, YY) "M,D,Y
25 Y1=Y
27 IF Y/4=INT(Y/4) THEN 29 ELSE Y=Y-1: GOTO 27
29 Y=Y/4
30 T=Y+Y1+N(M)+D
32 T1=FIX(T/7): T2=T-(T1*7): IF Y1=00 THEN 50
40 IF Y1/4=INT(Y1/4) AND M=1 THEN T2=T2-1 ELSE
   IF Y1/4=INT(Y1/4) AND M=2 THEN T2=T2-1
50 REM CHANGE THIS LINE FOR 1800'S AND 2000'S
60 PRINT "THE DAY IS: "; D$(T2): ".": PRINT
70 T=0: GOTO 20
100 DATA 1,4,4,0,2,5,0,3,6,1,4,6
110 DATA SAT,SUN,MON,TUE,WED,THU,FRI
```

That's most of the *Copier* features, which are many and varied, and which you can take days or weeks exploring before you find out all the program can do. (It can simulate a page up to 255 characters wide, for one thing.) If the price seems high, consider that Radio Shack's *Script* alone is \$99.95; for an extra \$30 you get a word processor with many features not found in *Script*, plus a graphics generator with a great many fascinating capabilities. If you want to combine words and pictures, *Copier* provides what may well be the only way to do it directly.

Short Program #35: Calendar

Max Salm of Stillwater, MN wrote to say he "recently picked up the latest issue of *Oz* magazine and quickly flipped to my favorite section: Games."

"I was very interested in the unique mathematical way they showed to determine the day of any given date. I decided to use this method to produce what I

think is the shortest Basic program ever written that does it.

"Note: The data are important and must be correct. Those twelve numbers are the key numbers for each month used in the formula in lines 29-32. That's the complete listing... all nine lines of it!"

The program as it sits will determine the day during the 1900's only. Line 50 must be changed for the 1800's and 2000's.

For the 1800's: 50 T2=T2+2
For the 2000's: 50 T2=T2-1

"The program could be easily modified to make these adjustments automatically. Simply input the year as four digits instead of two."

"1900 and 1800, although divisible by four, are not leap years. The program allows for this in the last part of line 32. Years such as 2000 and 4000 are leap years because they are divisible by 400. If you wish to input the year 2000, make sure the last part of line 32 is removed. The last part of line 32 simply jumps over the leap-year determinant if you input 00 for the year.

"If you have any questions, see pages 152-3 of the November 1981 *Oz* magazine."

Max's original program (which of course he submitted some time ago) did contain only nine lines, but I stretched it out a little to make it more readable and to fit this column.

The calendar item Max refers to in *Oz* is called "You too can be an idiot savant," and tells how, by memorizing a method and certain numbers, including those in DATA line 100, you can amaze people by giving the day for any particular date, with just a few moments of mental calculation. The method is fairly simple, but you'd have to use it quite often to be able to remember it for any length of time.



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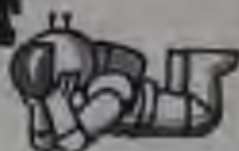
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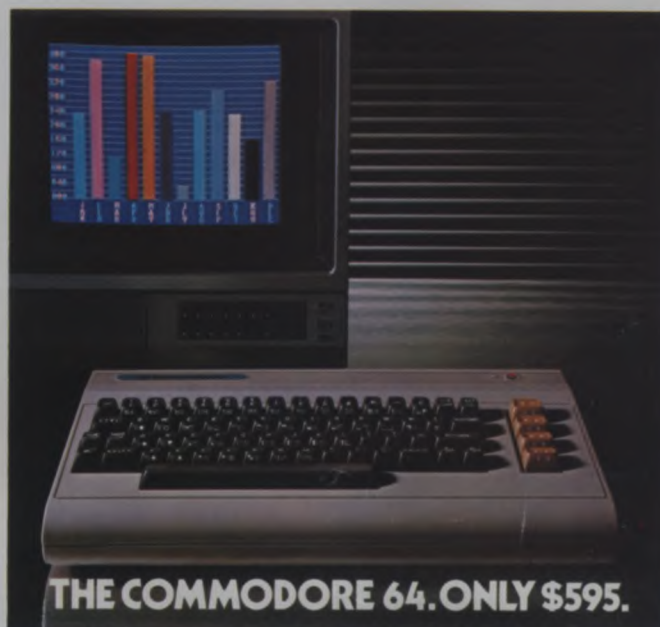
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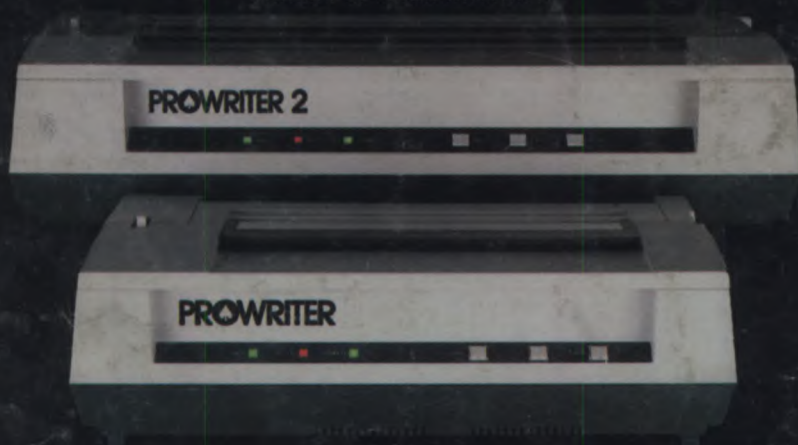
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