The Digital Window: Computer Graphics Today And Tomorrow

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$2.95
May
1986
Issue 72
Vol. 8, No. 5
$3.75 Canada
02193
ISSN 0194-357X

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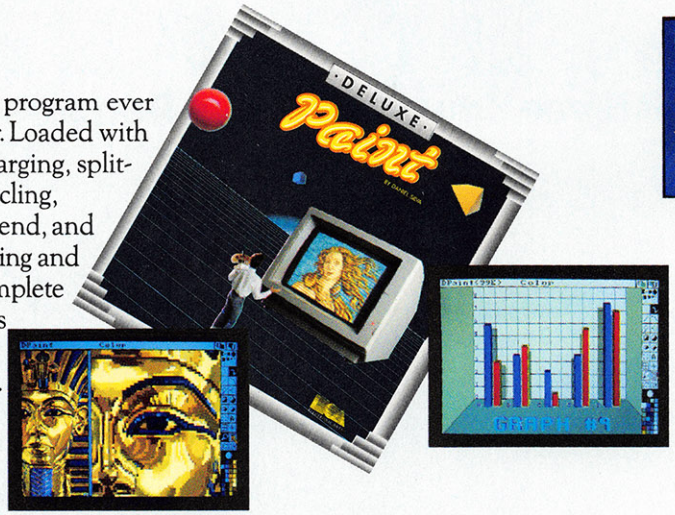

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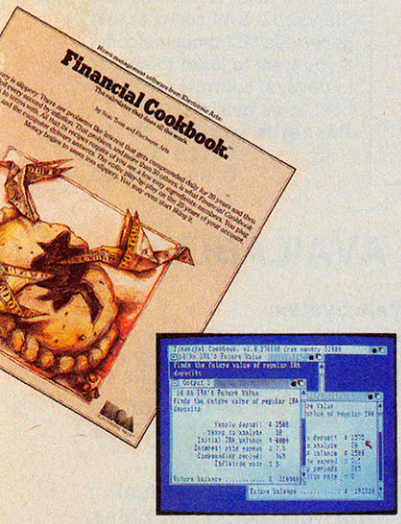

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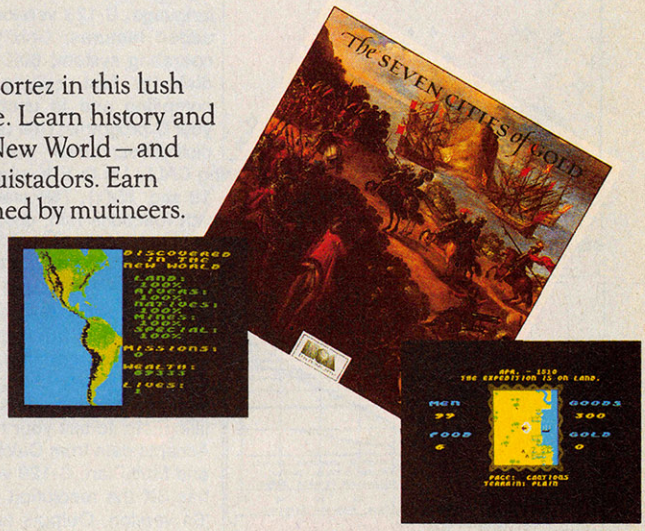

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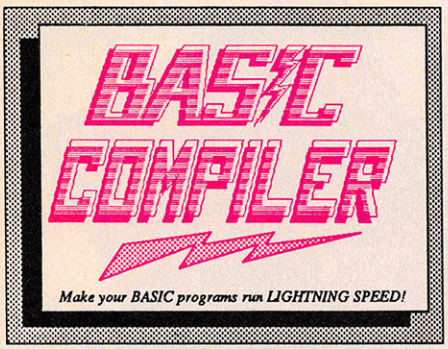

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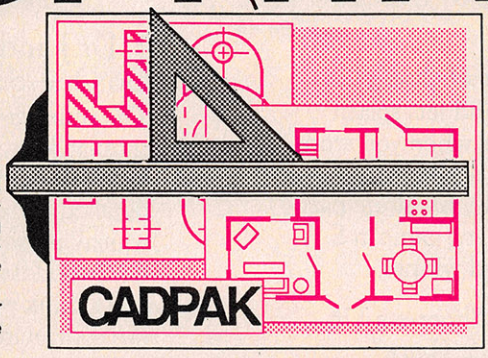

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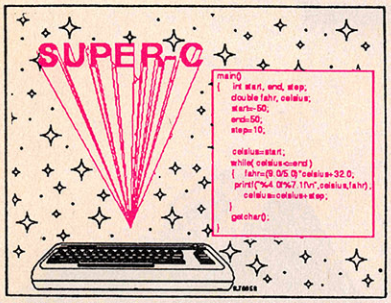

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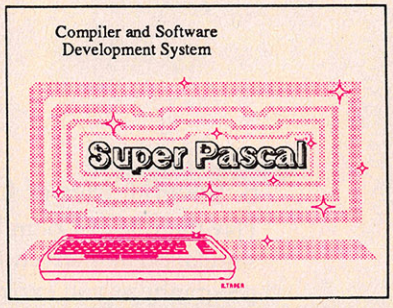

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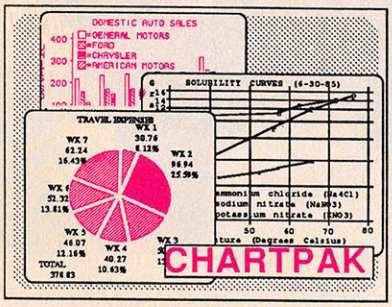

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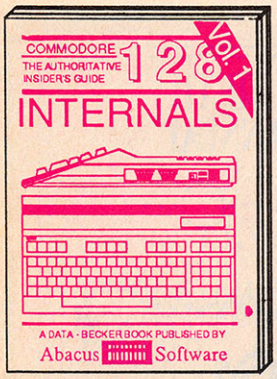

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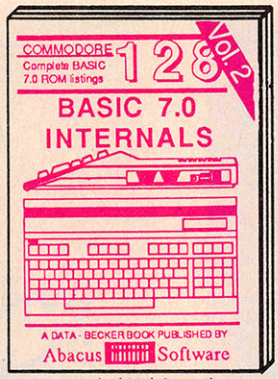

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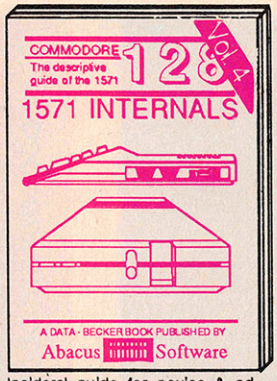

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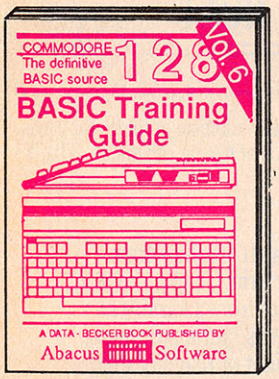

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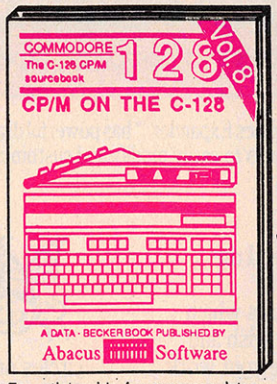

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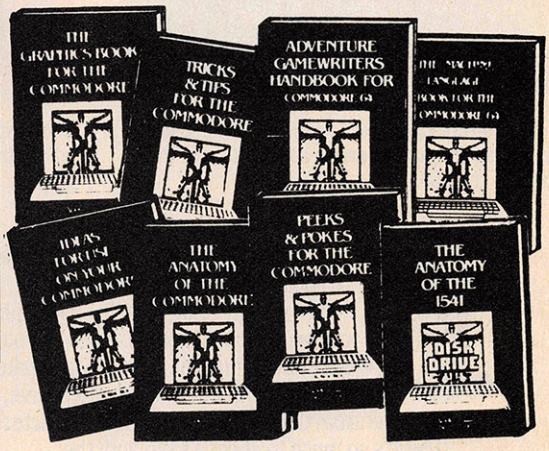

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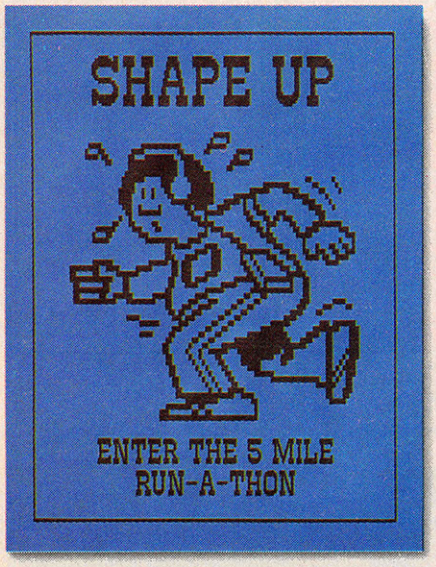

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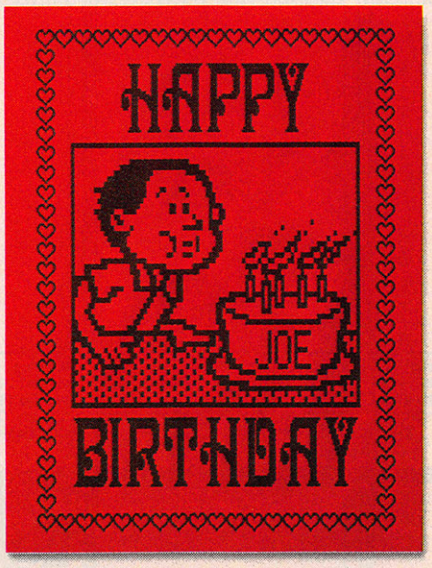

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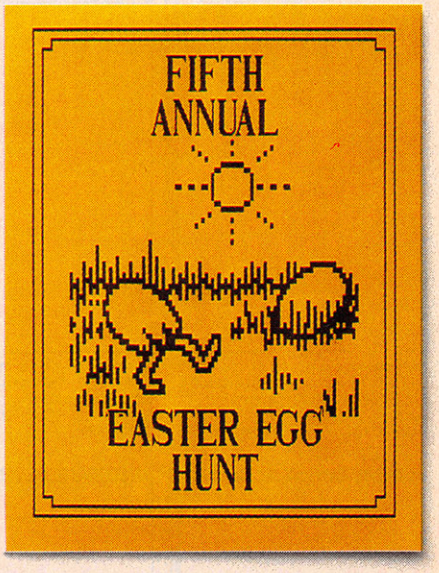

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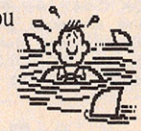

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COMPUTE!

MAY 1986
VOLUME 8
NUMBER 5
ISSUE 72

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Editor's Notes

A recent book, *Alan Turing: The Enigma*, is a fascinating study of the life of a brilliant scientist and of the development of early "computing engines" which helped decode secret German messages and significantly contributed to the Allied victory in World War II.

Turing worked with primitive decoders. Called *Bombes* because they ticked loudly, they were something like old-style adding machines, computing with gears and wheels—all mechanical in the days before the electronic revolution. In fact, much of the computation was done by hundreds of women on an assembly line:

> ...the Bombes ticked away, getting on with the work...while the Wrens [Women's Royal Naval Service] did their appointed tasks, without knowing what any of it was for. He [Turing] was fascinated by the fact that people could be taking part in something clever, in a quite mindless way.
>
> Machines, and people acting like machines, had replaced a good deal of human thought, judgment, and recognition. Few knew how the system worked, and for anyone else, it was a mystic oracle, producing an unpredictable judgment. Mechanical, determinate processes were producing clever, astonishing decisions.

Indeed, this large room of workers surrounding the Bombe suggested nothing to Turing so much as a giant machine. Here a group was mechanically adding results; over there was another crew responsible for feeding information back into the Bombe. Some people had to file information, some had to compare a template against each new pattern as it was passed down the line. We can now easily recognize that these activities are the elements of computers and software: RAM, ROM, masking, CPU, feedback loops, branching, and so forth. In those days, however, it took genius to see that the Bombe could be expanded to take over and speed up the functions of the hundreds of clerks working around it.

U-boats were sinking ships all over the Atlantic. Turing and his associates were always working against time, trying to decode messages faster. Eventually, they began to experiment with ways to store information electronically. It's intriguing to read of their efforts to hold onto a few bits of information for a brief time. One of the best solutions they came up with was to store the bits in a cathode ray tube, an early TV screen. This had the advantage that you could amuse yourself by watching the bits flickering while they briefly rested until needed again by the central processor.

But Turing's most famous contribution to computing is the related concepts we now call the *Turing machine* and the *Turing test.* His idea of the machine revealed that he achieved the first comprehensive understanding of the possibility of artificial intelligence. He imagines a universal machine, one that could perform the job of all the other, more specialized, machines. Adding machines operated according to fixed rules which were reflected in their metal cogs and gears. The Bombe, too, performed its job because its mechanism was physically shaped in certain ways.

Turing thought of "tapes" which could contain instructions describing the "state of mind" of the adding machine, the bombe, or any other calculating engine including human "computers." A tape could be fed into a supermachine, and it would then adapt to the state of mind, the description of some other machine, contained on the tape. In this way, the supermachine could "perform the equivalent of human mental activity. A single machine to replace the human computer! An electric brain!"

By the 1950s, Turing had completely formulated another startling concept: How can you tell if a machine is truly *thinking*? The Turing test is deceptively simple: If a questioner cannot tell the difference between written answers from two intelligences, then, for any practical purpose *there is no difference between the intelligences.*

> He imagined a game in which an interrogator would have to decide, on the basis of written replies alone, which of two people in another room was a man and which a woman.... They would alike be making claims such as "I am the woman, don't listen to him!".... A successful imitation of a woman's responses by a man would *not* prove anything. Gender depended on facts which were *not* reducible to sequences of symbols. In contrast, he wished to argue that such an imitation principle did apply to "thinking" or "intelligence." If a computer, on the basis of its written replies to questions, could not be distinguished from a human respondent, then "fair play" would oblige one to say that it must be "thinking."
>
> ...he produced an argument in favor of adopting the imitation principle as a criterion. This was that there was no way of telling that other *people* were "thinking" or "conscious" except by a process of comparison with oneself, and he saw no reason to treat computers any differently.

Turing expected a machine to pass his test around the end of this century:

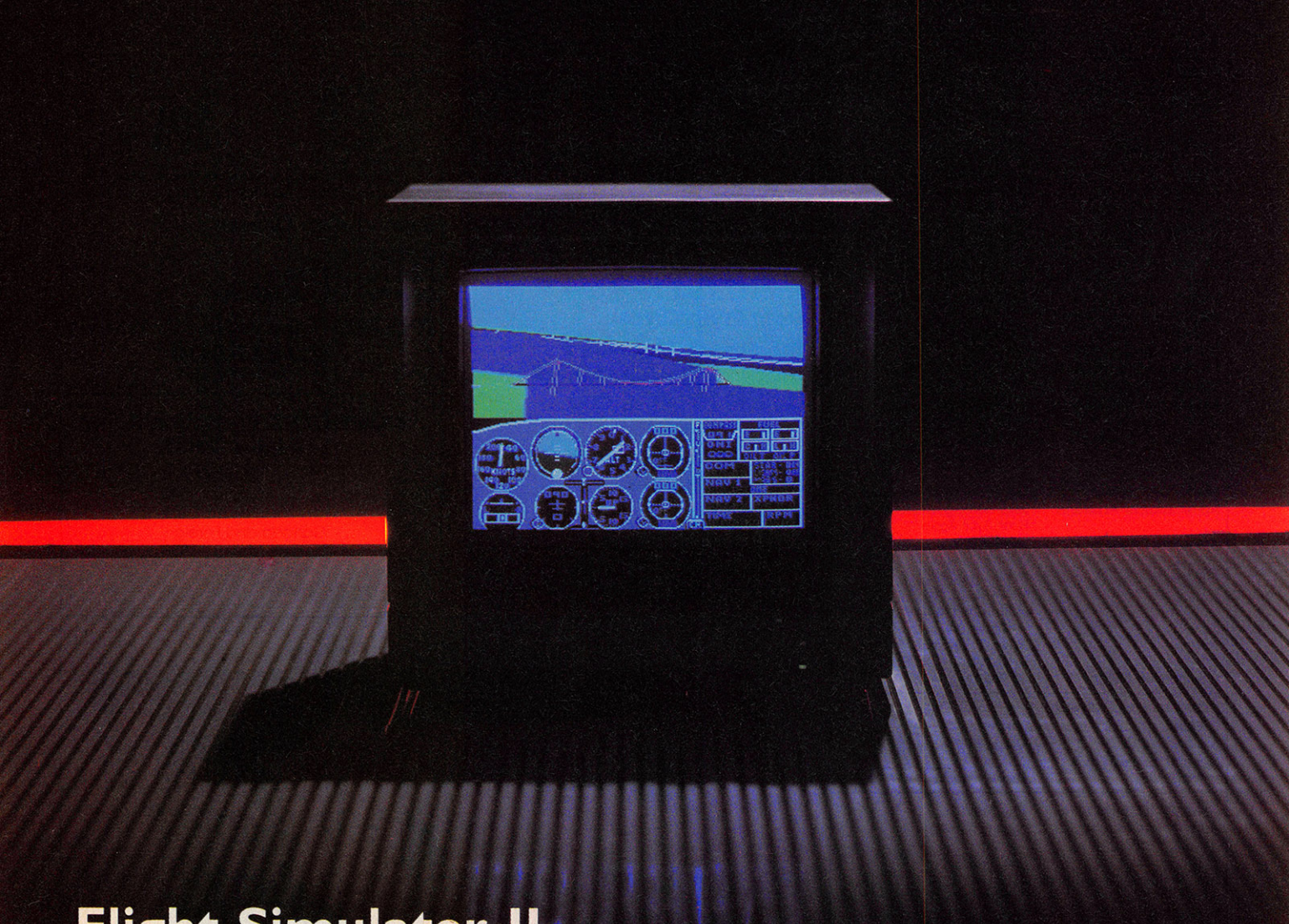
> I believe that in about fifty years' time it will be possible to programme computers, with a storage capacity of about 10^9, to make them play the imitation game so well that an average interrogator will not have more than 70 per cent chance of making the right identification after five minutes of questioning. The original question, "can machines think?" I believe to be too meaningless to deserve discussion. Nevertheless I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted.

Ten to the ninth power is 122,070K or 119 megabytes. (Turing's 10^9 represents bits). One hundred and nineteen megabytes is not an uncommon storage capacity nowadays—we've got more than that here at COMPUTE! in the hard disks servicing our minicomputer editing system. Yet our system would never pass the Turing test.

Nonetheless, Turing's machine, his test, and his other ideas continue to have enormous impact, and *Alan Turing: The Enigma* is a lively, understandable portrait of a major thinker's life and ideas. If you're curious about where computers came from and where they're likely to go from here, you'll enjoy this book very much indeed.

Richard Mansfield

Senior Editor



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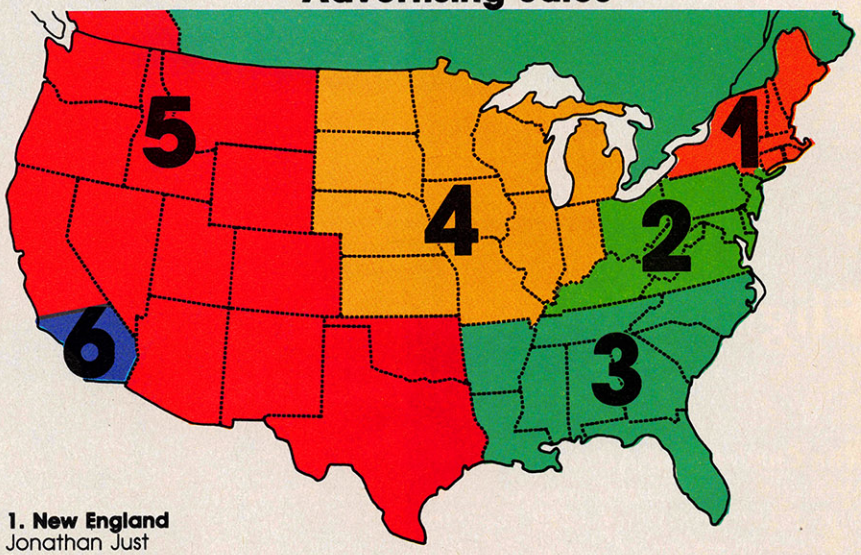

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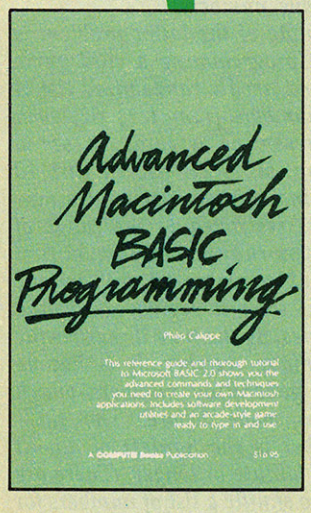

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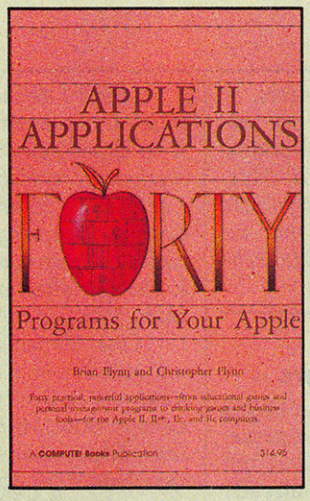

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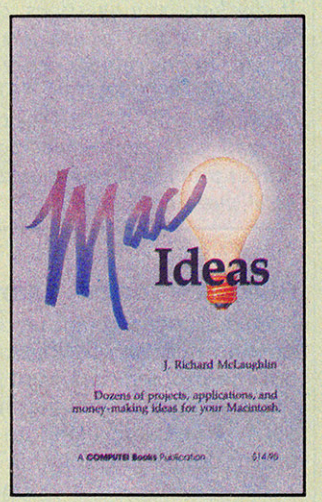

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Readers Feedback

The Editors and Readers of COMPUTE!

If you have any questions, comments, or suggestions you would like to see addressed in this column, write to "Readers' Feedback," COMPUTE!, P.O. Box 5406, Greensboro, NC 27403. Due to the volume of mail we receive, we regret that we cannot provide personal answers to technical questions.

Unique Random Numbers

I am writing a program that requires random numbers to control the game, but the problem is I want to filter out the random numbers that have already been picked. I'm using an Atari computer. What's the solution?

Daren O'Brien

There are a couple of solutions to this problem, and they apply to nearly any version of BASIC. Which method is fastest and most efficient depends on the particular requirements of your program. You may be writing an arcade-style game which needs to position characters or objects randomly about the screen, each in a different location; or you may be writing a card game simulation that requires a "shuffled" pile of 52 random numbers.

The most common approach is to generate a random number, check it against a list of previously generated random numbers stored in an array, and then generate a new number if there's a match. This can be done by a subroutine that your program calls whenever it needs a unique number. Here's an example in Atari BASIC that works with little or no modification in most other BASICs:

```
10 SIZE=100:DIM ARRAY(SIZ
   E):A=1
20 FOR J=1 TO SIZE:ARRAY(
   J)=0:NEXT J
30 GOSUB 1000:REM GET UNI
   QUE RANDOM NUMBER
40 PRINT "UNIQUE VALUE #"
   ;A-1;" = ";RNUM
50 IF A<SIZE+1 THEN 30
60 END
1000 RNUM=INT(RND(1)*1000
     +1)
1010 PRINT RNUM
1020 J=1
1030 IF RNUM=ARRAY(J) THE
     N 1000
1040 J=J+1:IF J<SIZE+1 TH
     EN 1030
1050 ARRAY(A)=RNUM:A=A+1:
     RETURN
```

Line 10 defines the size of the array which stores the random numbers and sets A=1 as an index into the array. You can change the variable SIZE, of course, to create any size array you need. Line 20 clears out the array with zeroes. The statements in these two lines should be placed in the initialization section of your program, followed by your own code.

Line 30 calls the random number subroutine, which begins at line 1000. The statement in line 1000 generates a random number (RNUM) between 1 and 1000 in Atari BASIC. Make whatever changes are appropriate for your particular program or version of BASIC. Line 1010 can be omitted in your own program—it simply prints the newly generated random number on the screen for this demonstration. Lines 1020–1040 set up a loop which compares RNUM to each element in the array. If a match is found—meaning the random number was previously generated and stored in the array—the program goes back to line 1000, which makes a new random number and repeats the process. If no match is found anywhere in the array—meaning the random number is unique—the program continues to line 1050. This line adds the number to the array, increments the array index (A=A+1), and finally ends the subroutine with a RETURN.

(Incidentally, some of you may be wondering why we didn't use a FOR-NEXT statement for the loop in lines 1020–1040. We didn't because the IF-THEN statement in line 1030 frequently jumps out of the loop back to line 1000 whenever it finds a match, and this could eventually cause a stack overflow and out-of-memory error.)

Lines 40 and 50 can be omitted from your own program. They merely print the random numbers on the screen for this demonstration.

This method of generating unique random numbers works, but suffers from a few problems. For one thing, if you need a great many random numbers, or if you can't predict how many you'll need as your program runs, your computer may not have enough memory for the large array that's required. Also, if the number *of random numbers you need coincides with the allowable* range *of the random numbers, this routine slows down almost to a crawl as it struggles to generate the last few unique numbers.*

An example of the latter problem is when you're programming a card game simulation and need a randomized list of 52 unique numbers from 1 to 52, each number representing a card. To see a demonstration, set SIZE=52 in line 10 and modify line 1000 so it generates random numbers restricted to the range of 1–52. When you run the program, at first it has no trouble coming up with unique numbers. But soon it begins exhausting the possibilities. By the time it reaches the forty-fifth unique number, it is having real trouble generating numbers which haven't been made before. The fifty-second number is the hardest of all—it might take a minute or longer. (There are better ways to shuffle a list of numbers for card games, but we haven't room to cover them here.)

If repeated calls to this subroutine slow down your program too drastically, rewrite it slightly to fill the array with all the unique numbers your program will need. Then call the routine just once, as your program initializes. Later, whenever your program needs a unique random number, it can simply pull a number out of the array, incrementing a counter each time so the same number isn't retrieved more than once.

Wide *SpeedCalc* Printouts

Does *SpeedCalc* work with the *Sideways* program? I would like the ability to print out a spreadsheet with lots of columns.

Stephen Forstein

Because SpeedCalc *allows as many as 50 cells per horizontal row, many worksheets can't be printed on a standard 80-column printer. For example, a 12-month worksheet with an extra left cell for row titles and an extra right column cell for totals will be 126 columns wide (if you use the default column width of nine characters per cell). If you print this in the normal manner, you'll find that each worksheet row wraps to one and a half lines on the printout, making the sheet difficult to read.*

A crude solution is to divide the completed sheet into several sections—each no more than 80 columns wide—then print the sections separately and tape them together. Condensed printing mode offers a more elegant solution, if

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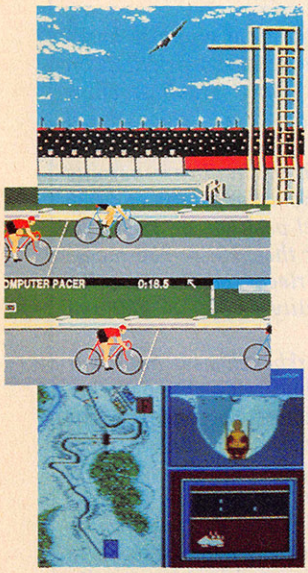

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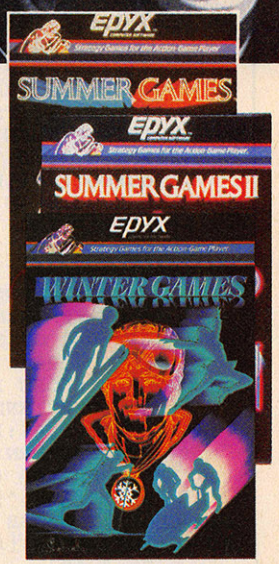

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your printer supports it (Commodore printers do not). On most printers this allows a 132-character line, enough for more than 14 default-width cells across. You'll need to set the printer for condensed printing before you run SpeedCalc, *either by setting the appropriate DIP switch on the printer or by sending the proper command codes. For example, CHR$(15) works for Epson and Epson-compatible printers. You may have to use "transparent mode" to send this command through your interface. For instance, Cardco interfaces require OPEN 4,4,4: PRINT#4,CHR$(15): CLOSE 4.*

With the Commodore (January 1986) and Apple (February 1986) versions of SpeedCalc, *the commercial program* Sideways *does let you print your sheets vertically down the page instead of horizontally across. This allows you to print spreedsheets of virtually unlimited width. The only restriction is that* Sideways *requires ASCII text files. For the Apple, just use Open Apple-CTRL-P to print a copy of the sheet to disk. For the 64/128, the procedure is slightly more complicated, since* Sideways *requires that the data be in a SEQ (sequential) file and* SpeedCalc *prints a PRG (program) file to disk. (The* SpeedCalc *article in the January issue is in error when it states that printing to disk stores the data in a sequential file.) To use* Sideways *with Commodore* SpeedCalc, *you must print (not save) the sheet to disk, then convert the printed data file from PRG format to SEQ format. The short program below performs this conversion:*

```
10 PRINT"{CLR}{DOWN}{RVS} PRG
    {SPACE}-> SEQ FILE CONVE
    RTER ":Z$=CHR$(0):OPEN 3
    ,8,15,"I0:":GOSUB 100
20 FP$="":INPUT"NAME OF PRG-TY
    PE FILE";FP$:IF FP$="" T
    HEN 20
30 OPEN 1,8,8,"0:"+FP$+",P,R":
    GOSUB 100:IF S THEN CLOS
    E 1:GOTO 20
40 FS$="":INPUT"NAME FOR SEQ-T
    YPE FILE";FS$:IF FS$=""
    {SPACE}THEN 40
50 OPEN 2,8,9,"0:"+FS$+",S,W":
    GOSUB 100:IF S THEN CLOS
    E 2:GOTO 40
60 PRINT"WORKING...";:GET#1,A$
    ,A$
70 GET#1,A$:A=ASC(A$+Z$):S=ST:
    PRINT#2,CHR$(A);:IF (S O
    R ST)=0 THEN 70
80 IF (S<>64) OR ST THEN A$=""
    :GOTO 120
90 CLOSE 2:CLOSE 1:CLOSE 3:PRI
    NT"DONE":END
100 INPUT#3,S,A$:IF S=0 THEN P
    RINT:RETURN
110 IF (S=62) OR (S=63) THEN P
    RINT"{RVS}";A$:RETURN
120 CLOSE 2:CLOSE 1:CLOSE 3:PR
    INT"{DOWN}{RVS}DISK ERRO
    R: ";A$
```

Sideways *is a product of Funk Software (222 Third Street, Cambridge, MA 02142); the Commodore 64/128 version is distributed by Timeworks, Inc. (444 Lake Cook Road, Deerfield, IL 60015).*

Atari ST Languages

What languages are available for the Atari ST?

Randy Johnson

Atari includes ST BASIC and Logo with the purchase of an ST system. Below is a list of additional languages available or under development for the ST at the time of this writing (mid-February). This list is by no means complete—new ST applications, including languages, are announced on an almost daily basis. Your Atari dealer is a good source of information about new products. You should also keep an eye on the product evaluations in COMPUTE!'s *"Reviews" and "News & Products" sections. Advertisements are timely information sources as well, since it's common for a developer to announce a product in ads before actually releasing it on the market.*

Language	*Company*
Compiled BASIC, Henry's Fundamental BASIC, C, Pascal, FORTRAN	*Philon 641 Avenue of the Americas New York, NY 10011*
Haba Hippo-C	*Haba Systems 15154 Stagg Street Van Nuys, CA 91405*
Lattice C, Meta Pascal, Macro Assembler Editor	*Antic Software 524 Second Street San Francisco, CA 94107*
Personal Pascal, Personal Prolog	*Optimized Systems Software (OSS) 1221-B Kentwood Avenue San Jose, CA 95129*
4 × FORTH	*The Dragon Group 148 Poca Fork Road Elk View, W. VA 25071*
Modula-2	*TDI Software Inc. 10410 Markison Road Dallas, TX 75238*

Reading Apple Keys

I have just read Apple *SpeedCalc* in COMPUTE!'s February 1986 issue and noticed that the program's commands use the Open Apple and Closed Apple keys. How do you read those keys? They don't show up in INPUT statements or when the keyboard is read. Can I access them from BASIC or only from machine language?

David Reed

The Open Apple and Closed Apple keys, which appear only on Apple IIe and IIc computers, are easy to read from BASIC or machine language. Both can be read in BASIC by PEEKing certain memory locations. The value in location 49249 ($C061) is 128 or greater if the Open Apple key is pressed, and less than 128 if it is not. Location 49250 ($C062) gives the same information for the Closed Apple key. Here's a program fragment that gets a keypress and also checks these two special keys:

```
100 GET K$ : REM WAIT FOR A
    KEYPRESS
110 OA = PEEK(49249) : CA =
    PEEK(49250)
120 IF K$="a" AND OA >= 128 AND
    CA < 128 THEN GOSUB 1000
```

These statements call a subroutine at line 1000 if Open Apple-A is pressed, but not if Open Apple-Closed Apple-A is pressed.

Amiga Graphics Update

We enjoyed your article on the graphics for Commodore's new Amiga computer ["Amiga's Amazing Graphics," COMPUTE!, November 1985]. Most of the information was very accurate, and the picture describing bit plane graphics was particularly effective. There was some inaccuracy, however. The actual color map at 640 × 200 resolution is the same as it is at 320 × 200, and there are no restrictions on adjacent pixels. Somehow, you must have gotten some old documentation. Also, although Intuition supports dual playfield mode, it does not do multiple screens using dual playfield mode—it uses the video coprocessor to rewrite the display parameters. This is much more flexible, as *any* display parameter can be changed instead of just the color map. You can change resolution, color map, or number of bit planes between screens running simultaneously.

Glenn Keller
Commodore-Amiga, Inc.

We appreciate your comments. At the time we wrote the article, we were working with the prerelease Hardware Manual, *which described an earlier version of the graphics chips.*

As you say, the final graphics hardware does not impose any restrictions on color resolutions. Early graphics chips could not fully change the color signal between adjacent pixels in 640 × 200 mode, but the current hardware permits any of 16 colors (from the palette of 4,096 colors) at any pixel position, or 32 simultaneous colors for the 320 × 200 mode. The 400-line interlaced modes have the same color capability as 320 × 200 and 640 × 200.

Since the Workbench uses only four colors (two bit planes), we assumed that dual playfields (where two independent screens can be overlapped and merged) were used to support pull-down custom screens. Since every multitasking application can call for its own custom bitmap, Intuition allows these custom screens to be overlapped and repositioned vertically with the mouse. This effect can be seen

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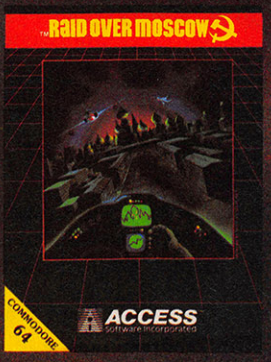

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when you click and drag the menu bar with the left *mouse button. When the left button is held down, pulling the mouse downward reveals the background AmigaDOS screen. It's also possible to switch between a custom screen and the Workbench screen by pressing either Left Amiga-M or Left Amiga-N.*

The special copper *(as in coprocessor) circuitry tracks the video beam on the fly. The copper's instruction list, similar in concept to Atari 800 display lists, can perform any video change at any line, as with display list interrupts (Atari) or raster interrupts (Commodore). The operating system permits applications to modify the copper list, giving full video control to the application, while using the copper list itself for the graphic effect of overlapping screens. A* copper wait *instruction tells the copper to wait until the video beam reaches a certain line, and then the video registers are reset to display another screen. The normal display is automatically reset at the top, so you get two overlapping screens, even with different colors and resolutions.*

TI Tips Book

In an effort to provide easily accessed documentation to TI users, I have put together a TI tips booklet that consists of 99 tips for the TI-99/4A. These are a compilation of suggestions given in our user group newsletter. They include PEEKs, POKEs, listings, hints, and so on. Also included is a complete disk drive memory map, summary of Extended BASIC commands, and a sorting program written in BASIC and machine language. One such tip that may interest your readers allows them to disable FCTN = (QUIT) in Extended BASIC. To do this, enter this statement:

CALL INIT :: CALL LOAD(−31806,16)

To enable it again, type CALL LOAD(−31806,0). Another POKE allows you to prevent Extended BASIC programs from being listed. Type CALL LOAD(−31931,128) to do this. To unprotect Extended BASIC programs, enter CALL LOAD(−31931,0). The TI tips booklet is available through the Central Iowa 99/4A Users Group for $4 (the cost of materials, printing, and postage) at the following address:

Central Iowa 99/4A Users Group
Box 3043
Des Moines, IA 50316

John Hamilton

Thank you for providing this information.

Setting Atari Tabs

I read with interest your examples of programming Atari tab stops using memory location 201. This location is in the BASIC zero page RAM because it is used only by BASIC, and can only be used with PRINT statements containing commas. The true tab function is executed by the operating system (the text editor). It is associated with memory locations 675–689. These memory locations form the tab set map. The highest bit of location 675 corresponds to column zero, and the lowest bit of location 689 corresponds to column 120 of the logical line. Normally every eighth bit is set (as can be seen by experimenting with the TAB key). This can be changed either with the TAB CLEAR and TAB SET keys or by POKEing values to the map locations. For example the following program clears the map with POKEs, then prints the heading while using the TAB SET character, CHR$(159). Then the names and addresses are printed while using the TAB character, CHR$(127).

```
10 FOR I=675 TO 689:POKE
   I,0:NEXT I
20 DIM NAME$(10),ADDRESS$
   (25),TAB$(1),TABSET$(1
   )
30 TAB$=CHR$(127):TABSET$
   =CHR$(159)
40 PRINT "NAME{13 SPACES}"
   ;TABSET$;"ADDRESS"
50 PRINT
60 FOR A=1 TO 4
70 READ NAME$;ADDRESS$
80 PRINT NAME$;TAB$;ADDRE
   SS$
90 NEXT A
100 END
110 DATA ADAMS,12 MAIN ST
    REET
120 DATA ARTHUR,1515 SUNN
    Y STREET
130 DATA SMITHSON,100 CIR
    CLE DRIVE
140 DATA WEEKS,2 DONNA LA
    NE
```

Sherwood Stolt

Thank you for the additional information.

Custom Characters For Plus/4 And 16

I was wondering how the Commodore Plus/4 can generate user-defined characters and where I would POKE them into memory.

Sean Donovan

The following program redefines the @ character as the familiar Commodore logo symbol.

```
FX 10 FORA=828TO860:READB:POKE
      A,B:NEXT:SYS828
AM 20 POKE65298,PEEK(65298)AND
      251
HP 30 POKE65299,PEEK(65299)AND
      3OR60
SR 40 FORA=15360TO15367:READB:
      POKEA,B:NEXT
JA 50 DATA 169,60,133,3,169,0,
      133,2,133,4,169,208,133
AC 60 DATA 5,162,3,160,0,177,4
      ,145,2,136,208,249,230
SK 70 DATA 3,230,5,202,16,242,
      96
HD 80 DATA 98,146,130,130,144,
      98,0,0:REM CUSTOM CHARAC
      TER DATA
```

Two memory locations are important for custom characters on the Commodore Plus/4 and 16. Bit 2 of location 65298 controls whether character data is fetched from ROM or RAM. The POKE in line 20 switches from the normal ROM character definitions to a custom character set in RAM. The upper six bits of location 65299 tell the computer where the character set is located in memory. When POKEing to location 65299 it is important not to disturb its lower two bits. To determine the number to POKE into this location, divide the starting address of the custom character set by 256. Since the example program puts the character set at location 15360, we use the POKE in line 30.

The program uses a machine language routine to copy the character set from ROM to RAM beginning at location 15360. To copy the character set to some location other than 15360, replace the second number in line 50 (currently 60) with the number you POKEd into line 30. Line 40 reads the custom character data from line 80 and POKEs it into the area reserved for the definition of the @ symbol.

IBM Mazes And Movement

I am trying to write a maze game for the IBM. How could I write the program to randomly generate a simple maze, allowing me to choose the dimensions, and make sure that it is a solvable one?

Aaron Greenberg

Few COMPUTE! *programs have spawned so many offspring as Charles Bond's maze generation algorithm, originally published in the December 1981 issue. The short and simple procedure generates a maze that's different every time the program is run, yet is always solvable. Here's a PC/PCjr adaptation for SCREEN 1, the medium-resolution graphics screen (for the PC, this requires a color/graphics adapter). In place of the PEEKs and POKEs of the earlier versions, this one uses BASIC's SCREEN, LOCATE, and PRINT statements:*

```
QK 100 KEY OFF:SCREEN 1,0:COLOR
       1,0:CLS:RANDOMIZE TIMER
DJ 110 MAXROW=23:MAXCOL=40:DIM P
       (3,1):FOR J=0 TO 3:READ P
       (J,0),P(J,1):NEXT
IE 120 DATA 0,2,-2,0,0,-2,2,0
DM 130 HL=8:YPOS=2:XPOS=2:LOCATE
        YPOS,XPOS:PRINT CHR$(5)
QO 140 J=INT(RND(1)*4):X=J
MP 150 NY=YPOS+P(J,0):NX=XPOS+P(
       J,1):IF NY<1 OR NY>MAXROW
        OR NX<1 OR NX>MAXCOL THE
       N 170
JP 160 IF SCREEN(NY,NX)=0 THEN L
       OCATE NY,NX:PRINT CHR$(J+
       1):LOCATE (YPOS+P(J,0)/2)
       ,(XPOS+P(J,1)/2):PRINT CH
       R$(HL):YPOS=NY:XPOS=NX:GO
```

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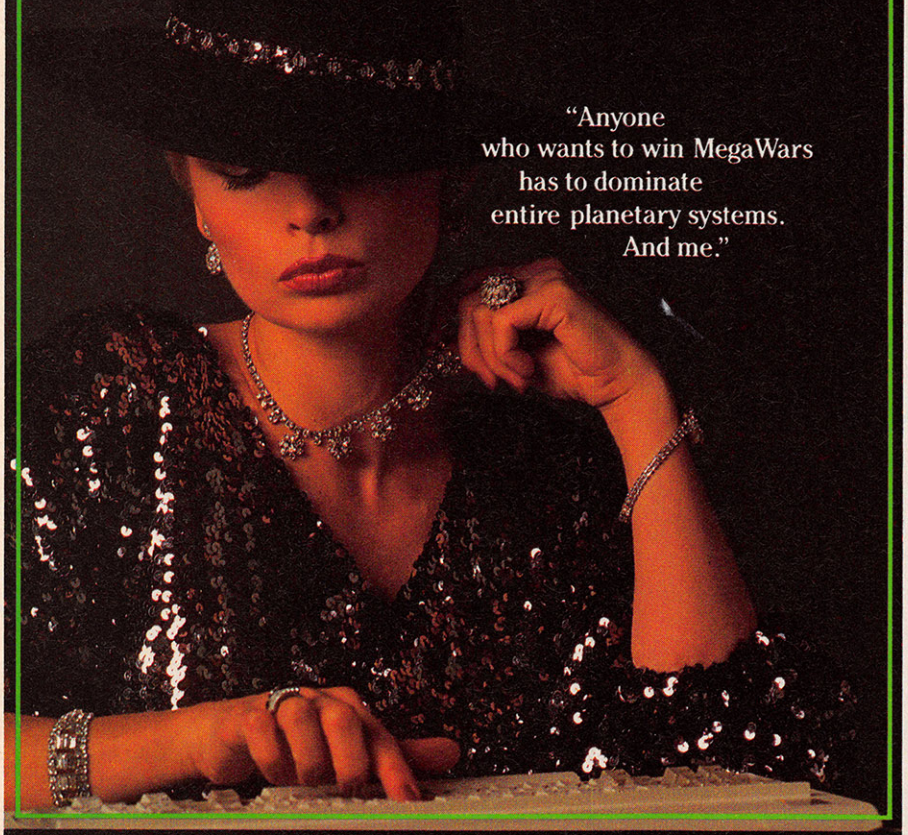

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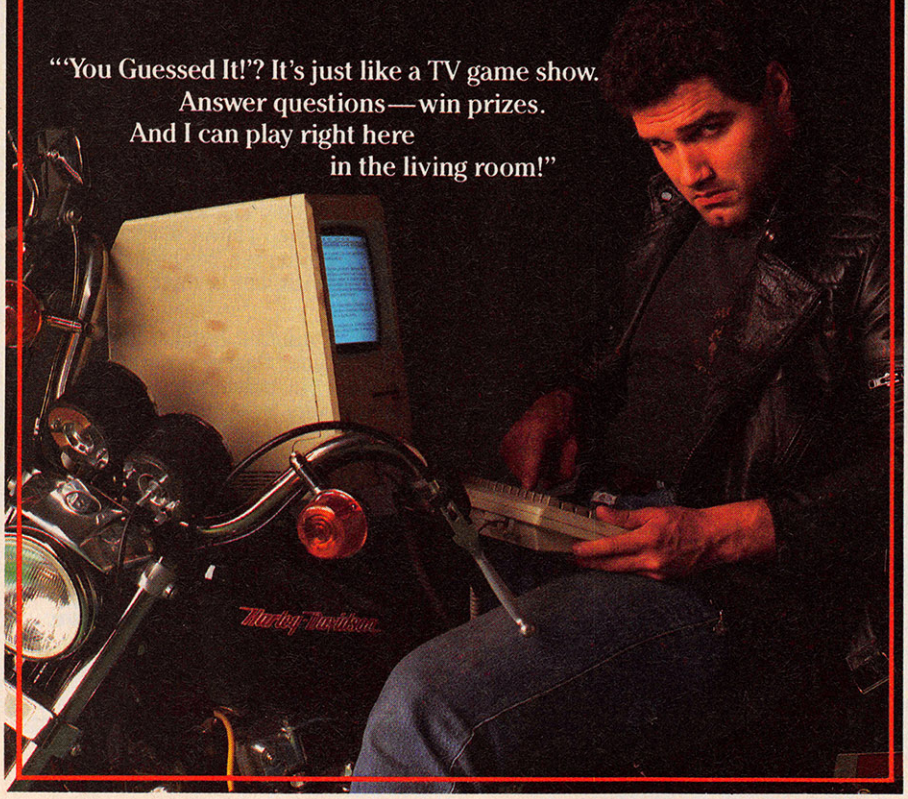


```
        TO 140
OC 170  J=(J+1)*-(J<3):IF J<>X TH
        EN 150
JK 180  J=SCREEN(YPOS,XPOS)-1:LOC
        ATE YPOS,XPOS:PRINT CHR$(
        HL);:IF J<4 THEN YPOS=YPO
        S-P(J,0):XPOS=XPOS-P(J,1)
        :GOTO 150
HB 190  GOTO 190
```

To customize the routine for your own use, change MAXROW and MAXCOL (line 110) for the maximum number of rows and columns in the maze. (Don't make MAXROW greater than 23, since printing on the bottom two lines of the screen causes scrolling.) As it stands now, the routine always starts constructing the maze from the upper-left corner. You can change this by changing the values of XPOS and YPOS (line 130). The values should always be at least 2, but less than MAXROW and MAXCOL. The variable HL (line 130) defines the character used for the paths of the maze. You can change this to any character you desire, but its value must be greater than 5 (lower values are used to draw the maze) and less than 128 (higher values are not available on the graphics screen). Unfortunately, this set of characters does not include a reverse space that would draw solid paths for the maze. It's up to you to define which end point is the finish of the maze.

Now that the maze is in place, it's an ideal time to answer a letter from R.C. Loveland, who wants to know how to use the IBM joystick. The joystick is an ideal tool for maneuvering a player through the maze, and BASIC's STICK and STRIG functions make it easy to read. IBM joysticks are "positional"; they return values that reflect the horizontal and vertical deflection of the stick relative to a simple coordinate system. In this system, coordinate 0,0 means the stick is pushed to the upper-left corner, and 255,255 means the stick is pushed to the lower-right corner. STICK(0) returns the horizontal (x) coordinate of the first joystick, while STICK(1) returns the vertical (y) coordinate. STICK(2) and STICK(3) perform the corresponding functions for the second joystick. The only special rule is that STICK(0) must be read first, before any other directions. (Even if you only want positions from the second joystick, you must read STICK(0) first.)

STRIG reads the status of the joystick buttons—most IBM joysticks have two, but only one per joystick can be read unless you're using BASICA. You must use the statement STRIG ON before you can read button status. After enabling button reading, STRIG(0) returns −1 if the primary button on the first joystick has been pressed since the last time STRIG(0) was called, or 0 if it has not been pressed. STRIG(1) is slightly different—it returns −1 if the primary button on the first joystick is currently pressed (regardless of its previous state), or 0 if it is not

pressed. STRIG(2) and STRIG(3) perform the corresponding functions for the primary button on the second joystick.

This system makes it easy to determine the position of the joystick. But in a situation like navigating the maze drawn by the routine above, what you really need to know is the direction *in which the stick is pressed. Add the lines below to the maze-drawing routine above:*

```
LO 190 CH=1:XPOS=2:XPOS=2:LOCATE
       YPOS,XPOS:PRINT CHR$(CH)
NK 200 XMOV=STICK(0)-XCTR:XJOY=S
       GN(XMOV):IF ABS(XMOV)<10
       THEN XJOY=0
JH 210 YMOV=STICK(1)-YCTR:YJOY=S
       GN(YMOV):IF ABS(YMOV)<10
       THEN YJOY=0
OB 220 NY=YPOS+YJOY:NX=XPOS+XJOY
       :IF NY<1 OR NY>23 OR NX<1
        OR NX>40 THEN 200
CO 230 IF SCREEN(NY,NX)=0 THEN 2
       00
JG 240 LOCATE YPOS,XPOS:PRINT CH
       R$(8):LOCATE NY,NX:PRINT
       CHR$(1):YPOS=NY:XPOS=NX:G
       OTO 200
```

Line 190 defines character 1 (the reverse-smiling face) as the player, then positions it at the start of the maze. Lines 200–210 calculate two directional values, XJOY and YJOY, based on how far the stick is moved from the center positions (XCTR and YCTR). XJOY is −1 if the stick is moved to the left, 1 if the stick is moved to the right, and 0 if the stick is not moved horizontally. YJOY is −1 if the stick is moved up, 1 if the stick is moved down, and 0 if the stick is not moved vertically.

The advantage of this system is that the screen player can be moved very simply in relationship to the joystick by adding the XJOY and YJOY values to the current position and using the LOCATE statement (lines 220 and 240). The sensitivity of the joystick can be adjusted by changing the value in the ABS test (lines 200–210). As shown, the joystick must be moved at least 10 increments in the desired direction for the change to register. This prevents small jiggles of the stick from causing unwanted movement. The test in line 230 prevents the player from leaving the maze. The SCREEN function returns 0 if no character has been printed in a position, while a maze path position will hold the value defined by HL in the maze-drawing routine.

One additional step is required to use this joystick routine. Each joystick returns slightly different readings, so it's difficult to predict what the values for the center coordinates will be. Thus, it's necessary to calibrate the joystick at the start of every program that reads it. The following lines show how this can be done:

```
PC 10 CLS:WIDTH 40:STRIG ON:PRIN
      T "Press fire button to se
      t center position."
PL 20 IF STRIG(0)=0 THEN 20
CO 30 XCTR=STICK(0):YCTR=STICK(1
      )
```

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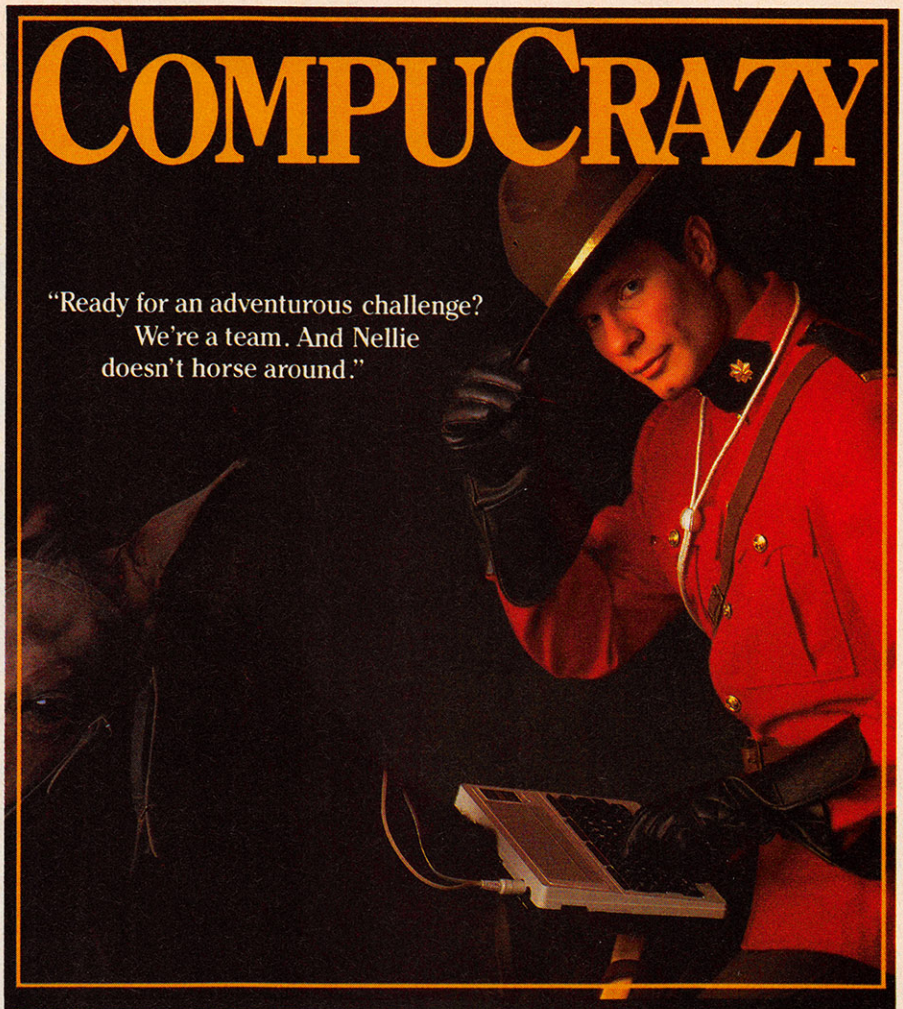

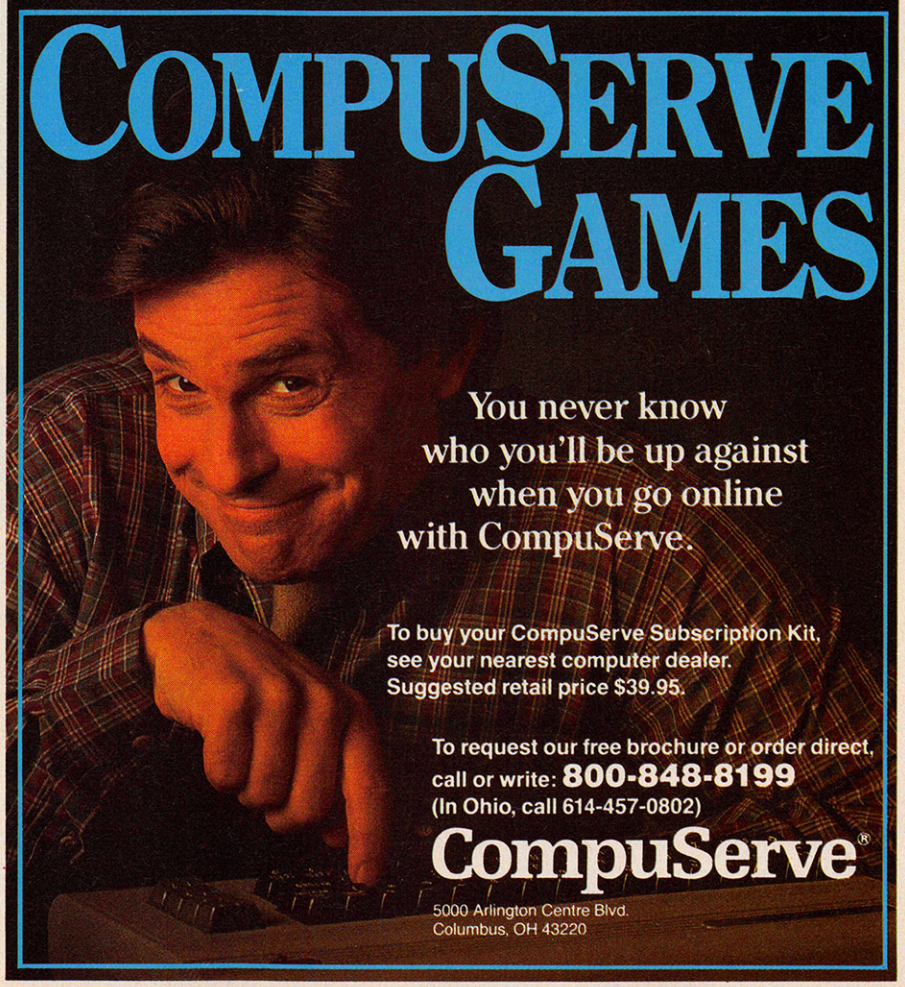

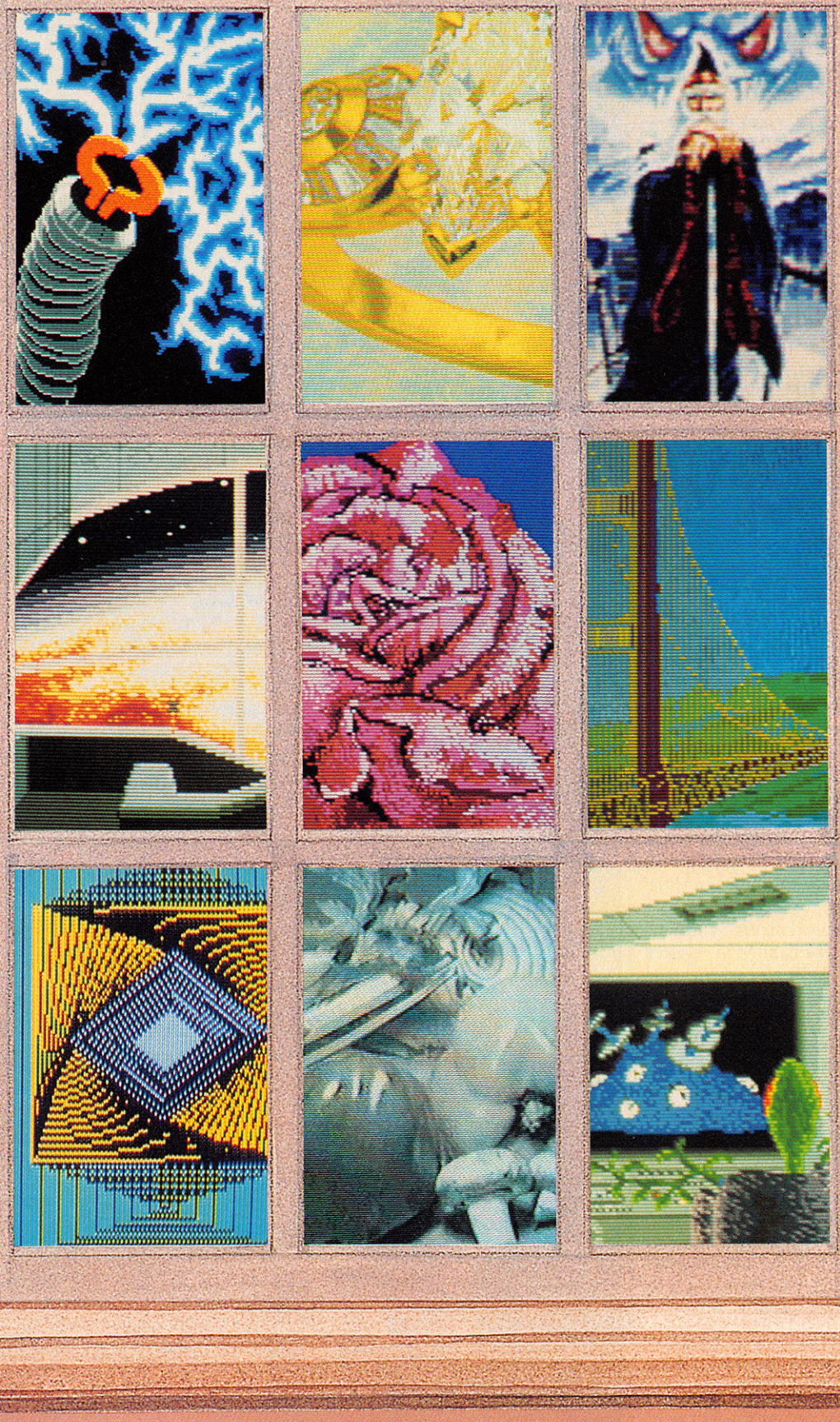

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Kathy Yakal
Assistant Features Editor

Maybe you've never thought of yourself as an artist, but maybe you've never had the right tools to experiment easily with shapes and colors. There's a lot of software available—ranging from simple drawing programs to digitizers to sophisticated animation creators—that lets you explore your talent. Some is even used by professional artists and animators.

Before there were words, there were pictures. Human beings have always communicated with art. Although the media have changed over the centuries, the need to express ourselves through pictures has always existed, even if it's just doodling on a legal pad while talking on the telephone.

Computers got into the act about 25 years ago when Ivan Sutherland, a graduate student at the Massachusetts Institute of Technology, programmed a computer to draw a straight line. Since then, computer-generated graphics have evolved rapidly. And they've been used for many business applications as well as for aesthetic purposes.

We're at an interesting stage in the evolution of microcomputer graphics in 1986. Many programs have been developed over the last few years for casual use on home computers. But the new 68000-based machines, such as the Atari ST and Commodore Amiga, offer graphics capabilities previously seen only on mini- and mainframe computers. The little computers are starting to catch up with the big ones.

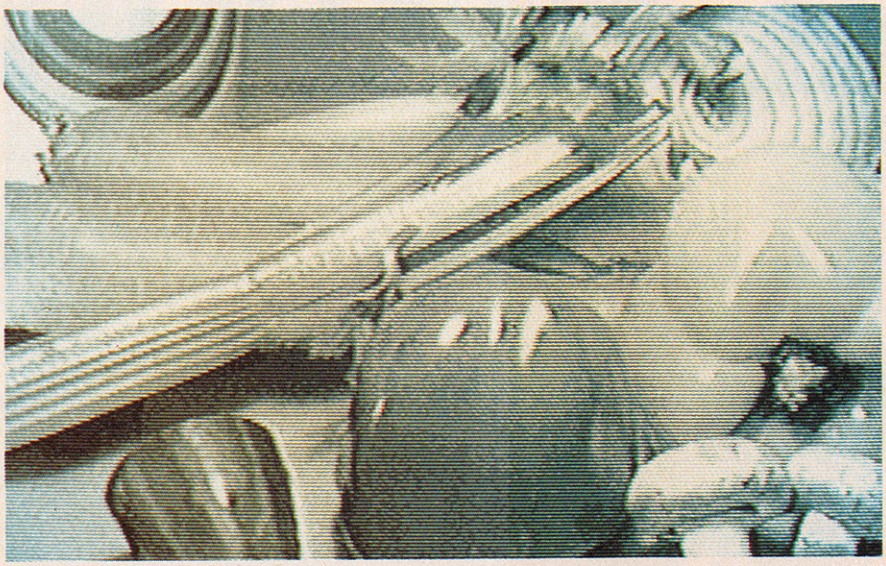
You probably see more computer-generated graphics every day than you realize, especially if you watch much television. Makers of rock videos use computers extensively to produce bizarre images and special effects. Station promos and title screens for movies, TV shows, and newscasts are commonly created with computers. Weather forecasters use computer equipment not only to track and predict weather conditions, but also to prepare graphic presentations for viewers. Usually, the graphics you see on TV

are created with dedicated work stations—special computers and programs designed specifically for advanced graphics applications.

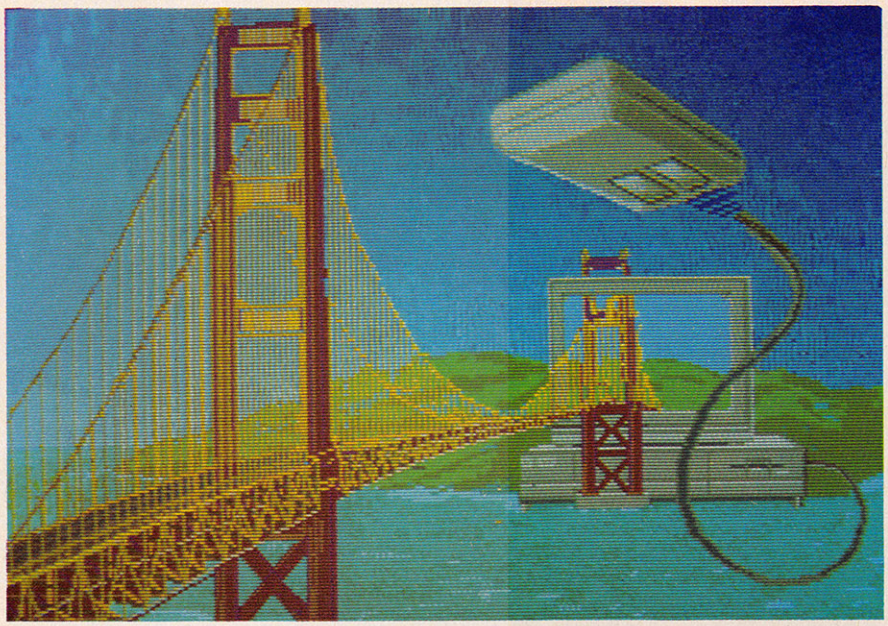
As the early microcomputer programmers explored applications for their machines, they came up with simple drawing programs. Though many of these programs were crude and difficult to use compared to what's available today, they allowed nonprogrammers to do something they couldn't do before: create images on a computer screen, using the keyboard or a joystick to select options and draw pictures.

In 1984, something happened that pushed the evolution of microcomputer graphics a bit further: Apple introduced the Macintosh. Two elements of this computer's design had a great impact on the next step in computer graphics. First, it used Motorola's 68000 microprocessor, a more sophisticated chip that allows higher-resolution bitmapped screens. Second, its user interface, incorporating pull-down menus and mouse control, made the Mac very easy for the average person to use.

In 1985, the Atari ST and Commodore Amiga hit the market, offering similar ease of use and superior graphics capabilities, including color. And since they cost less, both machines are opening up the computer graphics field to even more software developers and consumers.



Amiga LIVE, *a peripheral that accommodates digitization of real images on the computer screen, was used to create this picture. (Courtesy of Commodore-Amiga.)*



The Amiga's impressive graphics capabilities are well illustrated in this picture created using Aegis Images, *from Aegis Development.*

When you draw and paint a picture using traditional artist's tools, there are several processes required after visualizing what you're going to draw—though the order may vary from person to person. You draw shapes and fill some of them in. You mix different colors of paints to come up with just the right shade. You create backgrounds. And sometimes, you scrap the whole thing and start over.

Many draw-and-paint programs for computers let you do all of those things, but take advantage of the computer's processing powers to help with some of the detail work. Many of them use similar terms to describe these features, and here are some of the most common:

DRAW You can choose the width of stroke you want to use and draw your own shapes freehand.

FILL You can select a color or predefined pattern (or create your own pattern) and paint the inside of a hollow shape or the background. This doesn't require painting the area with the input device as you would with a paintbrush; you just indicate the area you want filled and press a button or key. It fills almost instantly.

ZOOM or **MAGNIFY** This lets you zoom in on one tiny area to draw in detail, pixel by pixel. With some programs, you can see the magnified area and the overall picture simultaneously, or at least by flipping screens.

CIRCLE or **BOX** By defining two points (centerpoint and radius for a circle or two opposite corners of a box), you can instantly create a shape between those points. Many programs have a variety of shapes to choose from. Before you actually set the second point, most programs let you preview the shape and adjust its size. This is called a "rubber band" effect because of the way the shape stretches on the screen.

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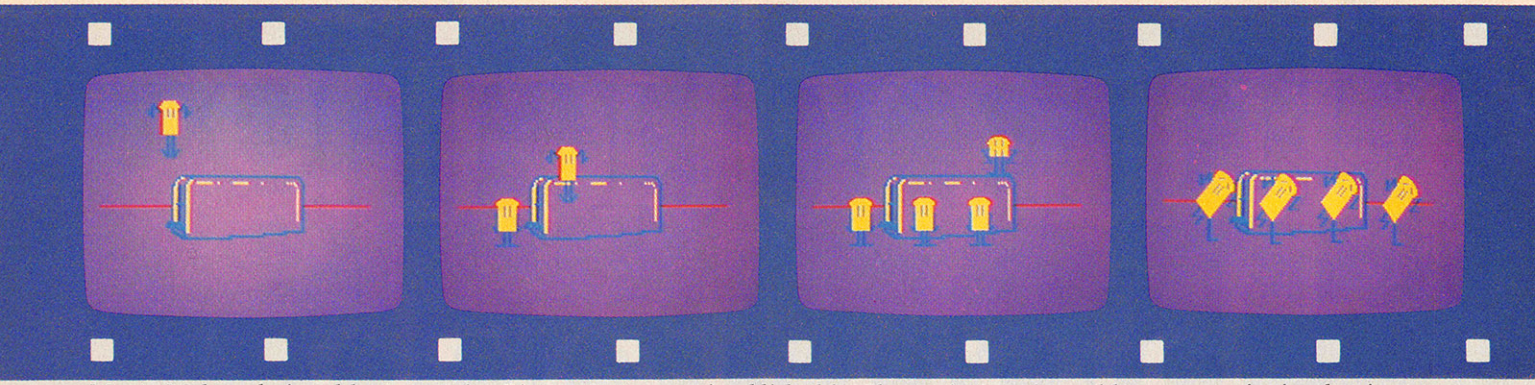


Movie Maker, *designed by Interactive Picture Systems and published by Electronic Arts, is used by many professional animators. With some practice, even the casual user can create sequences like the one shown above. These four frames were excerpted from a minute-long cartoon of four pieces of toast popping out of a toaster, performing a short dance, taking their bows, and popping back in.*

FLIP Using this option, you can invert or otherwise reorient a shape so it sits at a different angle.

SPRAY PAINT or **AIR BRUSH** This simulates what an airbrush does, something like fine-tuned spray-painting. Most programs let you select from a variety of widths, densities, and colors.

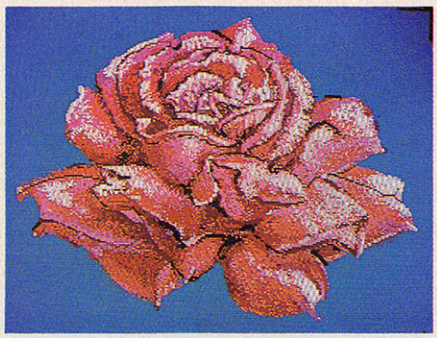
MIRROR IMAGE This feature lets you reverse an image you've already created, producing a mirror-image effect. With some programs, you can draw while this mode is active and see a reversed reflection of what you're drawing on the other half of the screen.

ERASE or **UNDO** There are usually two separate commands for deleting mistakes. One erases only the last thing you've done, and the other erases the entire picture. Also, you can use the input device as an eraser, moving around and deleting individual areas by redrawing them in the background color.

TEXT Some programs let you design your own character sets and integrate text with illustrations.

These are just some of the most common features found in drawing programs; each has its own additional options. The basic look of these programs is fairly similar, though. Lately, many of them have imitated *MacPaint* by displaying option icons around the perimeter of the screen. You select the icon representing the function you want, move onto the drawing surface, and begin using the function. At any time you can move off the drawing surface and choose another icon. Pull-down or drop-down menus are becoming popular, too. Input devices range from the keyboard to joysticks, light pens, graphics tablets, or mouse controllers.

When you're done with a picture, you can save it on disk or tape, print it out in black and white or color (most programs are compatible with popular printers), exchange it with other enthusiasts, hang it on a wall, or use it as an illustration in a newsletter or other publication. (Many of the figures appearing in COMPUTE! and COMPUTE! books have been created or conceptualized on a Macintosh.) Programmers can use the finished drawings as backgrounds or title screens. For instance, the drawing program that comes with an Atari ST system, *Neochrome*, has been used by at least one commercial software company to produce impressive effects in a graphics adventure game.



Aegis Images *was also used in designing this picture. Aegis Development recently began shipping* Aegis Animator, *an animation package that includes the Images program.*

Though many drawing programs developed for the newer 16-bit computers are aimed at the commercial market (see "Creating with CAD: Computer-Aided Design" in this issue), there are several programs that are inexpensive and easy to use, ideal for people who like to experiment without investing a lot of money. That's who Tom Hudson had in mind when he designed *Degas*.

Hudson had seen some demo programs for the Atari ST last June and was impressed with the machine's graphics capabilities. More of a programmer than an artist, Hudson sought out the advice of several artists and started writing his own drawing program.

The result is *Degas*, published by Batteries Included. *Degas* offers a palette of 500 colors and works in any of the Atari ST's three screen modes. The number of colors that can be displayed simultaneously depends on the mode—from 16 colors in low resolution (320 × 200) to black-and-white only in high resolution (640 × 400). In addition to these colors, the program also offers a selection of 60 patterns. Unlike many drawing programs, the actual working area is separate from the menu screen; you click the ST's mouse to move back and forth. *Degas* retails for $39.95.

One of the best drawing programs for Apple computers is Brøderbund's *Dazzle Draw*. This package for the Apple IIc or 128K Apple IIe uses a Macintosh-like user interface, multiple windows, cut-and-paste editing, and help screens. It allows ten shapes in 16 colors and 30 patterns in any one picture, and is compatible with a mouse, graphics tablet, KoalaPad, or joystick. *Dazzle Draw* also supports Apple's new UniDisk 3.5, which expands the program's slide show capacity to more than 40 images. It retails for $59.95.

Graphics programs were among the first software packages introduced for the Commodore Amiga, and with good reason. It's a powerful graphics machine, capable of producing almost TV-quality

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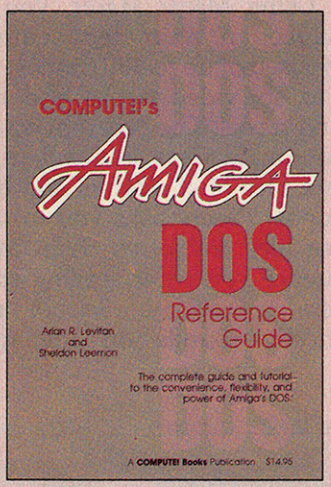

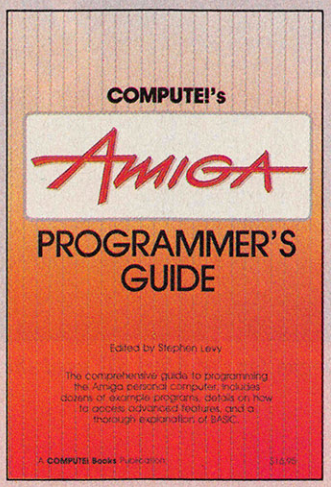

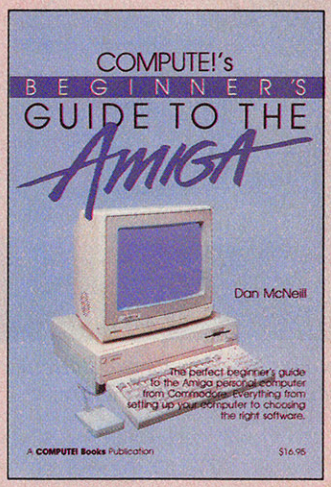

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COMPUTE!'s Beginners Guide to the Amiga

Dan McNeill

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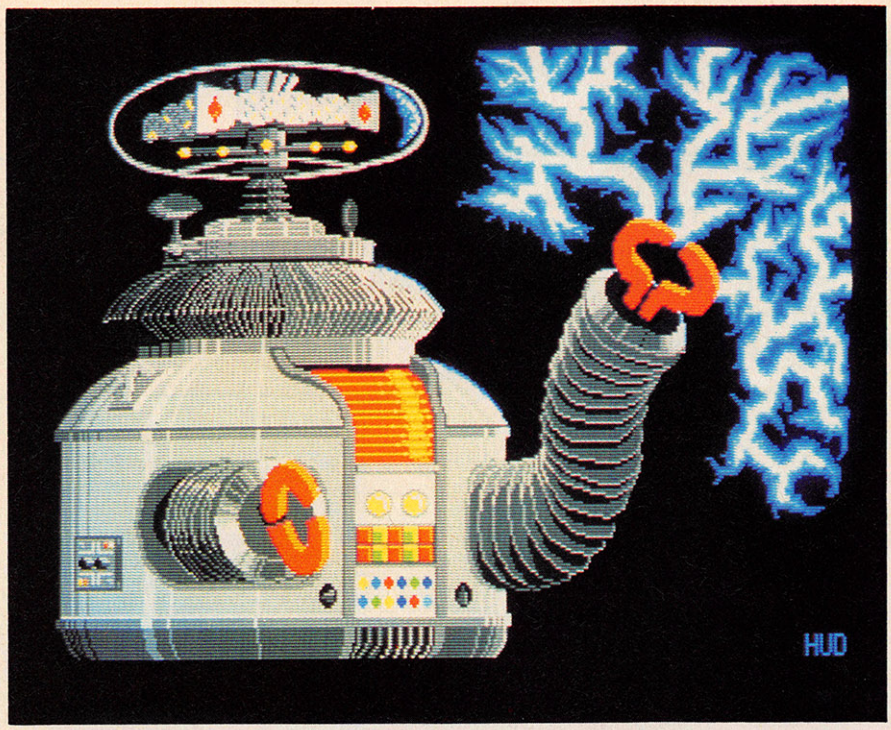


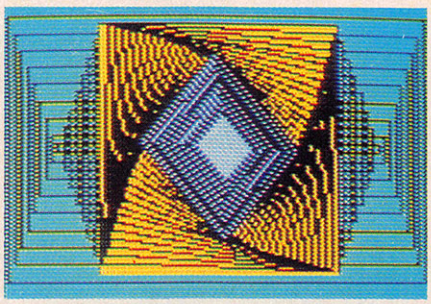
Tom Hudson, designer of Batteries Included's Degas *for the Atari ST, used the product to create this picture.*

pictures. Electronic Arts has released *Deluxe Paint* for the Amiga, a very sophisticated paint program. Beyond the usual features, *Deluxe Paint* has a special palette window that lets you easily mix any combination of the Amiga's 4,096 colors. With *color cycling*, you can make parts of the picture appear to move, like a waterfall flowing or Christmas lights twinkling on a tree. Brush size can vary from a single pixel to a full screen, and any piece of a picture can be picked up and used as a brush. *Deluxe Paint* retails for $99.95.

The next step, logically, is software which can take a static screen picture and add animation. This is an extremely complex procedure that taxes the power of even the fastest of today's personal computers. But even though the kind of animation seen in Saturday morning cartoons is still a few years away, you might be surprised at what can be done already.

Fantavision, from Brøderbund, is so easy to use that you can turn out an animated sequence in a few minutes. It incorporates the same kind of user interface adopted by many drawing programs—you pick up icons on the border of the screen, move to the drawing surface and work, then move back to the border to change functions. When you've finished each frame, you save it, then move on to the next. When you're done, you execute a command that runs the sequence.

Fantavision employs an unusual animation technique. In the past, conventional animation has required artists to draw each frame of a sequence when there is the slightest change. It takes thousands of drawings for even a short piece of animation. But *Fantavision* uses *tweening*, a process that automatically fills in the transitional frames, making the sequence run smoothly.

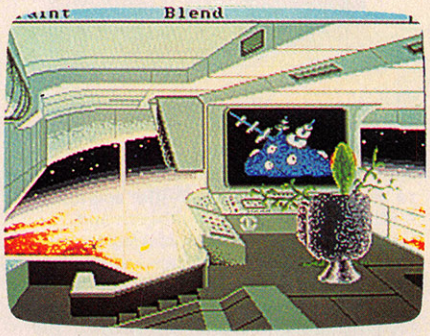


This still shot from Brøderbund's Fantavision *gives you an idea of what the program's palette allows you to do. Its real power, though, lies in its incredibly easy-to-use animation features.*

In effect, you tell the program where to start and end, and it fills in the middle. *Fantavision*, available for Apple II-series computers with at least 64K, retails for $49.95.

Movie Maker, designed by Interactive Picture Systems and published by Electronic Arts, is a bit more complicated to use, but the payoff is more sophisticated animation. So sophisticated, in fact, that some professional animators use it.

Using *Movie Maker*, you can produce an animated sequence composed of up to 300 frames, with up to six video tracks and three sound tracks. The program consists of four main areas. In *Compose*, you create files of characters and backgrounds. *Record* asks you to recall those files and order them in the sequence you want, adding sound where appropriate. *Smooth* automatically rounds off the rough



Deluxe Paint, *from Electronic Arts, was one of the first products shipped for the Commodore Amiga. This scene, created with the product, illustrates the sophisticated shapes and shading possible.*

Commodore 64 ($34.95), Atari ($32.95), and Apple ($39.95).

The Graphics Magician, designed by Polarware and published by Penguin Software, is actually two programs. *The Graphics Magician Painter* lets you draw pictures and save them in a very compact format on disk; *The Graphics Magician Animator* animates them. It's $59.95 for the Apple II series and $79.95 for Macintosh.

At this point, the way to create the most lifelike graphics on personal computers is to make digital images of real objects. *Computereyes*, from Digital Vision, Inc., lets you feed an image from a

videocassette recorder, video camera, TV, or any other video source into a computer and digitize it on the screen. The image can then be incorporated in a game or dumped to a printer. (An upgraded version of *Computereyes* that makes it compatible with both *The Newsroom* and *The Print Shop* can be purchased for $15.) The *Computereyes* software is sold both separately and as part of a package along with a black and white video camera. *Computereyes* is available for the Commodore 64, Apple, and Atari ($129.95; $399.95 with video camera) and IBM PC family ($249.95; $519.95 with camera).

Two peripherals which have been announced for the Amiga allow video mixing and digitizing. The Genlock mixes external video signals with the computer's own video, and the Amiga Live digitizer

Powerful personal computer software is closing the gap between what an artist can do with state-of-the-art drawing tools and what a photographer can do with a camera. This ring was created using Amiga's GraphiCraft *program. (Courtesy of Commodore-Amiga and artist Jack Haeger.)*

edges, and *Play* runs the movie. *Movie Maker* is available for the captures external video images in color and in realtime. Hippopotamus Software has announced a black and white digitizer for the Atari ST, with plans for an Amiga version later.

As technology advances, a debate rages over two issues related to computer-generated art. First, will these sophisticated tools mean that anyone can be an artist? Some people feel they could compete with traditionally trained artists if they had the right tools. They feel that they lack only the mechanical—not the *artistic*—abilities.

Second, can a computer ever be creative in the same way human beings are? Will it ever be the artist, and not just an artists's tool? No one knows yet, but if the evolution of computer graphics continues at the pace it's been going, it may not be too many years before we have some answers.

Pawn, *a new graphics and text adventure from Firebird Licensees, Inc., contains numerous sharp images like this. The program's graphics were developed using* Neochrome, *a graphics package included in the Atari 520 ST's development system.*

For More Information

To learn more about any of the products mentioned here, contact:

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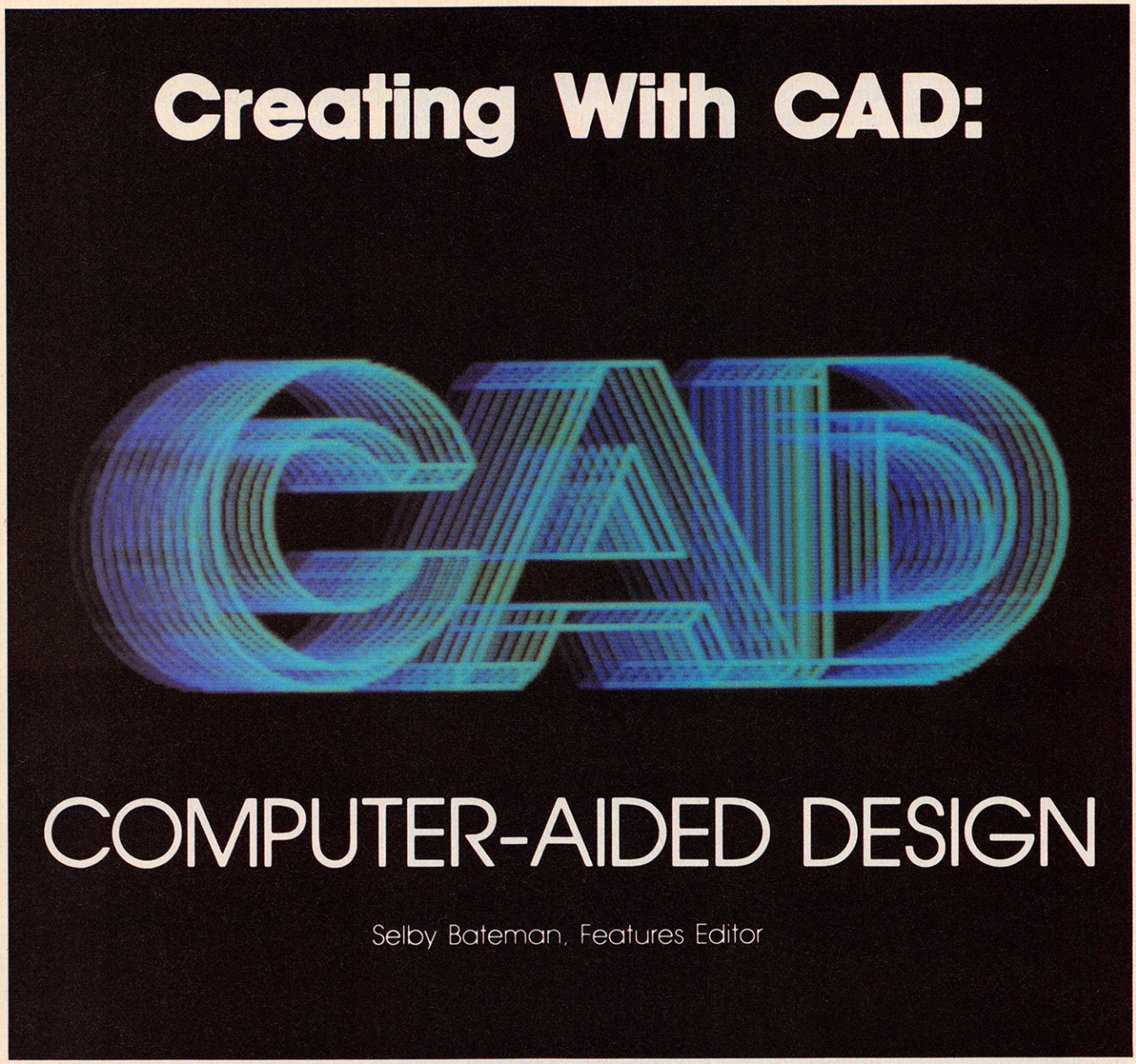

COMPUTER-AIDED DESIGN

Selby Bateman, Features Editor

From a simple floor plan to the most complex electronic circuitry, computers are changing the worlds of design and engineering in virtually every field. Formerly the sole province of mainframe computers and expensive graphics terminals, sophisticated computer-aided design (CAD) software is now available for a wide variety of personal computers. Even for casual users, CAD programs are practical design tools that can also be entertaining and educational.

In an automobile factory, a design engineer puts a new axle through a series of stress and endurance tests. In an aircraft plant, another engineer studies how a breakthrough in fuselage design improves the agility of a jet fighter. And in the civil engineering department of a major city, a highway planner examines how a new thoroughfare changes the urban landscape.

Yet, all of these projects are merely sketched in phosphor on computer screens. The axle, the fuselage, and the highway have never been constructed. But the computer-aided designs are so accurate that they won't have to be built until they've been thoroughly analyzed and tested.

Each year, engineers and designers save millions of dollars in time and effort by modeling new projects with a computer before actually manufacturing them. In high-risk endeavors, such as aircraft design, lives can be saved by discovering design bugs on a computer monitor rather than watching them appear at 30,000 feet. Whether today's designers are creating new shoes or rockets, they're finding that computers dramatically change the way they work.

Up to recently, however, these complex CAD projects could be accomplished only with expensive, powerful mainframe computers and dedicated graphics work stations. Microcomputers simply lacked the memory, screen resolution, and sophisticated software to let them be-

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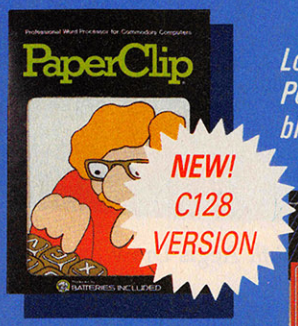

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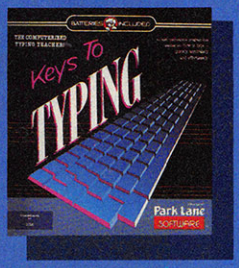

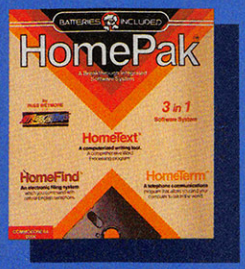

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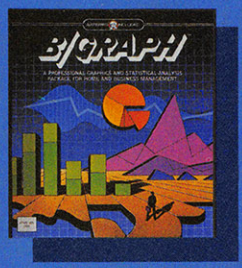

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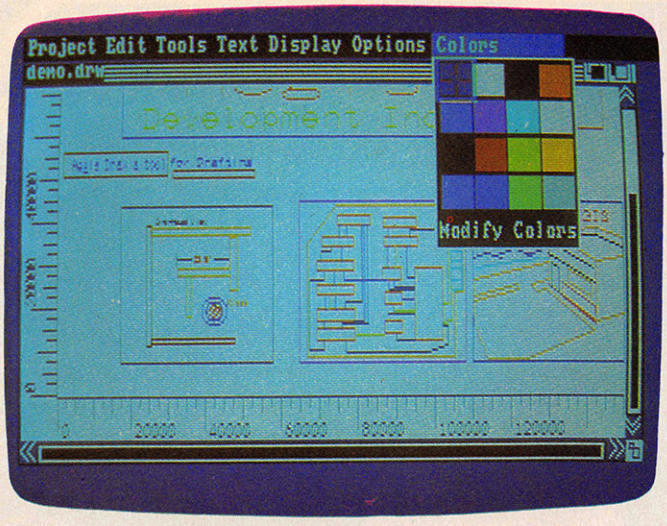
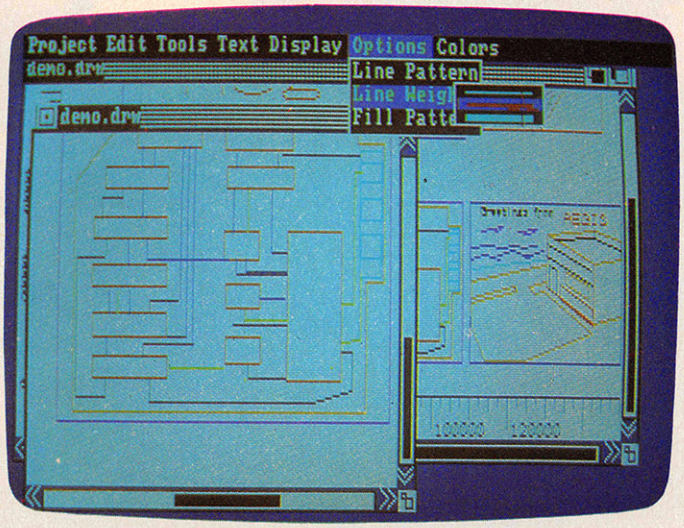
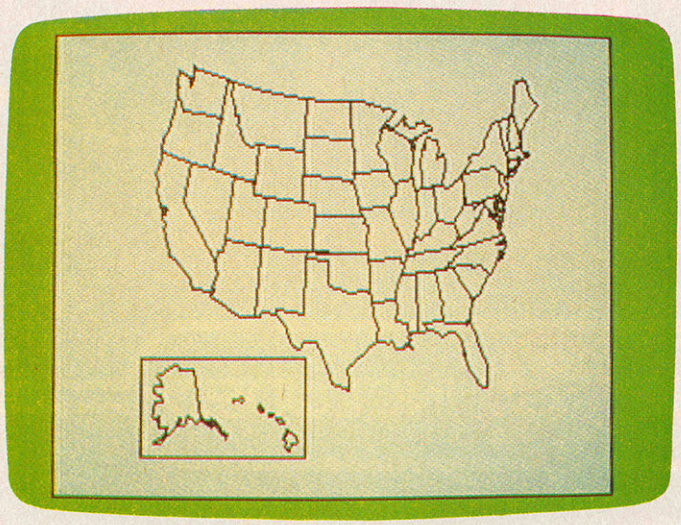


A computer-aided design created with Aegis Draw *on the Amiga.*



Aegis Draw *uses the Amiga's multitasking capability to permit more than one onscreen window to be used actively in a CAD project.*



A design created on the Commodore 64 with CADPAK *(Enhanced Version) from Abacus Software.*

gin to approach such tasks.

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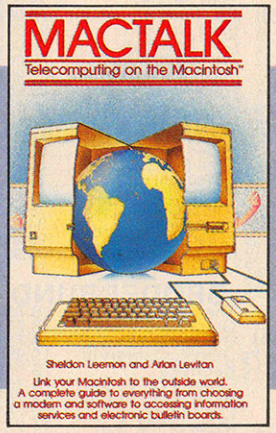

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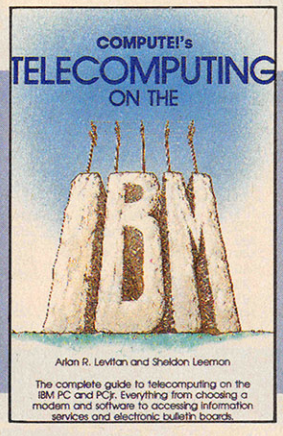

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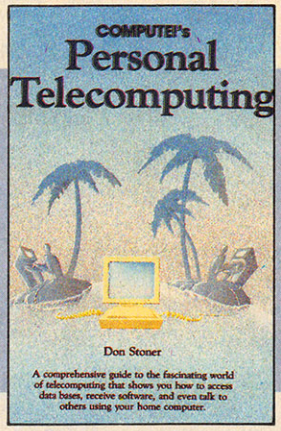

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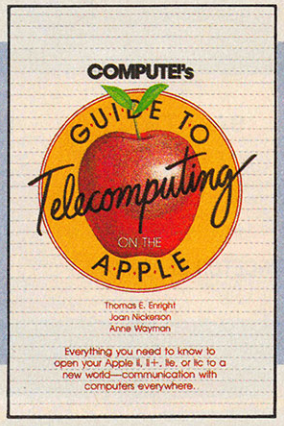

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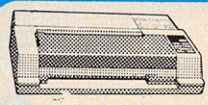

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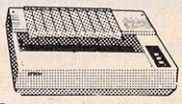

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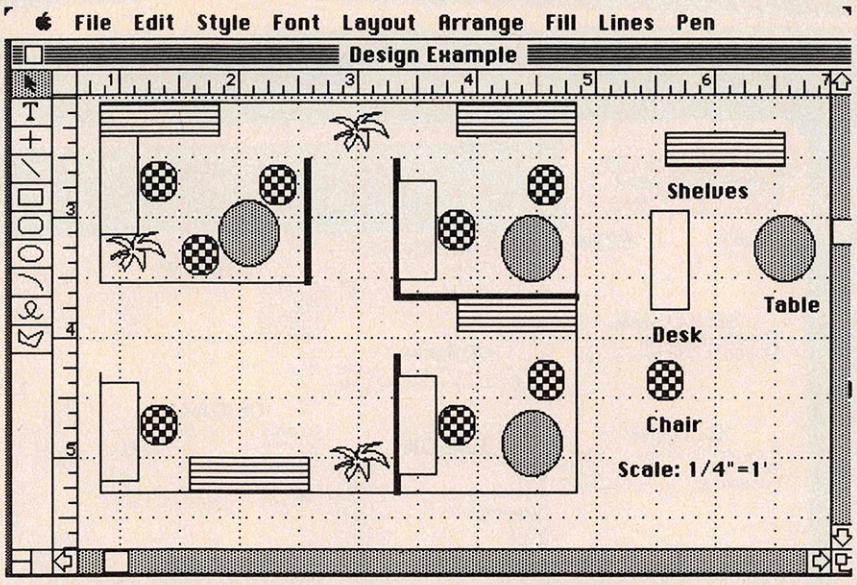
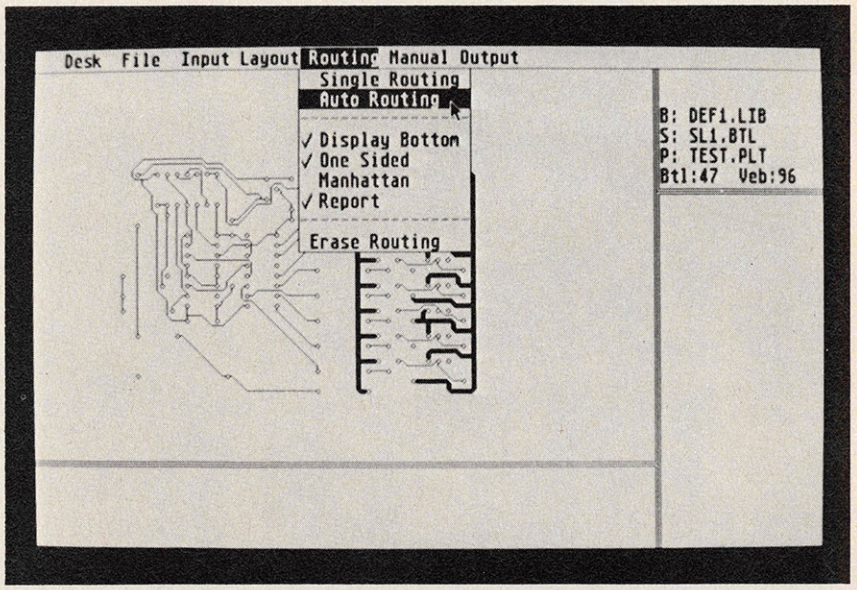
CAD software doesn't require the user to be an artist. Most CAD packages incorporate functions for creating lines, polygons, arcs, circles, rectangles, rounded corners, angles, and pattern fills, and for duplicating and resizing objects. In addition, built-in rulers and grid patterns take the guesswork out of precisely placing objects and text.

• **Object-based versus pixel-based programs:** With a CAD program, you can create and name a shape, then move it around the screen, recall it from memory, and reuse it at will. The program treats the shape as an object rather than as a collection of individual pixels. Most paint programs can't identify an image as an object, while CAD packages must have this capability to be useful.

Obviously, there are many more features that make up a CAD program, and they vary from package to package, just as prices range from less than a hundred dollars to several thousand dollars. But even the most expensive CAD programs for personal computers cost considerably less than high-end CAD hardware and software; advanced solid-modeling, three-dimensional packages can cost tens of thousands of dollars.



An office floorplan created with Apple Computer's MacDraw *for the Macintosh.*



Creating a printed circuit board layout is greatly simplified with Abacus Software's PCBoard Design *for the Atari ST.*

One of the most popular and powerful CAD packages for personal computers is *AutoCad* from Autodesk, Inc., used by many professional designers. So popular has the program become that there are dozens of support packages which add a variety of specific architectural and engineering tools. In February, the first national convention and trade show devoted to CAD systems for microcomputers was held near Chicago—and not surprisingly, the show was called *AutoCad*Con. It focused primarily on the *AutoCad* package and its support programs. Response to the show exceeded expectations, and the *AutoCad*Con sponsors even arranged for as many as 1,200 universities across the nation to receive satellite downlinks from the conference's 20 technical sessions.

Whether your interest in CAD is professional or casual, there are a growing number of software packages at every level of price and performance. However, it's difficult to understand how revolutionary and how widely applicable CAD can be until you've actually worked with one of these packages. What is it that CAD actually does for the designer?

"A word processor for drawing"—that's how software designer William Volk describes a good CAD program. Just as a word processor helps a writer assemble and edit words with unprecedented flexibility, CAD programs offer drafting tools that are versatile, fast, and simple to use. And, just as a word processor can change the way a writer approaches writing, so a CAD package can alter your view of design.

Volk is the creator of *Aegis Draw*, a sophisticated CAD program from Aegis Development, Inc., for the Amiga. *Aegis Draw* represents the direction in which CAD developers are headed today.

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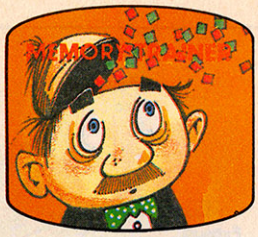

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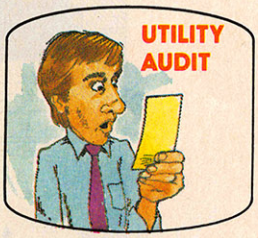

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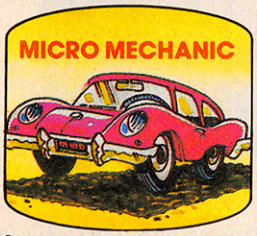

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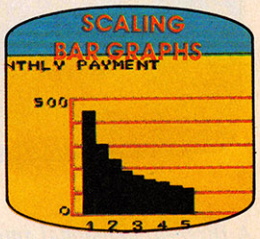

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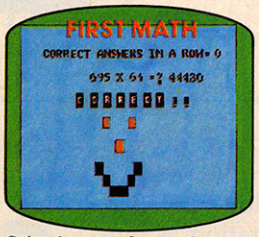

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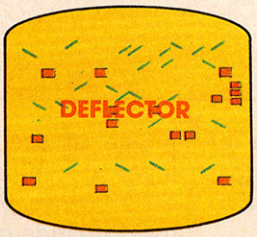

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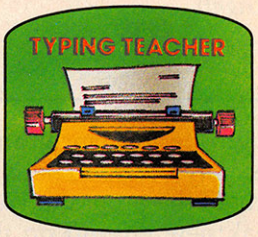

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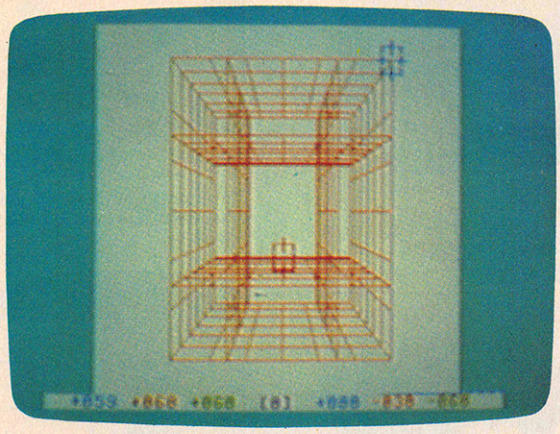

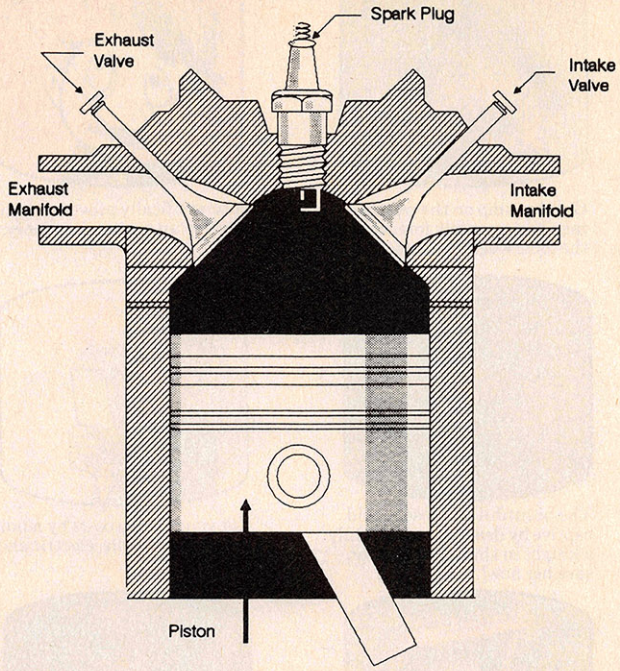

A three-dimensional image constructed with CAD-3D *for the Commodore 64 (above).* Easy-Draw *for the Atari ST is a structured drawing program with many CAD features (on right).*

"High performance and ease of use," says Volk. "That's the philosophy of the program. We wanted to break new ground on that."

Volk and other CAD developers are taking advantage of the new generation of personal computers—chiefly the Amiga, ST, and Macintosh—to create CAD packages that are far more sophisticated and yet less expensive than previous programs. Faster, more powerful microprocessors, more memory, multitasking operating systems, and custom graphics chips are all contributing to an expanded universe for CAD developers and users.

On the Amiga, Volk was able to take advantage of the machine's multitasking in ways that would be very difficult or impossible on other computers. "The idea being that you should be able to have multiple windows on the same drawing so that you can actually work in detail on a drawing and still maintain an overall view," he says. In other words, while one window on the Amiga screen shows the entire design, a second window can zoom onto a tiny area of the image for detailed work. Make a change in one window and it's reflected in the other window as well—two windows, both active.

Aegis Draw has other advanced features as well, including an almost infinite level of zoom. For example, you could zoom from an image of the Earth down to the level at which you could read a car's license plate. Additional features include object rotation as fine as .001 degree, angling, variable line thicknesses, and line patterning.

Volk sees two markets for his program and other CAD software: "One is the vertical application people—the engineers and the architects. And the other market is the people who aren't artistic enough to use [a computer paint program] accurately. In other words, if you want to create an organizational chart [with a paint program], typically people are not going to do a great job. But if you're using *Draw*, you can be rather clumsy and still end up with really accurate-looking drawings."

Although *Aegis Draw* can be used by both professionals and hobbyists, Aegis Development has a still higher-end package, *Aegis Draw Professional (Pro)*, that's upwardly compatible with *Aegis Draw*.

One of the most popular and easy to use design programs is Apple Computer's *MacDraw* for the Macintosh. Although not aimed at the professional design market, *MacDraw* and its companion program, *MacPaint*, broke new ground when they were introduced. Their use of icons, pull-down menus, command bars, and mouse-controlled cursor movement are all very well suited to CAD work. Similar user interfaces are becoming a virtual standard among programs for the Amiga and Atari ST.

One interesting new CAD package, both from a professional and educational standpoint, is a program for the Atari ST that automates printed circuit board layouts. Called *PCBoard Designer*, this $395 package was originally developed in West Germany and is now marketed in the U.S. by Abacus Software.

Aimed primarily at the narrow market of printed circuit designers, *PCBoard Designer* also offers valuable hands-on experience for high school and college electronics students. *PCBoard Designer* is a good example of how thousands of hours of development time can be eliminated by a computer with CAD software.

In printed circuit design, there are two phases of work that require large amounts of time, explains Arnie Lee, president of Abacus Software. One phase, called *tracing*, is the layout of circuit traces from one point to another on the board. None of the traces can overlap, or a short circuit would result. With *PCBoard Designer*, the tracing is handled by *autorouting*—automatically routing points that need to be connected on the PC board. The computer program determines the best layout for the traces in seconds.

The second time-consuming phase of printed circuit design is

when last-minute changes force the technician to redraw all traces from scratch. Again, what might have taken a couple of days of tedious tracing and retracing can now be done by the computer in seconds.

CAD programs can work similar wonders for all kinds of projects. Whether you're designing a printed circuit, compiling a family tree, or planning an office flowchart, CAD packages are becoming as easy to use and as powerful as the new computers they run on. Even the most advanced three-dimensional solid modeling will one day be as common on personal computers as two-dimensional graphics are now.

For More Information

While space does not permit a comprehensive listing of all CAD programs now available, the following should help you get started:

Aegis Draw
for Commodore Amiga
Aegis Development
2210 Wilshire Blvd., #277
Santa Monica, CA 90403
$199.95

AutoCad
for IBM PC family, compatibles, and many business computers
Autodesk, Inc.
2320 Marinship Way
Sausalito, CA 94965
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CadApple
for Apple II family (minimum 64K)
T&W Systems, Inc.
7372 Prince Drive
Suite 106
Huntington Beach, CA 92647
Entry-level package: $495

CAD-3D
for Commodore 64
IHT Software
2269 Chestnut Street
Suite 162
San Francisco, CA 94123
$39.95

CadPak *(Enhanced Version)*
for Commodore 64
CadPak 128
for Commodore 128
Abacus Software
2201 Kalamazoo S.E.
P.O. Box 7211
Grand Rapids, MI 49510
64 version $39.95
128 version $59.95

CadPlan
for IBM PC family and compatibles (minimum 320K)
CalComp
2411 West La Palma Avenue
P.O. Box 3250
Anaheim, CA 92803
$2,000

Computer-Aided Design for the C-128 and C-64
(Hands-on introductory book on CAD for Commodore 64 (using Simons'
BASIC*) and 128)*
Abacus Software
2201 Kalamazoo S.E.
P.O. Box 7211
Grand Rapids, MI 49510
Book: $19.95
Optional disk: $14.95

Easy-Draw
for Atari ST
Migraph, Inc.
720 S. 333rd Street
Suite 201
Federal Way, WA 98003
$149.95

MacDraw
for Apple Macintosh
Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014
$195

PCBoard Designer
for the Atari ST
Abacus Software
2201 Kalamazoo S.E.
P.O. Box 7211
Grand Rapids, MI 49510
$395

PC-Draw
for IBM PC family and compatibles (minimum 256K)
Micrografx, Inc.
1701 North Greenville
Suite 305
Richardson, TX 75801
$395

Robo Graphics CAD-1+ *and* CAD-2
for Apple II family (minimum 64K)
Chessell-Robocom Corporation
Robo Systems
111 Pheasant Run
Newtown, PA 18940
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CAD-2 (without RAM card): $1,095
CAD-2 (including RAM card): $1,320

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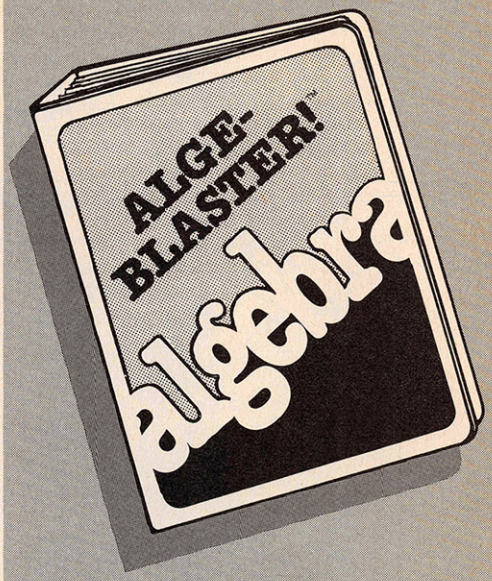

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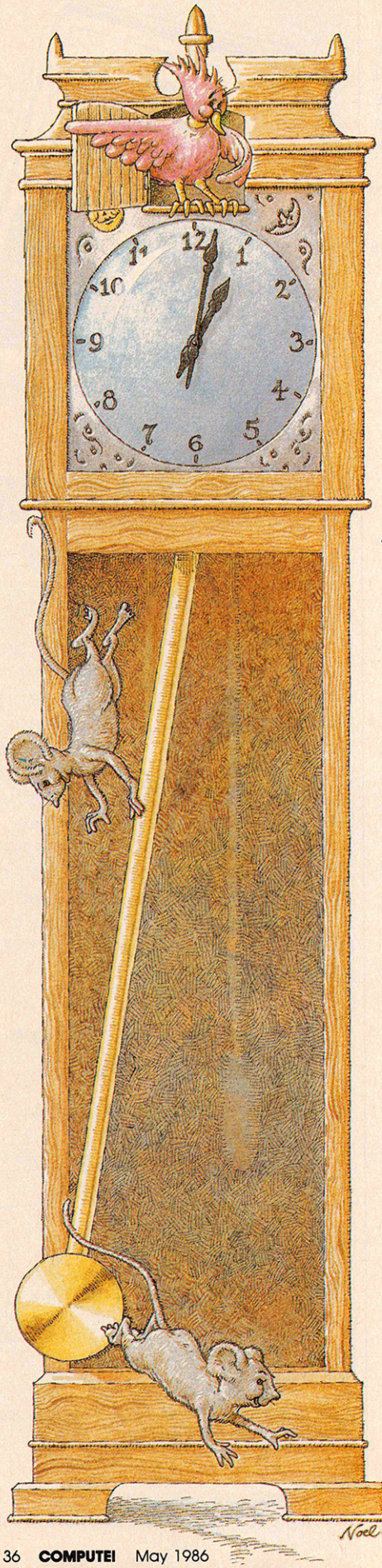


Hickory, Dickory, Dock

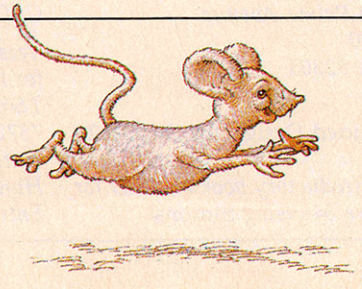
Barbara H. Schulak

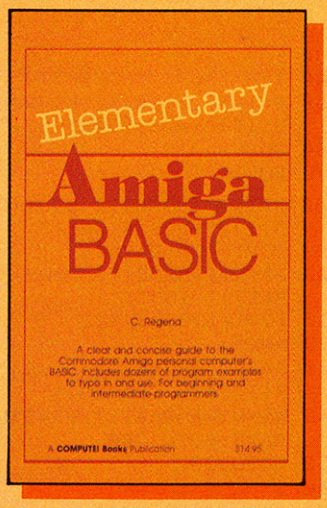
This fun, educational program helps children learn the concepts of telling time by relating a digital clock display to a conventional clock face. The original program is written for the Commodore 64 (and 128 in 64 mode). We've added new versions for Apple II-series computers, the IBM PC/ PCjr, Amiga, Atari 520ST, and Atari 400/800, XL, and XE computers.

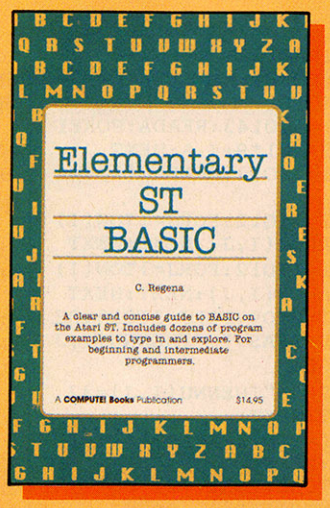
"Hickory, Dickory, Dock" offers an enjoyable way for children to learn how to tell time. Type in the program for your computer, then save a copy before running it. Because every version works much the same, read the general instructions first, then refer to the specific notes for your computer.

When you run Hickory, Dickory, Dock, it displays a round clock face as well as a digital display. Four different activities are available. The first option lets youngsters practice telling time. As the positions of the clock hands change on the screen, the digital clock display changes as well. This shows the relationship between the spatial position of hands on a clock face and the numeric representation of time.

The other three activities test a youngster's time-telling ability for hours only, hours and half-hours, or five-minute intervals. Move the hands to the correct position, then press RETURN (or Enter) to enter the answer. After five correct answers, the program plays a brief







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song and displays some graphics as a reward. After three incorrect choices, the program automatically moves the clock hands to the correct position.

In the Commodore 64 version (which also works on the 128 in 64 mode), press the f7 function key to move the minute hand (the long green one), and the f5 function key to move the hour hand (short and yellow). If you press M at any point, the program returns to the main menu.

For all Atari versions (including the ST), press the H key to move the hours hand, press M to move the minutes hand, and press Q to return to the main menu. Before running the Atari ST version, you should select Low Resolution from the Preferences menu and turn off buffered graphics. (If your ST has the TOS operating system in Read Only Memory, there may be enough Random Access Memory left to run Hickory, Dickory, Dock without turning off buffered graphics.)

The Amiga version includes speech synthesis and uses the mouse pointer instead of keyboard controls.

In the Apple and IBM PC/PCjr versions, press the 1 key to move the minutes hand, press 2 to move the hours hand, and press ESC to return to the main menu.

Program 1: Hickory, Dickory, Dock For Commodore 64

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!

```
AF 10 POKE53281,0:POKE53280,11
CP 20 PRINT"{CLR}{WHT}{8 DOWN}
      "TAB(8)"HICKORY, DICKORY
      , DOCK!
QR 30 PRINT"{10 DOWN}"TAB(14)"
      PLEASE WAIT
XC 40 POKE56,48:CLR
DC 50 POKE650,128:X=RND(-TI)
GJ 60 DIM N(12),LO(12,6),CH(12
      ,6),NU(10,15),T1(12),T2(
      12)
MB 70 S=54272:FORI=0TO24:POKES
      +I,0:NEXT:POKES+24,15
MM 80 FORI=1TO30:READA$,A,B,C:
      NEXT
DB 90 V=53248:POKE2040,13
RM 100 FORI=0TO63:READA:POKE83
       2+I,A:NEXT
FQ 110 POKEV+39,2:POKEV+37,1:P
       OKEV+38,6
SF 120 POKEV,150:POKEV+1,150
XM 130 POKEV+23,1:POKEV+29,1
MD 140 POKEV+28,1 :POKEV+21,1
PF 150 FORI=49152TO49152+81:RE
       ADA:POKEI,A:NEXT
CS 160 SYS49152
JJ 170 FORI=0TO143:READA:POKE1
       2288+101*8+I,A:NEXT
CB 180 FORI=1TO12:READ N(I):NE
       XT
JR 190 FORI=1TO12:FORJ=1TON(I)
       :READLO(I,J):NEXT:NEXT
QS 200 FORI=1TO12:FORJ=1TON(I)
       :READCH(I,J):NEXT:NEXT
SM 210 FORI=0TO9:FORJ=1TO15:RE
       ADA$:IFA$="+"THENNU(I,J
       )=160
KH 220 IFA$="-"THENNU(I,J)=32
ES 230 NEXT:NEXT
RJ 240 FORI=1TO12:READT1(I),T2
       (I):NEXT
DA 250 RESTORE:POKEV+21,0
DR 260 PRINT"{CLR}{3 DOWN}
       {WHT}CHOOSE ONE OF THE
       {SPACE}FOLLOWING:
AX 270 PRINTTAB(5)"{2 DOWN}1.
       {SPACE}TEST - HOURS
SB 280 PRINTTAB(5)"{DOWN}2. TE
       ST - HOURS AND HALF HOU
       RS
AK 290 PRINTTAB(5)"{DOWN}3. TE
       ST - 5 MIN. INTERVALS
BR 300 PRINTTAB(5)"{DOWN}4. PR
       ACTICE
JJ 310 PRINTTAB(5)"{DOWN}5. EN
       D PROGRAM"
JK 320 GETKK$:IFKK$=""THEN320
KA 330 KK=VAL(KK$):IFKK<1ORKK>
       5THEN320
JE 340 IFKK=5THENSYS2048:END
HX 350 POKE53272,(PEEK(53272)A
       ND240)+12
SD 360 RA=0:WA=0
CD 370 PRINT"{CLR}{3 DOWN}"
PJ 380 PRINTTAB(19)"12"
XM 390 PRINTTAB(14)"11
       {9 SPACES}1"
HF 400 PRINT:PRINTTAB(11)"10
       {15 SPACES}2"
HR 410 PRINT:PRINT:PRINTTAB(11
       )"9{8 SPACES}Q
       {8 SPACES}3"
HS 420 PRINT:PRINT:PRINTTAB(12
       )"8{15 SPACES}4"
CP 430 PRINT:PRINTTAB(15)"7
       {9 SPACES}5"
DD 440 PRINTTAB(20)"6"
DP 450 PRINT"{3 DOWN}{YEL}F5=*
       ***
BB 460 PRINT"{GRN}F7=*****
QX 470 PRINT"{WHT}RETURN=ANS.
GP 480 PRINT"M=MENU
JS 490 H=2:M=12:GOSUB950:GOSUB
       1060
BH 500 POKE1844,160:POKE1844+S
       ,2
GE 510 POKE1924,160:POKE1924+S
       ,2
XB 520 IFKK=4THEN2470
EM 530 C=H:D=M:PRINT"{WHT}
       {HOME}SET THE HANDS ON
       {SPACE}THE CLOCK:"
FB 540 GOSUB1590:H=A:M=B:GOSUB
       1230:GOSUB1450:H=C:M=D
KD 550 :
RP 560 POKE198,0
JF 570 K$="":GETK$:IFK$=""THEN
       570
DR 580 IFK$="{F5}"THENGOSUB111
       0
KG 590 IFK$="{F7}"THENGOSUB116
       0
KB 600 IFK$=CHR$(13)THEN640
JE 610 IFK$="M"THEN260
MR 620 GOTO570
SJ 630 :
RK 640 IFH<>AORM<>BTHEN770
HP 650 PRINT"{HOME}{2 DOWN}"TA
       B(17)"{RVS}{7}RIGHT!"
KQ 660 GOSUB2310
DH 670 FORI=1TO10
FD 680 PRINT"{HOME}{2 DOWN}"TA
       B(17)"{RVS}RIGHT!"
QX 690 FORT=1TO50:NEXT
MH 700 PRINT"{HOME}{2 DOWN}"TA
       B(17)"RIGHT!"
DS 710 FORT=1TO50:NEXT
CS 720 NEXT
DB 730 PRINT"{HOME}{2 DOWN}"TA
       B(17)"{6 SPACES}"
CK 740 WA=0:RA=RA+1:IFRA=5THEN
       RA=0:GOTO1700
MC 750 GOTO530
GB 760 :
HJ 770 PRINT"{HOME}{2 DOWN}"TA
       B(17)"{PUR}WRONG!"
FF 780 GOSUB2390:WA=WA+1
SF 790 FORT=1TO1000:NEXT
CR 800 PRINT"{HOME}{2 DOWN}"TA
       B(17)"{6 SPACES}"
GC 810 IFWA<3THEN570
KE 820 WA=0:PRINT"{HOME}{WHT}T
       HE CORRECT TIME IS:
       {7 SPACES}"
ME 830 GOSUB910:GOSUB1020
GK 840 H=A:M=B:GOSUB950:GOSUB1
       060
XK 850 FORT=1TO2000:NEXT
HH 860 PRINT"{HOME}{20 SPACES}
       "
HM 870 GOTO530
FK 880 :
FD 890 :CHANGE MINUTE HAND
AK 900 :
DQ 910 FORI=1TON(M)
CH 920 POKELO(M,I),32
PA 930 NEXT:RETURN
AQ 940 :
AD 950 FORI=1TON(M)
ME 960 POKELO(M,I),CH(M,I)
SX 970 POKELO(M,I)+S,5
JJ 980 NEXT:GOSUB2250:RETURN
HA 990 :
BB 1000 :CHANGE HOUR HAND
SX 1010 :
BH 1020 FORI=1TON(H)-1
PK 1030 POKELO(H,I),32
MJ 1040 NEXT:RETURN
PC 1050 :
RP 1060 FORI=1TON(H)-1
KS 1070 POKELO(H,I),CH(H,I)
PK 1080 POKELO(H,I)+S,7
GP 1090 NEXT:GOSUB2250:RETURN
GF 1100 :
KK 1110 GOSUB910:GOSUB1020
FA 1120 H=H+1:IFH=13THENH=1
MB 1130 GOSUB1060:GOSUB950
KG 1140 RETURN
FK 1150 :
PF 1160 GOSUB910:GOSUB1020
KD 1170 M=M+1:IFM=13THENM=1
KR 1180 GOSUB1060:GOSUB950
MM 1190 RETURN
AP 1200 :
QR 1210 : CHANGE HOUR NUMBER
GR 1220 :
CP 1230 IFH<10THEN1300
EX 1240 K=0
AB 1250 FORI=1796TO1956STEP40
SP 1260 FORJ=0TO2:K=K+1
XH 1270 POKEI+J,NU(1,K):POKEI+
       J+S,2
FJ 1280 NEXT:NEXT
FX 1290 TP=H-10:GOTO1310
EG 1300 TP=H
GD 1310 K=0
```

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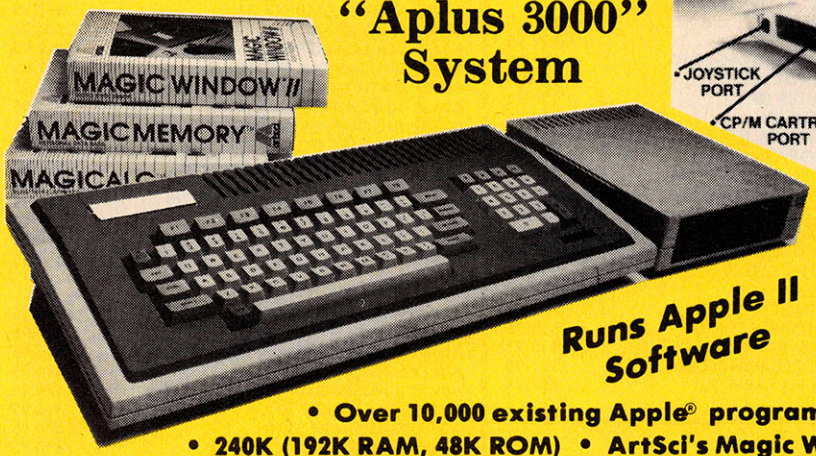

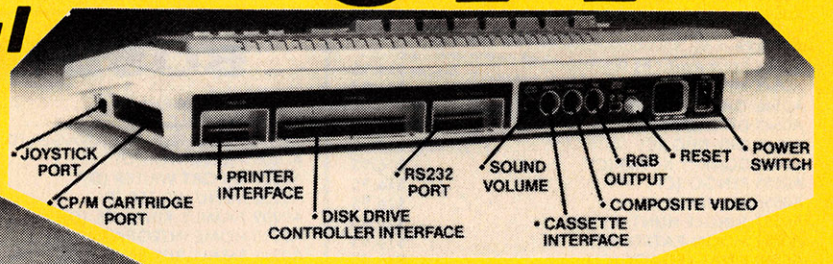

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- **TEXT**
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  - — 5 X 7 characters in 7 X 8 matrix.
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- **GRAPHICS**
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Features	Aplus 3000	Apple IIe	Commodore C-128
RAM	**192K**	64K	128K
Runs Apple II Software	**Yes**	Yes	No
Function Keys	**24**	None	16
4 Voice, 6 Octave Sound	**Yes**	No	Yes
Composite Video	**Yes**	Yes	Yes
Disk Drive	**included**	Extra Cost	Extra Cost
Numeric Keypad	**included**	Extra Cost	Included
Video Cable	**included**	Extra Cost	Extra Cost
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```
DC 1320 FORI=1800TO1960STEP40
XX 1330 FORJ=0TO2:K=K+1
QS 1340 POKEI+J,NU(TP,K):POKEI
        +J+S,2
GQ 1350 NEXT:NEXT
DX 1360 IFH>9THENRETURN
AK 1370 FORI=1796TO1956STEP40
KD 1380 FORJ=0TO2:K=K+1
XR 1390 POKEI+J,32:POKEI+J+S,2
BS 1400 NEXT:NEXT
RK 1410 RETURN
FK 1420 :
EX 1430 :CHANGE MINUTE NUMBER
XP 1440 :
SQ 1450 T1=T1(M):T2=T2(M)
XS 1460 K=0
PJ 1470 FORI=1806TO1966STEP40
HE 1480 FORJ=0TO2:K=K+1
MH 1490 POKEI+J,NU(T1,K):POKEI
        +J+S,2
EE 1500 NEXT:NEXT
FA 1510 K=0
GD 1520 FORI=1810TO1970STEP40
QM 1530 FORJ=0TO2:K=K+1
FP 1540 POKEI+J,NU(T2,K):POKEI
        +J+S,2
FJ 1550 NEXT:NEXT
KD 1560 RETURN
RE 1570 :
HB 1580 :GET RANDOM TIME
HF 1590 :
HD 1600 G=INT(RND(1)*12)+1:IFG
        =ATHEN1600
CR 1610 A=G
FA 1620 J=INT(RND(1)*12)+1
MQ 1630 IFKK=1THENB=12:RETURN
JA 1640 IFKK=2ANDJ<6THENB=12:R
        ETURN
MC 1650 IFKK=2THENB=6:RETURN
HJ 1660 B=J:RETURN
DM 1670 :
FX 1680 :HICKORY
RQ 1690 :
DC 1700 POKE53281,0:POKE53280,
        11:PRINT"{CLR}"
JJ 1710 FORI=0TO24:POKEI+S,0:N
        EXT
FX 1720 POKES+24,15:POKES+6,24
        0
DE 1730 POKEV,250:POKEV+1,184
JG 1740 POKEV+21,1
SX 1750 PRINT"{3 DOWN}"TAB(30)
        "{RVS}{23}{7 SPACES}"
PC 1760 PRINTTAB(30)"{RVS} {83}
        {2 SPACES}B{2 SPACES}
        {23} "
XM 1770 PRINTTAB(30)"{RVS} {83}
        {2 SPACES}-{2 SPACES}
        {23} "
KC 1780 PRINTTAB(30)"{RVS} {83}
        {2 SPACES}Q*C{23} "
RP 1790 PRINTTAB(30)"{RVS} {83}
        {5 SPACES}{23} "
RQ 1800 PRINTTAB(30)"{RVS}{23}
        {7 SPACES}"
HB 1810 FORI=1TO9
XX 1820 PRINTTAB(30)"{RVS}
        {2 RIGHT}{OFF}{YEL}-
        {2 SPACES}{RVS}{23} "
RF 1830 NEXT
AM 1840 PRINTTAB(30)"{RVS}
        {2 RIGHT}{OFF}{YEL}Q
        {2 RIGHT}{RVS}{23} "
GC 1850 PRINTTAB(30)"{RVS}
        {5 RIGHT} "
DC 1860 PRINTTAB(30)"{RVS}
        {7 SPACES}{WHT}"
RF 1870 PRINT"{HOME}{5 DOWN}"
RX 1880 Z=7:GOSUB1970:PRINT
BK 1890 Z=8:GOSUB1970:PRINT
KS 1900 FORI=186TO50STEP-2:POK
        EV+1,I:NEXT
```

"Hickory, Dickory, Dock" for the Commodore 64 and 128, an amusing educational program for children.

```
DX 1910 Z=4:GOSUB1970:PRINT
KM 1920 POKE1338,160:POKE1257,
        194:POKE1298,206:POKE1
        338+S,15:POKE1298+S,15
FS 1930 POKE1339,160:Z=4:GOSUB
        1970:PRINT
KS 1940 FORI=50TO186STEP2:POKE
        V+1,I:NEXT
DQ 1950 Z=7:GOSUB1970:GOTO250
FQ 1960 :
JE 1970 FORI=1TOZ
SM 1980 READA$,A,B,C:POKES+4,1
        7
XJ 1990 PRINTA$;:POKES+1,A:POK
        ES,B
QB 2000 FORT=1TOC:NEXT:POKES+4
        ,16
EE 2010 NEXT:RETURN
ES 2020 :
BX 2030 :
AS 2040 DATA "HICK",12,32,125,
        "O",12,216,125,"RY, ",
        14,107,125,"DICK",14,1
        07,125
HX 2050 DATA "O",16,47,125,"RY
        , ",18,42,125,"DOCK!",
        19,63,1000
JS 2060 DATA "THE ",12,32,125,
        "MOUSE",12,32,125," ",
        12,216,125,"RAN ",14,1
        07,125
KH 2070 DATA "UP ",14,107,125,
        ,16,47,125,"THE ",18,4
        2,125,"CLOCK.",19,63,1
        000
QP 2080 DATA "THE ",14,107,125
        ,"CLOCK ",19,63,250,"S
        TRUCK ",19,63,125
SE 2090 DATA "ONE,",18,42,250,
        "THE ",18,42,125,"MOUS
        E ",16,47,250
HG 2100 DATA "RAN ",16,47,125,
        "DOWN.",14,107,1000
PC 2110 DATA "HICK",14,107,125
        ,"OR",16,47,124,"Y, ",
        14,107,125,"DICK",12,2
        16,125
JS 2120 DATA "O",12,32,125,"RY
        , ",10,205,125,"DOCK!"
        ,9,159,1000
MG 2130 :
DH 2140 DATA 5,64,84,5,64,84,5
        ,85
AK 2150 DATA 84,0,85,80,0,68,6
        4,0
FJ 2160 DATA 85,64,16,81,65,16
        ,21,1
XX 2170 DATA 16,4,1,31,255,253
        ,15,255
SA 2180 DATA 252,0,255,192,0,2
        55,192,0
EM 2190 DATA 255,192,65,170,12
        8,68,162,128
BD 2200 DATA 80,162,128,0,162,
        128,0,17
GD 2210 DATA 0,0,17,0,1,81,80,
        255
BP 2220 :
HA 2230 :MUSIC SUBS
XR 2240 :
CR 2250 POKES+5,0:POKES+6,2
DQ 2260 POKES+4,129
DC 2270 POKES,100:POKES+1,100
DJ 2280 FORT=1TO10:NEXT
SH 2290 POKES+4,128:RETURN
MA 2300 :
SA 2310 POKES+5,0:POKES+6,240
PB 2320 FORI=1TO10
XC 2330 POKES+4,17
KF 2340 POKES,100:POKES+1,20
XA 2350 FORT=1TO50:NEXT
GA 2360 POKES+4,16
DQ 2370 NEXT:RETURN
CG 2380 :
KX 2390 POKES+6,240:POKES+5,0
QG 2400 POKES+4,17
CR 2410 POKES,108:POKES+1,6
BS 2420 FORT=1TO300:NEXT
BQ 2430 POKES+4,16:RETURN
QM 2440 :
JR 2450 :LEARNING MODULE
GP 2460 :
XJ 2470 PRINT"{2 UP}
        {11 SPACES}"
QX 2480 GOSUB1230:GOSUB1450
MP 2490 K$="":GETK$:IFK$=""THE
        N2490
DD 2500 IFK$="{F5}"THENGOSUB11
        10:GOSUB1230
CA 2510 IFK$="{F7}"THENGOSUB11
        60:GOSUB1450
DA 2520 IFK$="M"THEN260
KE 2530 GOTO2490
PA 2540 :
MG 2550 :ML DATA
RC 2560 :
HK 2570 DATA 173,14,220,41,254
        ,141,14,220
RF 2580 DATA 165,1,41,251,133,
        1,160,0
QJ 2590 DATA 185,0,208,153,0,4
        8,185,0
KA 2600 DATA 209,153,0,49,185,
        0,210,153
PA 2610 DATA 0,50,185,0,211,15
        3,0,51
SF 2620 DATA 185,0,212,153,0,5
        2,185,0
HA 2630 DATA 213,153,0,53,185,
        0,214,153
HS 2640 DATA 0,54,185,0,215,15
        3,0,55
AG 2650 DATA 200,208,205,165,1
        ,9,4,133
CJ 2660 DATA 1,173,14,220,9,1,
        141,14
XG 2670 DATA 220,96
RM 2680 :
AM 2690 :
AS 2700 :CHAR DATA
GM 2710 :
XE 2720 DATA 1,2,4,8,16,32,64,
        128
XG 2730 DATA 128,64,32,16,8,4,
        2,1
JE 2740 DATA 0,0,0,0,0,3,28,22
        4
KF 2750 DATA 0,0,1,14,112,128,
        0,0
FD 2760 DATA 7,56,192,0,0,0,0,
        0
RQ 2770 DATA 192,56,7,0,0,0,0,
        0
```

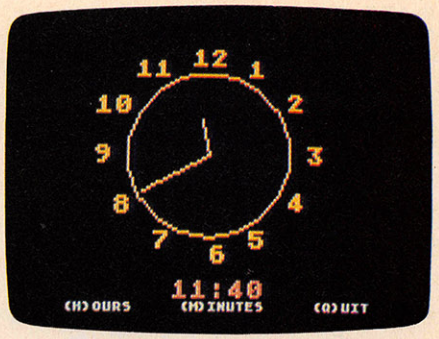
```
FK 2780 DATA 0,0,128,112,14,1,
        0,0
GH 2790 DATA 0,0,0,0,0,224,28,
        3
GS 2800 DATA 8,12,14,255,255,1
        4,12,8
FD 2810 DATA 24,24,24,24,24,12
        6,60,24
JQ 2820 DATA 31,15,15,31,57,11
        2,224,192
DH 2830 DATA 192,224,112,57,31
        ,15,15,31
SC 2840 DATA 3,7,14,156,248,24
        0,240,248
BP 2850 DATA 248,240,240,248,1
        56,14,7,3
QX 2860 DATA 0,0,254,62,126,13
        4,2,0
RH 2870 DATA 0,0,127,124,126,9
        7,64,0
FS 2880 DATA 0,0,0,2,134,126,6
        2,254
FC 2890 DATA 0,0,0,64,97,126,1
        24,127
EG 2900 :
QK 2910 :HOUR HAND DATA
MJ 2920 :
CB 2930 DATA 3,5,6,5,3,4,3,5,6
        ,5,3,4
AG 2940 DATA 1405,1366,1327
EJ 2950 DATA 1405,1406,1407,13
        68,1369
KM 2960 DATA 1445,1446,1447,14
        48,1449,1450
CG 2970 DATA 1485,1486,1487,15
        28,1529
FA 2980 DATA 1485,1526,1567
JE 2990 DATA 1484,1524,1564,16
        04
XG 3000 DATA 1483,1522,1561
GD 3010 DATA 1483,1482,1481,15
        20,1519
SQ 3020 DATA 1443,1442,1441,14
        40,1439,1438
HC 3030 DATA 1403,1402,1401,13
        60,1359
QS 3040 DATA 1403,1362,1321
SP 3050 DATA 1404,1364,1324,12
        84
CD 3060 DATA 78,78,111
RE 3070 DATA 103,104,105,103,1
        15
CP 3080 DATA 67,67,67,67,67,10
        9
AG 3090 DATA 106,107,108,106,1
        17
QB 3100 DATA 77,77,112
FC 3110 DATA 93,93,93,110
SF 3120 DATA 78,78,113
MS 3130 DATA 105,104,103,105,1
        18
QR 3140 DATA 67,67,67,67,67,31
PD 3150 DATA 108,107,106,108,1
        16
QJ 3160 DATA 77,77,114
CJ 3170 DATA 93,93,93,30
EJ 3180 :
JP 3190 :NUMBER DATA
GJ 3200 :
AX 3210 DATA +,+,+,+,-,+,+,-,+
        ,+,-,+,+,+,+
SE 3220 DATA -,+,-,-,+,-,-,+,-
        ,-,+,-,-,+,-
JD 3230 DATA +,+,+,-,-,+,+,+,+
        ,+,-,-,+,+,+
KG 3240 DATA +,+,+,-,-,+,-,+,+
        ,-,-,+,+,+,+
KR 3250 DATA +,-,+,+,-,+,+,+,+
        ,-,-,+,-,-,+
BG 3260 DATA +,+,+,+,-,-,+,+,+
        ,-,-,+,+,+,+
MD 3270 DATA +,+,+,+,-,-,+,+,+
        ,+,-,+,+,+,+
AF 3280 DATA +,+,+,-,-,+,-,-,+
        ,-,-,+,-,-,+
GD 3290 DATA +,+,+,+,-,+,+,+,+
        ,+,-,+,+,+,+
JS 3300 DATA +,+,+,+,-,+,+,+,+
        ,-,-,+,-,-,+
DX 3310 :
JJ 3320 :MORE DATA
GA 3330 :
HJ 3340 DATA 0,5,1,0,1,5,2,0,2
        ,5,3,0
KQ 3350 DATA 3,5,4,0,4,5,5,0,5
        ,5,0,0
```

Program 2: Hickory, Dickory, Dock For Atari 400/800/XL/XE

Version by Kevin Mykytyn, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
PN 10  GOTO 30
IG 20  X=INT(XC-XR*COS(A)):Y=
       INT(YC-YR*SIN(A)):RETU
       RN
PC 30  DIM A$(5),K$(1),TIME$(
       5):OPEN #1,4,8,"K:":PO
       KE 82,0
BM 40  GRAPHICS 18:PRINT #6;"
       1. TEST hours":PRINT #
       6:PRINT #6;"2. TEST ho
       urs and{6 SPACES}half
       hours"
AL 50  PRINT #6:PRINT #6;"3.
       TEST five minute
       {4 SPACES}intervals":P
       RINT #6:PRINT #6;"4. P
       RACTICE"
JB 60  PRINT #6:PRINT #6;"5.
       QUIT"
NL 70  GET #1,K:K$=CHR$(K):IF
       K$<"1" OR K$>"5" THEN
       70
OA 80  N=VAL(K$):IF N=5 THEN
       GRAPHICS 0:END
HN 90  IF N=4 THEN 250
KM 100 GOSUB 290
LH 110 HR=INT(RND(1)*12)+1:M
       N=0:IF N=2 THEN MN=IN
       T(RND(1)+0.5)*30:GOTO
        130
HF 120 IF N=3 THEN MN=INT(RN
       D(1)*12)*5
EA 130 GOSUB 480:AMN=MN:AHR=
       HR:MN=0:HR=12
JN 140 GOSUB 440:GOSUB 540:I
       F K$="Q" THEN 40
LP 150 IF K$<>CHR$(155) THEN
        140
EF 160 POKE 656,0:POKE 657,8
       :IF AMN<>MN OR AHR<>H
       R THEN 190
BE 170 NR=NR+1:NW=0:PRINT "R
       IGHT!";:FOR A=15 TO 0
        STEP -1
FE 180 SOUND 1,121,10,A:SOUN
       D 2,81,10,A:FOR T=1 T
       O 10:NEXT T:NEXT A:GO
       SUB 230:GOTO 210
ON 190 MN=AMN:HR=AHR:PRINT "
       WRONG!";:FOR A=10 TO
       150:SOUND 1,A,12,15:N
       EXT A:GOSUB 230:NW=NW
       +1:IF NW<>3 THEN 130
```



This version of "Hickory, Dickory, Dock" runs on all Atari 400/800, XL, and XE computers.

```
PC 200 NW=0:GOSUB 440:GOSUB
       480:FOR TD=1 TO 1500:
       NEXT TD:GOTO 110
MI 210 IF NR=5 THEN NR=0:GOS
       UB 590
FP 220 GOTO 110
PB 230 SOUND 2,0,0,0:SOUND 1
       ,0,0,0:FOR TD=1 TO 60
       0:NEXT TD:PRINT "
       {6 LEFT}{7 SPACES}";:
       RETURN
EM 240 FOR T=1 TO 1500:NEXT
       T:GOTO 40
LC 250 GOSUB 290
GH 260 GOSUB 440:GOSUB 480:G
       OSUB 540:IF K$<>"Q" T
       HEN 260
DG 270 GOTO 40
PJ 280 REM DRAW THE CLOCK
LC 290 GRAPHICS 6:SETCOLOR 2
       ,0,0:GOSUB 410:COLOR
       1:XC=80:YC=38:YR=28:X
       R=YR*1.2:GOSUB 340:XR
       =XR+8:YR=YR+6:YC=YC-4
OH 300 NW=0:NR=0:POKE 656,0:
       POKE 657,25:PRINT "(H
       )OURS{5 SPACES}(M)INU
       TES{5 SPACES}(Q)UIT"
MM 310 FOR Q=1 TO 12:A$=STR$
       (Q):A=Q*30+90:GOSUB 2
       0:X=INT(X/8):GOSUB 38
       0:NEXT Q:XR=XR-10:YR=
       YR-10:YC=YC+4
DN 320 HR=12:MN=0:OMX=XC:OHX
       =XC:OMY=YC:OHY=YC:RET
       URN
EI 330 REM CIRCLE DRAWING SU
       BROUTINE
CL 340 DEG :FOR A=0 TO 360 S
       TEP 10:GOSUB 20
CA 350 IF A=0 THEN PLOT X,Y
BL 360 DRAWTO X,Y:NEXT A:RET
       URN
IM 370 REM CHARACTER PLOTTIN
       G SUBROUTINE
GD 380 CHROM=57344:SCREEN=PE
       EK(88)+256*PEEK(89)+X
       +Y*20-(LEN(A$)=2)
ND 390 FOR A=1 TO LEN(A$):CS
       =CHROM+ASC(A$(A,A))*8
       -256
KN 400 FOR B=0 TO 7:POKE SCR
       EEN+B*20,PEEK(CS+B):N
       EXT B:SCREEN=SCREEN+1
       :NEXT A:RETURN
LK 410 DL=PEEK(560)+256*PEEK
       (561):POKE DL+85,71:P
       OKE DL+88,2:POKE DL+8
       9,65
AM 420 POKE DL+90,PEEK(560):
       POKE DL+91,PEEK(561):
       RETURN
```

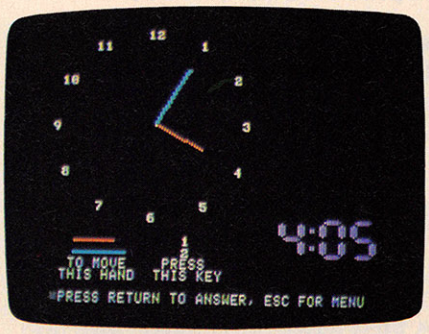
```
AH 430  REM OUTPUT CLOCK TIME
DF 440  COLOR 0:PLOT XC,YC:DR
        AWTO OMX,OMY:PLOT XC,
        YC:DRAWTO OHX,OHY
FC 450  COLOR 1:A=MN*6+90:GOS
        UB 20:PLOT XC,YC:DRAW
        TO X,Y:XR=XR/2:YR=YR/
        2:OMX=X:OMY=Y
MC 460  A=HR*30+90+MN/2:GOSUB
         20:PLOT XC,YC:DRAWTO
         X,Y:XR=XR*2:YR=YR*2:
        OHX=X:OHY=Y:RETURN
EJ 470  REM OUPUT DIGITAL TIM
        E
NK 480  POKE 656,0:POKE 657,8
        :POKE 658,0:IF HR<10
        THEN PRINT " ";
HE 490  TIME$=STR$(HR):GOSUB
        520:PRINT CHR$(154);
DO 500  IF MN<10 THEN PRINT C
        HR$(144);
CP 510  TIME$=STR$(MN)
IP 520  FOR A=1 TO LEN(TIME$)
        :PRINT CHR$(ASC(TIME$
        (A,A))+96);:NEXT A:RE
        TURN
HH 530  REM CHANGE TIME ROUTI
        NE
AN 540  GET #1,K:K$=CHR$(K):I
        F K$="M" THEN MN=MN+5
        :IF MN=60 THEN MN=0
FN 550  IF K$="H" THEN HR=HR+
        1
JM 560  IF HR=13 THEN HR=1
GM 570  IF K$="M" OR K$="H" O
        R K$=CHR$(155) OR K$=
        "Q" THEN RETURN
GP 580  GOTO 540
FK 590  RESTORE 620
OJ 600  READ NT,L:IF NT=-1 TH
        EN SOUND 1,0,0,0:RETU
        RN
FG 610  SOUND 1,NT,10,15:FOR
        A=1 TO L*40:NEXT A:SO
        UND 1,0,0,0:GOTO 600
IG 620  DATA 81,1,72,1,81,1,9
        1,1,96,1,108,1,121,5,
        96,1,81,1,72,1,81,1,9
        1,1,96,1,108,1,121,5
KH 630  DATA 96,1,108,2,108,1
        ,72,3,81,2,81,1,60,3,
        81,1,72,1,81,1,91,1,9
        6,1,108,1,121,6,-1,-1
```

Program 3: Hickory, Dickory, Dock For Apple

Version by Tim Victor, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
6F 100  PI = 4 * ATN (1)
ED 110  DIM DP(4,7),CX(12),CY(12)
77 120  GOSUB 840: GOSUB 960: GOS
        UB 1120: GOSUB 1160: POKE
         6,0: POKE 7,138
25 130  IF PEEK (190 * 256) = 76
        THEN PRINT CHR$ (4);"PR#A
        $300": GOTO 150
BA 140  POKE 54,0: POKE 55,3: CAL
        L 1002
32 150  HGR : GOSUB 510
39 160  HGR : HOME : GOSUB 600
1E 170  VTAB 19: HTAB 16: PRINT "
        1": HTAB 16: PRINT "2"
1C 180  FOR I = 0 TO 1: HCOLOR= 5
         + I: FOR J = 0 TO 1: HPL
        OT 18,147 + J + 8 * I TO
        52 + 8 * I,147 + J + 8 *
        I: NEXT : NEXT
85 190  VTAB 21: HTAB 3: PRINT "T
        O MOVE";: HTAB 14: PRINT
        "PRESS": HTAB 2: PRINT "T
        HIS HAND";: HTAB 13: PRIN
        T "THIS KEY"
BB 200  CH = 213: FOR CV = 138 TO
         150 STEP 12: GOSUB 770:
        NEXT
3C 210  FOR I = 1 TO 4:DD(I) = 10
        : FOR J = 1 TO 7:DP(I,J)
        = 0: NEXT : NEXT
E5 220  HH = 84:HV = 35:MH = 83:M
        V = 24
DA 230  IF GM = 4 THEN 410
46 240  NW = 0:TH = INT ( RND (1)
         * 12) + 1:TM = INT ( RND
         (1) * 60)
1E 250  IF GM = 1 THEN TM = 0
B6 260  IF GM = 2 THEN TM = 30 *
        INT (TM / 30)
5C 270  IF GM = 3 THEN TM = 5 * I
        NT (TM / 5)
77 280  HR = TH:MN = TM: GOSUB 61
        0
```



"Hickory, Dickory, Dock" for Apple computers offers children a fun way to learn about telling time.

```
C5 290  HR = 1:MN = 0
4C 300  VTAB 24: HTAB 2: PRINT "P
        RESS RETURN TO ANSWER, ES
        C FOR MENU";
4F 310  GOSUB 670
CF 320  GOSUB 460: IF A$ = CHR$ (
        27) THEN 150
33 330  IF A$ = CHR$ (13) THEN 35
        0
96 340  GOTO 310
23 350  IF TH = HR AND TM = MN TH
        EN 390
47 360  NW = NW + 1: IF NW < 3 TH
        EN VTAB 24: HTAB 2: PRINT
         SPC( 38);: HTAB 5: PRINT
         "THAT IS NOT CORRECT, TR
        Y AGAIN";: FOR I = 1 TO 1
        000: NEXT : GOTO 300
C8 370  HR = TH:MN = TM: GOSUB 67
        0: VTAB 24: HTAB 2: PRINT
         SPC( 38);: HTAB 7: PRINT
         "THIS IS THE CORRECT ANS
        WER";
DE 380  FOR I = 1 TO 1500: NEXT :
         GOTO 240
37 390  VTAB 24: HTAB 2: PRINT SP
        C( 38);: HTAB 10: PRINT "
        CORRECT! GOOD ANSWER";
7F 400  FOR I = 1 TO 1000: NEXT :
         GOTO 240
DD 410  VTAB 24: HTAB 11: PRINT "
        PRESS ESC FOR MENU";
B9 420  HR = 1:MN = 0
09 430  GOSUB 610: GOSUB 670
D4 440  GOSUB 460: IF A$ = CHR$ (
        27) THEN 150
1C 450  GOTO 430
2A 460  VTAB 24: HTAB 1: GET A$:
        IF A$ = CHR$ (27) THEN RE
        TURN
94 470  IF A$ = CHR$ (13) THEN RE
        TURN
0E 480  IF A$ = "1" THEN HR = HR
        + 1 - 12 * (HR = 12): RET
        URN
EF 490  IF A$ = "2" THEN MN = MN
        + 5 - 60 * (MN = 55): RET
        URN
16 500  GOTO 460
56 510  TEXT : HOME : VTAB 6: HTA
        B 8: PRINT "PRESS KEY TO
        CHOOSE GAME:"
76 520  VTAB 10: HTAB 7: PRINT "1
        : HOURS TEST"
E8 530  VTAB 12: HTAB 7: PRINT "2
        : HOURS AND HALF HOURS TE
        ST"
02 540  VTAB 14: HTAB 7: PRINT "3
        : 5 MINUTE INTERVALS TEST
        "
38 550  VTAB 16: HTAB 7: PRINT "4
        : PRACTICE"
59 560  VTAB 18: HTAB 7: PRINT "5
        : QUIT"
26 570  VTAB 24: GET A$: IF A$ <
        "1" OR A$ > "5" THEN 570
58 580  IF A$ = "5" THEN END
6B 590  GM = VAL (A$): RETURN
69 600  FOR I = 1 TO 12: VTAB CY(
        I): HTAB CX(I): PRINT I:
        NEXT : RETURN
CE 610  DE = 1:HC = 160:DC = INT
        (HR / 10): IF DC = 0 THEN
         DC = 10
AC 620  IF DC < > DD(1) THEN GOSU
        B 790
45 630  DD(1) = DC:HC = 186:DE =
        2:DC = HR - 10 * INT (HR
        / 10): IF DC < > DD(2) TH
        EN GOSUB 790
6F 640  DD(2) = DC:HC = 220:DE =
        3:DC = INT (MN / 10): IF
        DC < > DD(3) THEN GOSUB 7
        90
04 650  DD(3) = DC:HC = 246:DE =
        4:DC = MN - DC * 10: IF D
        C < > DD(4) THEN GOSUB 79
        0
13 660  DD(4) = DC: RETURN
95 670  HCOLOR= 0: GOSUB 700: GOS
        UB 720
A7 680  GOSUB 690: GOSUB 710: RET
        URN
E3 690  A = (HR / 6 + MN / 360) *
         PI:HV = 68 - 33 * COS (A
        ):HH = 84 + 44 * SIN (A):
         HCOLOR= 5
F6 700  HPLOT 84,68 TO HH,HV: HPL
        OT 83,67 TO HH - 1,HV - 1
        : RETURN
94 710  A = MN / 30 * PI:MV = 68
        - 44 * COS (A):MH = 83 +
        59 * SIN (A): HCOLOR= 6
DC 720  HPLOT 84,68 TO MH,MV: HPL
        OT 83,67 TO MH - 1,MV - 1
        : RETURN
65 730  FOR I = - 2 TO 2: HPLOT C
        H + I,CV - 4 + ( ABS (I)
        = 2) TO CH + I,CV + 4 - (
         ABS (I) = 2): NEXT
1F 740  RETURN
5B 750  FOR I = - 1 TO 1: HPLOT C
        H - 5 - (I = 0),CV + I TO
         CH + 5 + (I = 0),CV + I:
         NEXT
```

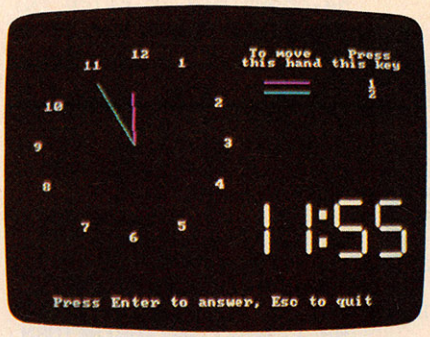
```
23 760 RETURN
27 770 HCOLOR= 2: FOR I = - 2 TO
       2: HPLOT CH + I,CV - 2 +
       ( ABS (I) < 2) TO CH + I
      ,CV + 2 - ( ABS (I) < 2):
       NEXT
27 780 RETURN
0B 790 CI = 0:CH = HC + 10: FOR
       CV = 132 TO 156 STEP 12:
       GOSUB 830: IF DP(DE,CI) <
       > PC THEN GOSUB 750:DP(D
       E,CI) = PC
FF 800 NEXT
7A 810 FOR CV = 138 TO 150 STEP
       12: FOR CH = HC + 2 TO HC
       + 18 STEP 16: GOSUB 830:
       IF DP(DE,CI) < > PC THEN
       GOSUB 730:DP(DE,CI) = PC
5E 820 NEXT : NEXT : RETURN
CB 830 CI = CI + 1:PC = VAL ( MI
       D$ (SS$(DC),CI,1)): HCOLO
       R= 2 * PC: RETURN
F0 840 FOR I = 35456 TO I + 72 S
       TEP 8: POKE I,128: POKE I
       + 7,128
D8 850 FOR J = 1 TO 6: READ A: P
       OKE I + J,A: NEXT : NEXT
       : RETURN
90 860 DATA 188,230,246,238,230,
       188
B1 870 DATA 152,156,152,152,152,
       188
75 880 DATA 188,230,176,140,230,
       254
88 890 DATA 188,230,176,224,230,
       188
9F 900 DATA 176,184,180,254,176,
       176
5D 910 DATA 254,134,190,224,230,
       188
79 920 DATA 188,134,190,230,230,
       188
8A 930 DATA 254,224,176,152,140,
       140
14 940 DATA 188,230,188,230,230,
       188
80 950 DATA 188,230,230,252,176,
       152
E8 960 FOR I = 768 TO I + 87: RE
       AD A: POKE I,A: NEXT : RE
       TURN
A4 970 DATA 216,120,133,69,134,7
       0
50 980 DATA 132,71,166,7,10,10
5B 990 DATA 176,4,16,62,48,4
A2 1000 DATA 16,1,232,232,10,134
4A 1010 DATA 27,24,101,6,133,26
8D 1020 DATA 144,2,230,27,165,40
7F 1030 DATA 133,8,165,41,41,3
6B 1040 DATA 5,230,133,9,162,8
28 1050 DATA 160,0,177,26,36,50
73 1060 DATA 48,2,73,127,164,36
57 1070 DATA 145,8,230,26,208,2
AF 1080 DATA 230,27,165,9,24,105
1F 1090 DATA 4,133,9,202,208,226
71 1100 DATA 165,69,166,70,164,7
       1
5C 1110 DATA 88,76,240,253
A1 1120 FOR DC = 0 TO 10: READ S
       S$(DC): NEXT : RETURN
02 1130 DATA 1011111,0000101,111
       0110,1110101
14 1140 DATA 0101101,1111001,111
       1011,1000101
8E 1150 DATA 1111111,1111101,000
       0000
42 1160 FOR I = 1 TO 12: READ CY
       (I),CX(I): NEXT : RETURN
AC 1170 DATA 2,18,5,22,9,23
23 1180 DATA 13,22,16,18,17,12
5B 1190 DATA 16,6,13,2,9,1
65 1200 DATA 5,2,2,6,1,12
```

Program 4: Hickory, Dickory, Dock For IBM PC/PCjr

Version by Tim Victor, Editorial Programmer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
PK 10 KEY OFF:RANDOMIZE TIMER
MN 20 DIM DD(4),DS(4,7),SS$(10),
      CH(12),CV(12)
HO 30 DIM DH(5),DV(5)
FB 40 PI=4*ATN(1)
HP 50 GOSUB 900:GOSUB 940:GOSUB
      840
GA 60 GOSUB 300
KC 70 SCREEN 1
CH 80 GOSUB 530:GOSUB 540:GOSUB
      400
CH 90 FOR CP=0 TO 3:DD(CP)=10:FO
      R SN=1 TO 7:DS(CP,SN)=0:NE
      XT:NEXT
JM 100 HH=84:HV=36:MH=84:MV=21
BI 110 IF GM<4 THEN 160
OA 120 HR=1:MN=0:GOSUB 700:GOSUB
       550
IA 130 LOCATE 25,11:PRINT "Press
       Esc to quit";
PH 140 GOSUB 500:IF K$=CHR$(27)
      THEN 60
GC 150 GOSUB 700:GOSUB 550:GOTO
      140
PA 160 NC=0
NE 170 NW=0:HR=INT(12*RND(1))+1
LD 180 IF GM=1 THEN MN=0
PM 190 IF GM=2 THEN MN=30*INT(2*
      RND(1))
OO 200 IF GM=3 THEN MN=5*INT(12*
      RND(1))
BM 210 GOSUB 700:TH=HR:TM=MN:HR=
      1:MN=0
LG 220 LOCATE 25,3:PRINT "Press
      Enter to answer, Esc to q
      uit";
EJ 230 K$="":WHILE K$<>CHR$(27)
      AND K$<>CHR$(13):GOSUB 55
      0:GOSUB 500:WEND
PL 240 IF K$=CHR$(27) THEN 60
CA 250 LOCATE 25,3:IF HR=TH AND
      MN=TM THEN 280
IH 260 NW=NW+1:IF NW<3 THEN PRIN
      T SPACE$(8) "That's not c
      orrect"SPACE$(8);:NC=0:FO
      R DLAY=1 TO 500:NEXT:GOTO
       220
LB 270 HR=TH:MN=TM:GOSUB 550:PRI
      NT SPACE$(4) "This is the
       correct answer" SPACE$(4
      );:FOR I=1 TO 1500:NEXT:G
      OTO 170
JD 280 PRINT SPACE$(10) "You're
      right!" SPACE$(11);:NC=NC
      +1:IF NC=5 THEN NC=0:GOSU
      B 460
GB 290 FOR DLAY=1 TO 1500:NEXT:G
      OTO 170
NO 300 SCREEN 0:WIDTH 40:CLS
BB 310 LOCATE 6,8:PRINT "Press k
      ey to select game:"
ON 320 LOCATE 8,5:PRINT "1. Hour
      s test"
IB 330 LOCATE 9,5:PRINT "2. Hour
      s and half hours test"
LH 340 LOCATE 10,5:PRINT "3. Fiv
      e minute intervals test"
DH 350 LOCATE 11,5:PRINT "4. Pra
      ctice"
NC 360 LOCATE 12,5:PRINT "5. Qui
      t"
NA 370 K$=INPUT$(1):IF K$<"1" OR
       K$>"5" THEN 370
```



"Hickory, Dickory, Dock" for the IBM PC/PCjr.

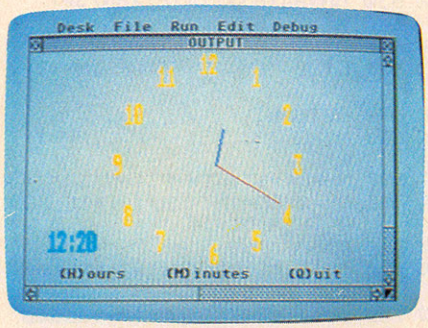
```
JN 380 IF K$="5" THEN END
PA 390 GM=VAL(K$):RETURN
IE 400 LOCATE 1,23:PRINT " To mo
      ve    Press";
DG 410 LOCATE 2,23:PRINT "this h
      and this key";
CG 420 LOCATE 4,37:PRINT "1":LOC
      ATE 5,37:PRINT "2"
DF 430 LINE (196,27)-(235,28),2,
      BF
PA 440 LINE (196,35)-(235,36),1,
      BF
NI 450 RETURN
CP 460 PLAY "mnt180o318gggaaal2g
      14n018g14e18e14f18f12e14n
      0"
LC 470 PLAY "18e14c18c14e18e14d1
      8d14a."
KA 480 PLAY "ml18gagfed14c."
NA 490 RETURN
FI 500 K$=INPUT$(1):IF K$="1" TH
      EN HR=HR+1+12*(HR=12)
EA 510 IF K$="2" THEN MN=MN+5+60
      *(MN=55)
MD 520 RETURN
OM 530 FOR I=1 TO 12:LOCATE CV(I
      ),CH(I):PRINT MID$(STR$(I
      ),2):NEXT:RETURN
BA 540 LH=241:FOR LV=128 TO 149
      STEP 21:LINE (LH,LV)-(LH+
      5,LV+6),3,BF:NEXT:RETURN
QK 550 LINE (84,76)-(HH,HV),0
DN 560 LINE (83,75)-(HH-1,HV-1),
      0
NL 570 LINE (84,76)-(MH,MV),0
BI 580 LINE (83,75)-(MH-1,MV-1),
      0
IB 590 HH=84+48*SIN(PI*(HR/6+MN/
      360))
FM 600 HV=76-40*COS(PI*(HR/6+MN/
      360))
CH 610 LINE (84,76)-(HH,HV),2
GC 620 LINE (83,75)-(HH-1,HV-1),
      2
DO 630 MH=84+63*SIN(PI*MN/30)
IJ 640 MV=76-55*COS(PI*MN/30)
OC 650 LINE (84,76)-(MH,MV),1
CD 660 LINE (83,75)-(MH-1,MV-1),
      1
NO 670 RETURN
HO 680 LINE (83,75)-(HH-1,HV-1),
      2
EK 690 MH=84+63*SIN(PI*MN/30)
MK 700 CP=0:DC=INT(HR/10):IF DC=
      0 THEN DC=10
MK 710 GOSUB 760
DL 720 CP=1:DC=HR-10*INT(HR/10):
      GOSUB 760
CJ 730 CP=2:DC=INT(MN/10):GOSUB
      760
MM 740 CP=3:DC=MN-10*DC:GOSUB 76
      0
NL 750 RETURN
IP 760 IF DD(CP)=DC THEN RETURN
      ELSE DD(CP)=DC
```

```
LL 770 SN=0:FOR SV=0 TO 40 STEP
      20:GOSUB 810:IF DS(CP,SN)
      <>HC THEN GOSUB 820:DS(CP
      ,SN)=HC
QD 780 NEXT
DM 790 FOR SV=0 TO 20 STEP 20:FO
      R SH=0 TO 24 STEP 24:GOSU
      B 810:IF DS(CP,SN)<>HC TH
      EN GOSUB 830:DS(CP,SN)=HC
FL 800 NEXT:NEXT:RETURN
FP 810 SN=SN+1:HC=(MID$(SS$(DC),
      SN,1)="1"):RETURN
JC 820 PUT (174+CP*36-12*(CP>1),
      120+SV),DH,XOR:RETURN
ID 830 PUT (170+CP*36-12*(CP>1)+
      SH,123+SV),DV,XOR:RETURN
LM 840 SCREEN 1:CLS
GG 850 FOR LV=0 TO 3:LINE (1+(LV
      =1 OR LV=2),LV)-(18-(LV=1
       OR LV=2),LV),3:NEXT
LG 860 GET (0,0)-(19,3),DH:PUT (
      0,0),DH,XOR
LO 870 FOR LH=0 TO 3:LINE (LH,1+
      (LH=1 OR LH=2))-(LH,16-(L
      H=1 OR LH=2)),3:NEXT
ON 880 GET (0,0)-(3,17),DV:PUT (
      0,0),DV,XOR
NE 890 RETURN
HB 900 FOR DC=0 TO 10:READ SS$(D
      C):NEXT:RETURN
BI 910 DATA "1011111","0000101",
      "1110110","1110101"
QO 920 DATA "0101101","1111001",
      "1111011","1000101"
NN 930 DATA "1111111","1111101",
      "0000000"
QD 940 FOR I=1 TO 12:READ CV(I),
      CH(I):NEXT:RETURN
NN 950 DATA 2,16,6,20,10,21
IG 960 DATA 14,20,18,16,19,11
FD 970 DATA 18,6,14,2,10,1
MG 980 DATA 6,2,2,6,1,11
```

Program 5: Hickory, Dickory, Dock For Atari ST

Version by Kevin Mykytyn, Editorial Programmer

```
10 randomize 0:goto 30
20 z=a*.0175:x=int(xc-xr*cos(z)):y=int(y
   c-yr*sin(z)):return
30 ch=16:gosub 470:openw 2:clearw 2:ful
   lw 2:ohx=130:omx=130:ohy=75:omy
   =75
40 nr=0:xr=70:yr=60:xc=130:yc=75:got
   oxy 0,5:color 6:print " 1. Test - hours"
50 print:print " 2. Test - hours and half ho
   urs"
60 print:print " 3. Test - five minute inter
   vals"
70 print:print " 4. Practice":print:print " 5
   . Quit"
80 k=inp(2):if k<49 or k>53 then 80
90 if k=53 then ch=6:gosub 470:end els
   e if k=52 then 250
100 n=k-48:gosub 280
110 hr=int(rnd(1)*12)+1:mn=0:if n=2 th
   en mn=int(rnd(1)+.5)*30:goto 130
120 if n=3 then mn=int(rnd(1)*12)*5
130 gosub 380:amn=mn:ahr=hr:mn=0:h
   r=12
140 gosub 340:gosub 420:if k=113 then 30
150 if k<>13 then 140
160 color 2:if amn<>mn or ahr<>hr the
   n 190
170 nr=nr+1:gotoxy 26,15:print "Right!":
   b=1:c=5:gosub 560
180 nw=0:gosub 240:goto 220
190 gotoxy 26,15:print "Wrong!":b=5:c=1
   :gosub 560
200 gosub 240:hr=ahr:mn=amn:nw=nw
   +1:if nw<>3 then 130
210 gosub 340:for td=1 to 4000:next:nw=
   0:goto 230
220 if nr=5 then nr=0:gosub 500
230 for t=1 to 500:next:goto 110
240 for td=1 to 300:next:sound 1,0:gotox
   y 26,15:print "                ":return
250 gosub 280
260 gosub 340:gosub 380:gosub 420:if k=1
   13 then 30 else 260
270 ' draw the clock
280 clearw 2:color 1
290 ch=6:gosub 470:gotoxy 3,17:print "(H)
   ours    (M)inutes    (Q)uit";
300 color 6:ch=16:gosub 470:nr=0:nw=0:
   for q=1 to 12:a=q*30+90:gosub 20
310 x=int(x/8):y=int(y/8):if q=11 or q=
   12 then x=x-1
320 gotoxy x,y:print q:next
330 xr=xr-7:yr=yr-7:xc=xc+28:yc=yc+
   8:mn=0:hr=12:return
340 color 1,1,0:linef xc,yc,omx,omy:linef xc
   ,yc,ohx,ohy
350 color 1,1,2:a=mn*6+90:gosub 20:line
   f xc,yc,x,y:xr=xr/2:yr=yr/2
360 color 1,1,4:omx=x:omy=y:a=hr*30+
   90+mn/2:gosub 20:linef xc,yc,x,y
370 xr=xr*2:yr=yr*2:ohx=x:ohy=y:retu
   rn
380 color 5:gotoxy 2,15:if hr<10 then prin
   t " ";
390 q=hr:gosub 410:print q$;":";:if mn<1
   0 then print "0";
400 q=mn:gosub 410:print q$:return
410 q$=right$(str$(q),len(str$(q))-1):return
420 k=inp(2):if k=109 then mn=mn+5:i
   f mn=60 then mn=0
430 if k=104 then hr=hr+1
440 if hr=13 then hr=1
450 if k=104 or k=109 or k=13 or k=11
   3 then return
460 goto 420
470 poke contrl,12:poke contrl+2,1:pok
   e contrl+6,0
480 poke ptsin,0:poke ptsin+2,ch
490 vdisys (0):return
500 restore 520:for nt=1 to 29:read a,b,c
510 sound 1,15,a,b,c*7:next:sound 1,0:retu
   rn
520 data 8,5,1,10,5,1,8,5,1,6,5,1,5,5,1,3,5,1,1,5
   ,5
530 data 5,5,1,8,5,1,10,5,1,8,5,1,6,5,1,5,5,1,3,5
   ,1,1,5,5
540 data 5,5,1,3,5,2,3,5,1,10,5,3,8,5,2,8,5,1,1,6
   ,3
550 data 8,5,1,10,5,1,8,5,1,6,5,1,5,5,1,3,5,1,1,5
   ,6
560 for a=b to c step 2*sgn(c-b):sound 1,1
   5,a,6
570 wave 1,1,14,5,5:next:return
```

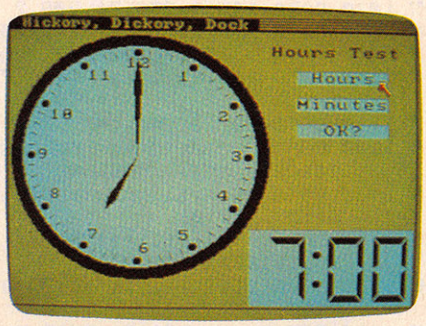


The Atari ST version of "Hickory, Dickory, Dock."

Program 6: Hickory, Dickory, Dock For Amiga

Version by John Krause

```
CLEAR,30000←
GOSUB init←
loop:←
MENU 1,0,1←
IF MENU(0)=1 THEN ON MENU(1) GOS
UB practice,hours,half,five,quit←
IF p THEN GOSUB SetClock←
GOTO loop←
practice:←
COLOR 3,0:LOCATE 2,17:PRINT " Practi
ce "←
SAY TRANSLATE$("praktis.")←
p=1:hour=0:minute=0:GOSUB Updat
eAnalog←
HourDigital=0:MinuteDigital=0:GOSU
B UpdateDigital←
RETURN←
hours:←
p=0:COLOR 3,0:LOCATE 2,17:PRINT '
' Hours Test "←
SAY TRANSLATE$("hours test.")←
FOR count=1 TO 5←
MinuteDigital=0:HourDigital=INT(R
ND*12)*12←
GOSUB GetAnswer←
NEXT←
GOSUB music←
RETURN←
half:←
p=0:COLOR 3,0:LOCATE 2,17:PRINT "H
alf Hours Test"←
SAY TRANSLATE$("half hours test.")←
FOR count=1 TO 5←
MinuteDigital=CINT(RND)*72:HourDi
gital=INT(RND*12)*12←
GOSUB GetAnswer←
NEXT←
GOSUB music←
RETURN←
five:←
p=0:COLOR 3,0:LOCATE 2,17:PRINT
" 5 Minute Test"←
SAY TRANSLATE$("five minut test.")←
FOR count=1 TO 5←
MinuteDigital=INT(RND*12)*12:Hour
Digital=INT(RND*12)*12←
GOSUB GetAnswer←
NEXT←
GOSUB music←
RETURN←
```



Speech synthesis and mouse control are featured in the Amiga version of "Hickory, Dickory, Dock."

```
quit:←
SYSTEM←
SetClock:←
answer=0←
IF MOUSE(0)=1 THEN←
IF MOUSE(3)>220 AND MOUSE(3)<29
0 THEN←
IF MOUSE(4)>27 AND MOUSE(4)<36 TH
EN←
GOSUB IncHour←
IF p THEN GOSUB IncHourDigital←
END IF←
IF MOUSE(4)>45 AND MOUSE(4)<54 TH
EN←
GOSUB IncMinute←
IF p THEN GOSUB IncMinuteDigital←
END IF←
IF MOUSE(4)>63 AND MOUSE(4)<72 AN
D p=0 THEN←
COLOR 1,0←
IF INT(hour/12)=HourDigital/12 AN
D minute=MinuteDigital THEN←
LOCATE 10,23:PRINT "Correct!"←
answer=2:SAY TRANSLATE$("corekt.'
')←
ELSE←
LOCATE 10,23:PRINT "Wrong!"←
answer=1:SAY TRANSLATE$("wrong.'
')←
END IF←
FOR i=0 TO 2000:NEXT←
LOCATE 10,23:PRINT SPACE$(9)←
END IF←
END IF←
END IF←
RETURN←
GetAnswer:←
MENU 1,0,0←
GOSUB UpdateDigital:wrong=0←
loop1: GOSUB SetClock←
IF answer=0 THEN loop1←
IF answer=2 THEN←
RETURN←
ELSE←
wrong=wrong+1←
IF wrong<3 THEN←
GOTO loop1←
ELSE←
WHILE MinuteDigital<>minute:GOSU
B IncMinute:WEND←
WHILE HourDigital/12<>INT(hour/12)
:GOSUB IncHour:WEND←
count=count-1←
FOR t=0 TO 4000:NEXT←
END IF←
END IF←
RETURN←
music:←
FOR i=0 TO 27:SOUND f(i),t(i):SOUND 0,
1:NEXT:RETURN←
IncHourDigital:←
HourDigital=(OldHourDigital+12) MO
D 144←
GOSUB UpdateDigital←
RETURN←
IncMinuteDigital:←
MinuteDigital=(OldMinuteDigital+12
) MOD 144←
HourDigital=(OldHourDigital+1) MO
D 144←
GOSUB UpdateDigital←
RETURN←
IncHour:←
hour=(OldHour+12) MOD 144←
GOSUB UpdateAnalog←
RETURN←
IncMinute:←
minute=(OldMinute+12) MOD 144←
hour=(OldHour+1) MOD 144←
GOSUB UpdateAnalog←
RETURN←
number:←
COLOR 1,2←
LOCATE r(i),c(i)←
IF i>9 THEN PRINT "1";←
PRINT CHR$(48+(i MOD 10))←
RETURN←
UpdateDigital:←
GOSUB DrawDigital←
OldHourDigital=HourDigital:OldMinu
teDigital=MinuteDigital←
GOSUB DrawDigital←
RETURN←
DrawDigital:←
IF OldHourDigital<12 THEN OldHourDi
gital=OldHourDigital+144←
IF OldHourDigital>119 THEN PUT (165,
139),d(0,1)←
PUT (200,139),d(0,(OldHourDigital\12
) MOD 10)←
PUT (245,139),d(0,INT(OldMinuteDigit
al*5/120))←
PUT (280,139),d(0,(OldMinuteDigital*5
\12) MOD 10)←
RETURN←
ClrAnalog:←
GOSUB MinuteHand←
COLOR 2:AREAFILL←
GOSUB HourHand←
AREAFILL←
i=CINT(OldMinute/12):IF i=0 THEN i=
12←
GOSUB number←
RETURN←
UpdateAnalog:←
GOSUB ClrAnalog←
OldMinute=minute:GOSUB MinuteHan
d←
COLOR 1:AREAFILL←
OldHour=hour:GOSUB HourHand←
AREAFILL←
RETURN←
MinuteHand:←
AREA (cx,cy)←
AREA (cx+60*x((OldMinute+143) MO
D 144),cy+60*y((OldMinute+143) MO
D 144))←
AREA (cx+80*x(OldMinute MOD 144),c
y+80*y(OldMinute MOD 144))←
AREA (cx+60*x((OldMinute+1) MO
D 144),cy+60*y((OldMinute+1) MOD 14
4))←
RETURN←
HourHand:←
AREA (cx,cy)←
AREA (cx+40*x((OldHour+142) MO
D 144),cy+40*y((OldHour+142) MO
D 144))←
AREA (cx+50*x(OldHour MOD 144),cy
+50*y(OldHour MOD 144))←
AREA (cx+40*x((OldHour+2) MOD 144
),cy+40*y((OldHour+2) MOD 144))←
RETURN←
init:←
SAY ""←
SCREEN 2,320,200,2,1←
WINDOW 2," Hickory, Dickory, Dock ",,
2,2←
PALETTE 0,.6,.5,.3←
PALETTE 1,0,0,0←
PALETTE 2,.7,.7,.7←
PALETTE 3,0,0,0←
DIM s(300,6),d(300,9),x(143),y(143),r(1
2),c(12),f(27),t(27)←
MENU 1,0,1,"Test "←
MENU 1,1,1,"Practice "←
MENU 1,2,1,"Hours "←
MENU 1,3,1,"Half hours"←
MENU 1,4,1,"5 minute "←
MENU 1,5,1,"Quit "←
MENU 2,0,0,"":MENU 3,0,0,"":MENU 4,
0,0,""←
RANDOMIZE TIMER←
pi=4*ATN(1):p=1←
FOR i=0 TO 143←
x(i)=COS(pi*(i/72-.5))←
y(i)=SIN(pi*(i/72-.5))*.84←
NEXT←
FOR i=0 TO 6←
CLS:READ k←
FOR j=1 TO k:READ x,y:AREA (x,y):NE
XT←
AREAFILL:GET (0,0)-(32,48),s(0,i)←
NEXT←
FOR j=0 TO 9←
CLS:READ a$←
FOR i=1 TO 7←
IF MID$(a$,i,1)="1" THEN PUT (0,0),s(
0,i-1)←
NEXT←
GET (0,0)-(32,48),d(0,j)←
NEXT←
CLS:ERASE s←
FOR i=1 TO 12:READ r(i),c(i):NEXT←
FOR i=0 TO 27:READ f(i),t(i):NEXT←
cx=100:cy=85←
CIRCLE (cx,cy),100,1:PAINT (cx,cy),1←
CIRCLE (cx,cy),90,2:PAINT (cx,cy),2←
COLOR 1,2←
FOR i=1 TO 12:GOSUB number:NEXT←
FOR i=0 TO 143 STEP 12←
CIRCLE (cx+84*x(i),cy+84*y(i)),3←
PAINT (cx+84*x(i),cy+84*y(i))←
NEXT←
FOR i=0 TO 59←
dx=COS(pi*(i/30-.5)):dy=SIN(pi*(i/3
0-.5))←
LINE (cx+82*dx,cy+69*dy)-STEP(4*dx,
3*dy)←
NEXT←
LINE (185,135)-(320,200),2,bf←
CIRCLE (236,151),3:PAINT (236,151)←
CIRCLE (236,171),3:PAINT (236,171)←
GOSUB DrawDigital←
LOCATE 4,23:PRINT " Hours "←
LOCATE 6,23:PRINT "Minutes"←
LOCATE 8,23:PRINT " OK? "←
SAY TRANSLATE$("welcome to hickor
y dickory dock.")←
GOSUB practice←
RETURN←
DATA 4,0,1,0,21,4,19,4,5←
DATA 4,1,0,26,0,22,4,5,4←
DATA 4,27,1,27,21,23,19,23,5←
DATA 4,27,23,27,43,23,39,23,25←
DATA 4,26,44,1,44,5,40,22,40←
DATA 4,0,43,0,23,4,25,4,39←
DATA 6,1,22,6,20,22,20,26,22,21,24,5,2
4←
DATA 1111110,0011000,0110111,0111
101,1011001←
DATA 1101101,1101111,0111000,1111
111,1111101←
DATA 4,14,7,17,10,18,13,17,16,14,17,1
1←
DATA 16,7,13,4,10,3,7,4,4,7,3,10←
DATA 783.99,2,783.99,2,783.99,2,880,2
,880,2,880,2,783.99,11←
DATA 783.99,2,659.26,5,659.26,2,698.4
6,5,698.46,2,659.26,11←
DATA 659.26,2,523.25,5,523.25,2,659.2
6,5,659.26,2,587.33,5,587.33,2,880,8←
DATA 783.99,2,880,2,783.99,2,698.46,2
,659.26,2,587.33,2,523.25,11←
```

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Philips CD-ROM And *The Electronic Encyclopedia* For IBM

Tony Roberts, Production Director

Requirements: IBM PC with at least 256K RAM. Versions for other personal computers expected soon.

Recent years have unleashed an information explosion—an uncoordinated, unmanaged proliferation of data. New developments, however, indicate that we stand poised to harness this data and place the immense power of the information age at the fingertips of anyone with access to a personal computer.

The harbinger of this new era is the hardware/software combination of a CD-ROM (Compact Disc–Read Only Memory) player and a compact disc containing up to 600 megabytes of digitized data. The first such combination available is the Philips CM100 player and Grolier's *The Electronic Encyclopedia.* Available now for the IBM PC and compatibles, this package is an exciting look at the future of information retrieval.

The Electronic Encyclopedia is a 20-volume, nine-million-word encyclopedia with cross-referenced index encoded on a five-inch plastic disc (with about two-thirds of the disc to spare). Using this disc, a CD-ROM player, and an IBM PC running Activenture Corporation's *Knowledge Retrieval System,* it's possible to access any article in the encyclopedia in seconds. In fact, you can find every occurrence of any keyword throughout the entire encyclopedia.

The System

The Philips CM100 system consists of the CD-ROM drive itself, a tan box about 14 inches wide, 6 inches high, and 10 inches deep; an interface card, which occupies one of the full slots in the IBM PC; and a connecting cable. Everything can be set up in a matter of minutes. The disc player, incidentally, cannot play audio compact discs, although the technology is quite similar.

Activenture's *Knowledge Retrieval System* is the link between you and the CD-ROM. It's so simple to operate that the 94-page instruction manual is practically superfluous.

The left quarter of the screen shows the commands available by pressing one of the ten function keys on the IBM. For instance, the F1 key, labeled About Keys, displays a map showing you where you are in the program and offers help on any of the functions available. The remainder of the screen displays options for your searches and the articles you call up.

A Simple Search

After viewing the title screen and pressing the function key labeled Word Search, you're ready to begin sifting through the encyclopedia. Let's say you're looking for references to the subject "information age."

Following the onscreen prompts, you can ask the computer to search for the word *information* along with the word *age* occurring anywhere in the same article. Within seconds, a message is flashed on the screen that 1,472 occurrences of the word *information* have been found. Then the display indicates that 3,221 occurrences of the word *age* have been located. Putting the two words together, the program finally reports that there are 228 occurrences of the words *information* and *age* in 117 articles.

That's probably more than you bargained for. To narrow things down, you can instruct the computer to look only for occurrences of the two words within the same paragraph. Seconds later, the program reports finding 33 occurrences in 15 articles, including pieces on animal behavior, insurance, census, and poison.

Narrowing the search parameters further, you can specify that *information* and *age* must appear in exact order: that is, "information age." This time, the program finally reports that there are two occurrences in one article. When you press F4, Show Titles, the program loads and displays the titles of the articles located during the search. In this case, the article you're probably interested in is "Information Science."

Pressing F2 loads the article and displays the paragraph containing the first reference to the search words. The search words are highlighted throughout the article, so it's easy to scan it using the function keys labeled Next Page and Previous Page to find your information quickly. As it turns out, the "Information Science" article has only one relevant paragraph relating to "information age" (the other occurrence of the phrase appears in the bibliography at the end of the article). To print out a hardcopy, you can press F7, Make Copy. The result is the following paragraph:

> It is common to speak of the present as the Information Age, or to refer to the information explosion. About 50 percent of all workers in the United States today are in some way involved in information processing. Many people do not receive the right information at the right time, however, because they are not aware the information exists, because they do not know where to look for it, or because it is buried in a mass of extraneous information and is difficult to find.

Plenty Of Options

There are many options available after choosing Make Copy. You can copy the article or parts of it to a printer, or save it to disk. You can select printer margins, line spacing, hyphenation, and justification, if you like. If you're saving to disk, you can save it in ASCII text format, in a *WordStar*-compatible format, or in a PRINT format.

Only A Beginning

This description of using *The Electronic Encyclopedia,* and the encyclopedia itself, are only beginnings. Much more complex searches are possible by using wildcards and negating certain words. For example, you could search for *horse* but not *iron* to eliminate articles about steam engines from your research on equestrians. Another timesaving feature is the Outline option. If you find yourself mired in a complex article,

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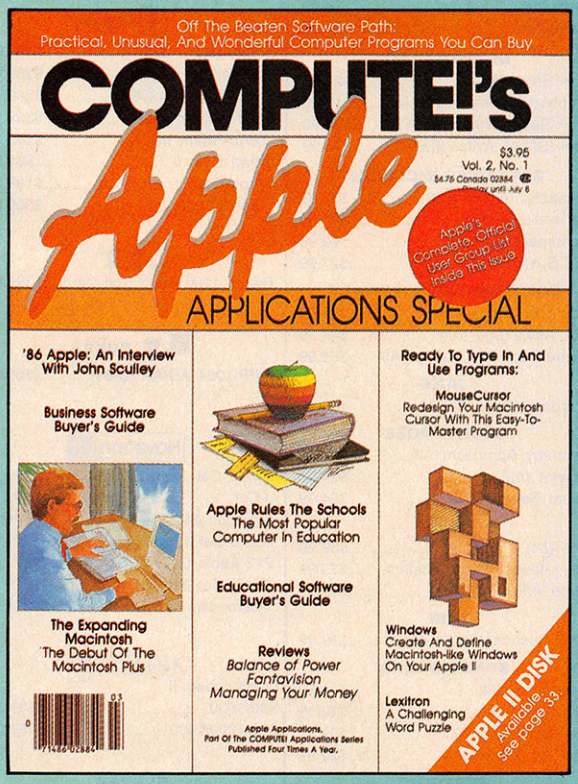

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Apple Automatic Proofreader

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Though it contains more than 30,000 articles, *The Electronic Encyclopedia* is, by its very nature, general. It is not detailed enough to be particularly helpful in serious research, though it does quite well at answering general questions. Thanks to the compact disc format, however, it is practical and economical to update regularly, another advantage over its paper counterparts. Grolier promises to update the encyclopedia each year for $24.95.

Having all the information in 20 volumes available on a single disc is exciting, but even more thrilling is what it promises for the future. Imagine a whole library of compact disc databases—indexes to law libraries, census data, technical journals—and imagine what it might mean to have the key to all that information—the key to the information age.

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The Body In Focus

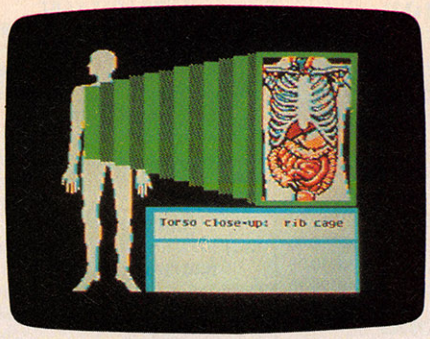
Larry Krengel

Requirements: Commodore 64; Apple II-series computer with at least 64K RAM; IBM PC with color/graphics adapter; or an IBM PCjr. Disk only.

I'm always excited when I see computer software that displays impressive graphics. And *The Body in Focus* is exciting software. What's more, this human anatomy program is educational, accurate, and engaging.

I've been teaching biology for 15 years. When I first examined *The Body in Focus,* I found it to be technically correct. But why did I continue looking at the program long after I had assured myself it was biologically valid? Because I didn't want to miss any of the great graphic presentations.

For example, the designers must have burned the midnight oil to make the simulated body sneeze and even raise goose bumps. My kids thought they were seeing things when the skeleton swung its head around to demonstrate a pivot joint. (When you can't believe what you're seeing, one keypress repeats the action.)



With The Body in Focus, *anyone can have X-ray vision. (Commodore 64 version.)*

The Body in Focus comes on two disks. The first contains tutorials, and the second presents questions based on the tutorials. Eight vital body systems are covered—including the circulatory, respiratory, endocrine, skeletal, nervous, digestive, muscular, and integumentary (skin, that is). A tour of each system takes 10 to 15 minutes.

To illustrate each body system, the disk contains three "body closeups": a closeup view of each system within the head, torso, and arm. The closeups let you strip away the body layer by layer, going deeper and deeper. It's like a graphic dissection. If you find one of the screens particularly interesting, there's a "tell me more" key which calls up a more complete discussion of what you see.

Body Trivia

The second disk contains a library of more than 200 questions based on the tutorials. If you think you already know a lot about the human body, try the "body I.Q. test" before using the tutorials. Do you know how many taste buds there are on a human tongue? Or how long it takes your body to pump 3,000 gallons of blood? Or why you get goose bumps?

The Body in Focus is very simple to use. Which key do you press to view the digestive system? Or the skeletal system? You don't have to memorize these details—a soft plastic keyboard overlay lists all the key functions.

Another strong point of the program is its use of sound. With some software, you can often tell that sound was added as an afterthought. But with *The Body in Focus,* the sound is very functional. You quickly learn the different sounds for "your turn" and "that key doesn't do anything." Sounds are used intelligently for getting your attention at the right time and for signifying right and wrong responses.

As a parent, I would recommend *The Body in Focus* for a youngster who is taking biology. As a teacher, I probably wouldn't use *The Body in Focus* as part of the curriculum because it is not sequential (some students may choose not to press "tell me more"). However, this program is exciting enough that I think students would invest their own time to travel through *The Body in Focus.* It would be great for enrichment.

The Body in Focus
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One-On-One For Amiga

Charles Brannon, Program Editor

Requirements: Amiga with 256K RAM. Joystick and 512K RAM recommended.

As promised, Electronic Arts has successfully translated for the Amiga several of its popular games originally written for the Commodore 64, Atari, and Apple. These programs are showcase pieces of game design. On computers like the Amiga, they can be even better, using the power of the machine to enhance the realism with additional color, detail, and smoother motion. The Amiga's stereo sound system can also be exploited for more realistic music and unusual sound effects.

Not all games can easily incorporate these new features without being redesigned, however. Because *One-on-One* is an adaptation, it is very similar to the original version running on, say, a Commodore 64. Although the Amiga version has a more colorful screen with true-to-life color schemes, basically the original game's graphics have been retouched. For example, the basketball court is convincingly colored to look like a polished wood floor. This is possible due to the Amiga's ability to display up to 32 colors simultaneously on its low-resolution graphics screen. (The term *low resolution* is relative; the same resolution of 320 × 200 pixels is called *high resolution* on the Commodore 64.) Each color is chosen from a wide range of possible hues (4,096 in all), so it's easier to approximate real-life colors.

On the other hand, the sound effects in *One-on-One* are considerably enhanced, since the Amiga can play back digitally recorded sounds. You can hear the actual background noises of a basketball game, with the crowd murmuring, cheering, booing, catcalling,

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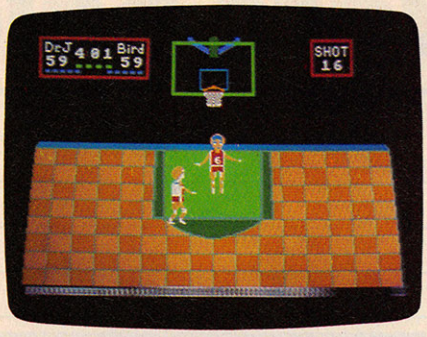

The Amiga version of One-on-One *has more colorful graphics and real-life sound effects.*

and roaring when a player makes a basket (if the Amiga is hooked up to a stereo sound system, you'll notice that the cheering is loudest from the scoring team's side). And if you listen closely, you can even hear a vendor wandering through the crowd ("Hot Dogs! Cold Beer!").

Two Superstars

For those unfamiliar with *One-on-One*, it's a two-man basketball game with a 3-D perspective of the court. The two ballplayers are none other than Larry Bird and Dr. J (Julius Erving). Consulting with Larry Bird and Dr. J, Electronic Arts has modeled the actual playing characteristics of the two superstars. You control the action with the mouse or a joystick. Push forward to move toward the basket, back to move away, and left and right to move laterally. A quick press of the button spins you around (a "360"). If you're holding the ball, a long press sends it flying towards the basket (you have to time it carefully). If you're not holding the ball, a long press sends your player leaping up for a rebound or attempted block.

The computer sometimes adjusts your player's position. When you're facing the basket and the opposing player shoots, you automatically turn around to face the ball so you can jump up and attempt to block it.

The game attempts to be realistic without encumbering arcade-style play. A bar graph at the bottom of the screen shows each player's remaining energy, a sort of exhaustion factor. As your energy drains, from strenuous running, leaping, and blocking, your player becomes sluggish, moves slower, is unable to jump very high, and misses more shots. If you stand still, your energy level builds as you rest. When either player takes a time out or when a quarter ends, both players are refreshed. This is an important part of the game, since if you had infinite energy, you could run the best players off the court.

Every feature of professional basketball is here: the 24-second shot clock, the three-point goal, and penalties for hacking, charging, blocking, and traveling. However, the game makes no attempt to charge you for goaltending—where you try to block a shot on its downward flight into the basket.

Although you have a choice of using the mouse or a joystick in *One-on-One*, the mouse doesn't make a very good controller in this game. You have to keep moving it constantly to keep your player going. This is difficult with limited desk space for the mouse. A joystick affords much better control. (Any Commodore or Atari joystick works with the Amiga.)

Master Of The Slam-Dunk

While playing *One-on-One*, I found that the simulation of the characters really doesn't seem to affect the game much. As in real life, Larry Bird is nearly always able to make a three-point shot and Dr. J. is the master of the slam-dunk, but there doesn't seem to be all that much difference between the players. (However, a 76ers or Celtics fan might instantly notice some subtle nuances.) In the end, it's joystick dexterity coupled with some basketball experience that determines the ultimate winner.

Pull-down menus that work with either the joystick or the mouse let you select the game's difficulty level, loser's outs versus winner's outs, and whether you are competing for points or against time. There are four difficulty levels: Park & Rec, Varsity, College, and Pro. You can also play against the computer, choosing which player the computer controls. If you can beat the computer playing at the Pro level, you can whip most human opponents.

As proof of the careful attention that went into this game, Electronic Arts has included several cute features that give the game a special character. When the computer considers that it's just observed a particularly interesting or amazing shot, it calls for an *Instant Replay* that repeats the last few seconds—quite flattering if your player made the shot, but bound to draw a sneer from your opponent. A sufficiently powerful slam-dunk can shatter the backboard, raining down slivers of glass. A little janitor waddles out with a broom, looks at you and grumbles, then sweeps the fragments into his dustpan. This happened twice within a few hours of play, so it's more likely to happen than in real life.

Although the graphics and sound are uniquely Amiga, the game play is consistent with earlier versions. A testament to careful research and clever programming, perhaps this element of *One-on-One* doesn't really need improving, even on such a powerful computer as the Amiga.

One-on-One
Electronic Arts
1820 Gateway Drive
San Mateo, CA 94404
$39.95

AtariWriter Plus

Tom R. Halfhill, Editor

Requirements: Atari 400, 800, XL, or XE computer with at least 48K RAM, a disk drive, and printer. Special version included for 130XE.

The original *AtariWriter* was by no means the first word processor for Atari computers, nor the most powerful—but it quickly became one of the most popular. Its manageable range of commands, ease of use, and pop-in cartridge convenience rapidly made it the word processor of choice for thousands of beginners and experienced users alike.

Now comes its successor: *AtariWriter Plus*. All new and improved, *AtariWriter Plus* nevertheless retains a familiar resemblance to *AtariWriter*. Significant new features include an integrated spelling checker program with 36,000-word dictionary, an integrated mail-merge program, a utility program that lets you construct your own printer driver in case you have an oddball printer, the ability to take advantage of the 128K RAM in the 130XE, selectable insert/strikeover modes, optional horizontal scrolling up to 249 columns, double-column printing, form-letter printing, support for dual-drive systems, and a larger failsafe buffer.

Buy One, Get One Free

AtariWriter Plus comes on two disks instead of a cartridge, and one of the disks is a flippy with a different version of the program on each side. One version works on all eight-bit Atari computers with at least 48K RAM, and the other version works only on the 130XE. The second disk contains the dictionary for the spelling checker.

There are disadvantages to this new arrangement, especially if you've grown accustomed to the instant start-up convenience and durability of the *AtariWriter* cartridge. *AtariWriter Plus* takes nearly a minute to load, and the program disk is copy-protected. That means if the disk fails after the 90-day warranty expires, you're out of action until you can get another (at the full

replacement cost of the program). Fortunately, the dictionary disk is not copy-protected, and that's the disk which may get the heaviest use, as we'll explain below.

When you boot up *AtariWriter Plus*, the first thing you see after a title screen is the main menu. It's almost identical to the main menu of *AtariWriter* with these additions: Verify Spelling, Global Format, Mail Merge, Index Drive 1, and Index Drive 2. Verify Spelling and Mail Merge load those corresponding programs, which we'll cover in a moment. The Index selections call up disk directories for one- or two-drive systems (*AtariWriter* allowed access to only one drive).

Global Format is a new option that changes the way you format a file for printing. The old *AtariWriter* always places a row of formatting commands across the top of your file; *AtariWriter Plus* eliminates this. Instead, Global Format brings up a screen that lets you adjust these settings for any file currently in memory. Settings include top and bottom margins, page length, paragraph indention and spacing, type font, justification on/off, left and right margins, second left and right margins (for double-column printing), page numbering, line spacing, and page wait on/off (for single-sheet or tractor-feed paper). As before, all of these settings default to common values, and you can imbed additional formatting commands within your file if you need to change a setting partway through a document.

Although Global Format rids the writing/editing screen of distracting formatting codes, it adds them to the disk file. When you save an *AtariWriter Plus* document from the main menu, the program no longer saves the text in standard ASCII format as *AtariWriter* did. Instead, the formatting codes are tacked onto the file as a header. This restores the settings when you reload the file later, but also causes problems if you try to load an *AtariWriter Plus* document into another word processor or upload it via modem. Fortunately, Atari provided a solution: If you press CTRL-S at the main menu, a Save ASCII option pops up. It strips off the format header and saves the text in straight ASCII.

To convert an *AtariWriter* file for *AtariWriter Plus*, all you have to do is delete the print formatting line at the top of the document and reenter the codes on the Global Format screen. ASCII files created by other word processors are easily converted, too.

Adjustable Screen

Aside from the missing format line at the top, the writing/editing screen is

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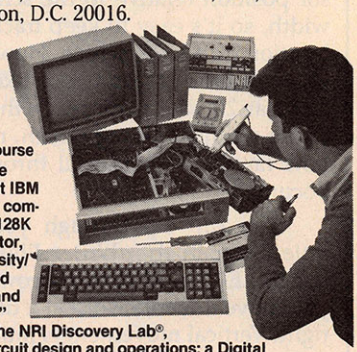

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almost identical to *AtariWriter*'s. It defaults to a width of 38 columns and 20 lines. Below this area is a three-line command window that displays the tab stops, a pair of counters for the cursor position (column and line), system messages, and other information.

New additions to the command window are indicators for the typing mode, caps lock mode, and number of bytes free. The typing mode determines whether newly typed characters make room for themselves by pushing existing characters forward, or whether they simply replace existing characters. *AtariWriter* was limited to insert mode, which irked some people. *AtariWriter Plus* defaults to insert mode, but offers the strikeover mode as well. The caps lock indicator is only semi-useful, since you'll quickly discover if you've accidentally hit this key anyway. The free memory indicator is a little more practical, although it was only a keystroke away in the old *AtariWriter*.

By pressing OPTION-C, you can change the default 38-column screen to any width from 5 to 249 columns. Of course, no more than 40 columns can be displayed at a time, so the screen scrolls horizontally to bring additional ones into view. This makes it much easier to line up columns of numbers and the like. Since this setting can be altered at any time, you can type in 38- or 40-column mode if you find horizontal scrolling distracting, and then switch to a wider screen to check the alignment of your columns.

The column counter in the command window always displays the cursor position relative to the screen's full width, so it's easy to keep track of your location on a wide screen. However, the line counter doesn't do likewise—it stops at 20 when you reach the bottom of the writing/editing screen, no matter how far down you scroll through your document.

You can zip through your text a little faster in *AtariWriter Plus* because the SELECT and cursor-arrow keys let you move a whole word at a time left or right. Vertical movement is much quicker because the OPTION up-arrow and down-arrow keys now flip screens instantly rather than scrolling them slowly as in the old *AtariWriter*. And incidentally, the cursor itself has been changed to a blinking block instead of the blinking underline that was its precursor's cursor.

Memory In The Bank

If you're using a 48K or 64K machine, *AtariWriter Plus* leaves 12,645 bytes free for text (roughly 2,100 words). That's not much compared to other word processors for the Atari. Most of them, including *AtariWriter*, leave at least 20K free.

If you're using a 130XE, the news is a little better. The 130XE version on the flip side of the *AtariWriter Plus* program disk takes advantage of the extra RAM to give you a total of 47,616 bytes free (roughly 7,900 words). But there's a catch—the program usually doesn't see this memory as one, continuous "blank page." Instead, the memory is divided into three sections called banks. The technical reasons for this are beyond the scope of this review, but they're related to the memory-addressing limitations of eight-bit computers. Although it's possible to get around these limitations, it's a programmer's nightmare.

As a result, *AtariWriter Plus* gives you three banks of 15,872 bytes on a 130XE. When you save and load from disk, the program *does* treat the banks as one continuous block of memory: a long document that occupies two or three banks is saved and loaded as a single file. Almost all other functions, however, require you to deal with each bank separately. For instance, to switch from bank to bank, you must press START-B. To move the cursor to the top or bottom of the file, you can't simply press SELECT-T or SELECT-B as usual; these commands move the cursor only to the top or bottom of the current bank. You can move blocks of text from one bank to another, but you can't define a text block that crosses a bank boundary. Search and replace operations won't bridge the bank boundaries either, but the search and replace strings remain intact so you can continue the operation after switching banks.

Another limitation is that you can't merge a file across banks. In other words, if you've got a 10,000-byte file in memory, you can't merge it with another file that is 6,000 bytes long or more without exceeding the banks' 15,872-byte capacities. (If you can merge the two files outside of the program—perhaps with DOS—you can load the joined file as a single document, though.)

One interesting command (OPTION-F) redistributes your text equally among all three banks. For instance, if you fill up bank 1, continue writing in bank 2, and later decide to insert a paragraph in bank 1, you can press OPTION-F to free up some memory. Your document will be split across three banks—somewhat awkward, but at least you'll have room for your insert. When you load a long file that won't fit in a single bank, this redistribution happens automatically.

Other Enhancements

Like *AtariWriter*, *AtariWriter Plus* preserves deleted blocks of text in a failsafe buffer so you can restore them or paste them elsewhere in the document. But while *AtariWriter*'s failsafe buffer has only enough memory for less than two screenfuls of text, *AtariWriter Plus* sets aside all remaining text memory for the buffer. That means the failsafe buffer can range in size from more than 12,000 bytes to 0 bytes, depending on how much you've written. A new command (START-E) lets you erase the buffer if it gets too full to let you continue writing.

The 130XE version, however, always sets aside about 8K for the failsafe buffer.

Defining text blocks is handled a little differently, too. Instead of marking the beginning and ending points of a block with CTRL-X, as you do in *AtariWriter*, you mark the beginning with OPTION-B. When you move the cursor, the characters you're defining as a block become highlighted in inverse video. Then you mark the end of the block with a different command that depends on which operation you want to perform. For example, to indicate the end of a text block you want to delete, you press OPTION-DELETE/BACK SPACE. A DELETE BLOCK Y/N? message asks you to confirm your choice.

AtariWriter Plus lets you perform several other operations on text blocks as well. OPTION-W counts the number of words in a block. (When you press OPTION-W without defining a block, the program counts all the words in your document—or in the current bank on a 130XE.) OPTION-A alphabetizes all the words in a block. OPTION-S saves the block on disk. And OPTION-E copies the block into the failsafe buffer so you can paste it elsewhere.

Another new feature is form printing. Let's say you need to print out a number of form letters with different names, addresses, or other information inserted at certain points. You can indicate those points by pressing OPTION-INSERT; an arrow appears on the screen. Later, the printer will pause at those points and let you type up to 35 characters.

So many other improvements have been added to *AtariWriter Plus* that we can't cover them all in detail. For instance, you can search forward and backward, search and replace control characters and specify wildcards in search strings, turn the alert beep on and off (except for keystrokes and error messages), print text in double columns for newsletters, and construct your own custom printer drivers with a BASIC program that's included. Furthermore, the 80-column (horizontal-scrolling)

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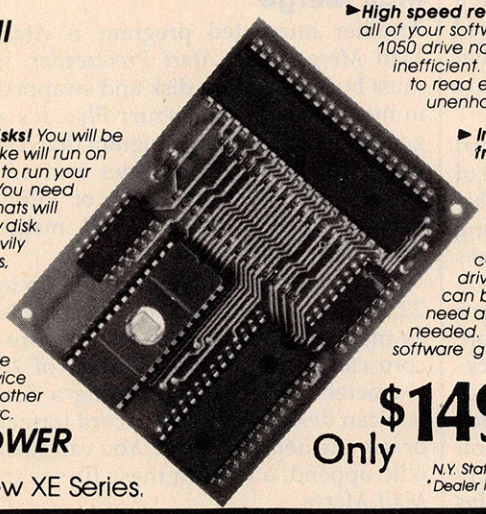

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print-preview feature has been improved: It now can show foreign-language characters if you have an XL or XE, and it even displays a preview of double-column printing.

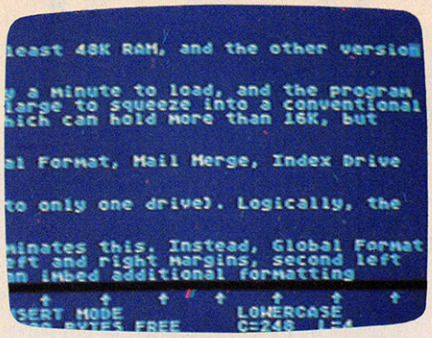
Editor On A Disk?

One of the most significant additions to *AtariWriter Plus* is *Atari Proofreader*, a spelling-checker program. Although it's integrated with *AtariWriter Plus*, it's not memory-resident. That means when you select Verify Spelling from the main menu, you have to insert the program disk and wait a half-minute or so as *Atari Proofreader* replaces *AtariWriter Plus* in memory. The same procedure is necessary when returning to the word processor from the spelling checker. Fortunately, your text file is preserved in memory during this exchange.

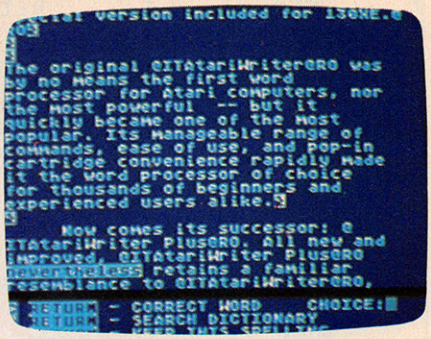
Once *Atari Proofreader* is up and running, you insert the dictionary disk and choose from several options (on a two-drive system, less disk-swapping is required). Highlight Errors checks the whole document and highlights in inverse video any words the *Proofreader* doesn't recognize; Correct Errors also highlights unrecognized words, but then pauses and lets you type in the correct spelling; Print Errors proofreads the document and dumps all unrecognized words on a printer; Dictionary Search lets you look up words on the dictionary disk by typing in your best guess as to how they're spelled; File Personal Dictionary saves on disk a short dictionary of your own special words; Add Personal Dictionary loads one of these special dictionaries from disk; Index Drive 1 or 2 calls up disk directories; Load File loads a document for proofing; Save File saves a proofed document; and Return To AtariWriter Plus exits the spelling checker back to the word processor.

Like all spelling checkers, *Atari Proofreader* lets you add your own list of special words to the dictionary. This keeps the checker from highlighting certain technical terms or proper names that you frequently use. Building a personal dictionary is easy. When proofing a file with the Correct Errors option, you can press a key that tells the checker to remember a word it didn't recognize. Later, you can save these words on disk as a personal dictionary. You can also build a dictionary by simply creating a new file with *AtariWriter Plus* and typing in a word list.

The personal dictionaries are fairly limited, however. *Atari Proofreader* remembers only the last 256 words it highlighted when checking a file. The maximum space available for a personal dictionary is 8,400 bytes on a 48K or 64K Atari—and, oddly, only 4,396 bytes on the 128K RAM 130XE. Since the average English word is about six letters long, that breaks down to about 1,200 words on a 48K/64K machine, or about 628 words on a 130XE. Of course, the kind of words you'll include in a personal dictionary will probably average longer than six letters, so these word counts may be misleading. To get around this limitation, though, you can create several personal dictionaries and proof a document in more than one pass.



The writing/editing screen of AtariWriter Plus *can now scroll horizontally as wide as 249 columns.*



Atari Proofreader, *another new feature of* AtariWriter Plus, *checks your spelling against a 36,000-word dictionary and highlights any mistakes.*

However, it takes *Atari Proofreader* quite a while to check a large document—mainly because it must read the dictionary disk constantly when proofing a file (a good reason for backing up the disk). This 3,000-word review, written with *AtariWriter Plus* on a 130XE with a 1050 disk drive, took the *Proofreader* 15 minutes to check. Of course, even a good copy editor (the kind that doesn't come on a disk) would take at least that long.

Mail Merge

Another integrated program is *Atari Mail Merge*. Like *Atari Proofreader*, it must be loaded from disk and swapped in memory with *AtariWriter Plus*. It's a general-purpose filing program that lets you compile a list of names and addresses (or any other kind of information, for that matter) and merge them into form letters.

Mail Merge can handle a file up to 22,292 bytes long. This file can include as many as 255 records, and each record can contain up to 15 fields of 20 characters each. When creating a file, you can design your own record format or use the default format. You can then edit, append, and print these files with *Mail Merge*.

To use *Mail Merge* with *AtariWriter Plus*, you press OPTION-M at the point in your document where you want to insert information from *Mail Merge*. A heart character appears on the screen, and you follow it with a number that indicates which field you want printed (1 to 15). When you print the document, the information from that field is inserted into your text. This is a particularly useful feature for printing out form letters and address labels.

You can also define a subset of a *Mail Merge* file. For instance, you could send form letters to only ten people out of a list of 100.

Integrated features like *Mail Merge* and the *Proofreader* elevate *AtariWriter Plus* to the upper rank of word processors for Atari computers. It's still not the most powerful or full-featured word processor you can buy for your Atari. But like its popular predecessor, *AtariWriter Plus* strikes a good balance between versatility and ease of use.

AtariWriter Plus
Atari Corp.
1196 Borregas Avenue
Sunnyvale, CA 94088
$49.95

Borrowed Time

Selby Bateman, Features Editor

Requirements: Commodore 64 or 128; Apple II-series computer with at least 64K RAM; IBM PC with color/graphics adapter and at least 64K RAM; Enhanced Model IBM PCjr; Atari ST-series computer; Commodore Amiga; or an Apple Macintosh. Disk only; color monitor recommended.

Your name's Harlow...Sam Harlow, private eye.

You're sitting in your office with your feet propped up, trying to figure out how to pay the rent, when the phone rings. "Sam, they want you dead," says a voice at the other end of the line. The voice fades, and you get the funny feeling someone's watching you. Before you know it, people—all kinds of people—are doing more than watching. They're coming after you. And you're living on borrowed time.

Your secretary, Iris Spencer, has taken a powder; Jerry the bartender freezes when you ask about Farnham; Hawkeye, the blind newspaper vendor, has a tip about Fred Mongo; Dave, who runs the corner hotdog stand, thinks you're trying to pin a hamburger rap on him. He keeps throwing hotdogs at you. And now someone's kidnapped your wife, Rita.

Life's tough in the big city for a down-in-the-heels gumshoe, and never tougher than in Activision's graphic-and-text adventure, *Borrowed Time*. But you don't have an opportunity to feel sorry for yourself. People keep breaking down your door, running after you in dark alleys, and unloading .38s in your direction. It's up to you, Sam. Find out who's sending all those thugs after you, and quickly. One more thing, Sam. You'd also better find out why.

Fun, Not Frustrating

In *Borrowed Time*, Activision has created a delightful game environment with the look and feel of those classic hard-boiled detective movies and novels. The game is also fun to work with, easier and faster than earlier graphics-and-text games (especially the ST and Amiga versions). Some computer adventures can be frustrating, limiting your options with complex puzzles to such an extent that just leaving a room can take hours of problem-solving. *Borrowed Time* offers a plot line and puzzles that are intriguing and challenging without demanding that you enroll in a code-breaking class.

The screen format and game movement are very well executed in *Borrowed Time*. The screen is divided into six sections: a graphics window showing scenes representing the action described in the text; a scrolling text window along the bottom third of the screen; an inventory window displaying what you're carrying; a compass showing north, south, east, and west; and two lists of words, verbs on the left and nouns on the right.

Using a joystick or mouse (depending on the computer), you can quickly select the direction you wish to travel, choose verb-noun commands from the lists, and even examine or drop what you're carrying by pressing the mouse or joystick button. Of course, you can still type in all the commands if you'd prefer, and the game's vocabulary is much more extensive than just the couple of dozen words listed on the screen at any one time. With the mouse or joystick, and especially with the fast disk access of computers like the ST, Amiga, and Macintosh, you can travel very rapidly from place to place with a minimum of typing. There is, naturally,

The Atari ST version of Borrowed Time *has the best graphics of all.*

much disk access. Depending on the computer, this can be frustratingly slow (Commodore 64 and 1541 disk drive) or amazingly swift (Atari ST).

Making a map of your travels through the city is almost mandatory. There are many different locations, and an engaging (and often dangerous) cast of characters. You can usually converse with the people you see, some of whom may not always tell you the truth. Just like any good private eye, you'll want to examine everything and watch the different screens for visual clues to help you solve the mystery or escape from tight spots.

Life Is Tough

As Sam Harlow, you're prone to meet with a lot of "accidents," resulting in the frequent untimely end of the game. But Activision has provided both a QUICKSAVE and a QUICKLOAD command that helps keep you in the action. If you hear someone pounding on your door, if a shadow suddenly looms behind you, or if there's the quiet click of a hammer being drawn back on a gun, you'd be well advised to use the QUICKSAVE command. Then, should something happen to you, use QUICKLOAD and you're back where you were just before your accident.

The designers of *Borrowed Time* obviously had a lot of fun putting the pieces together. There's a sense of humor in the text, and the visuals can be charming. Clothes hanging on a line ripple in the wind, a dog's tail wags and his tongue peeks out as he pants, the telephone receiver bounces in its cradle as it rings, and occasionally a character will glance at you from the corners of his eyes. As bullets whine over your head, your natural inclination may be to type in the command, DUCK!. All you'll get for that is the response, QUACK!.

In addition to a concise printed explanation of game rules and features, the program also contains a tutorial on the disk which helps first-time players get started. However, so intuitive is the feel of *Borrowed Time* that you can boot the disk and start to play without knowing anything about the game. The program and the graphics can vary slightly from computer to computer, depending on the differing technical capabilities of various machines. But game play appears to be quite similar throughout.

You can have a lot of fun with *Borrowed Time*. Just keep checking over your shoulder, keep moving, and expect the worst.

Borrowed Time
Activision, Inc.
2350 Bayshore Frontage Road
Mountain View, CA 94043
$29–$44 (depending on the version)

Europe Ablaze For Commodore And Apple

Neil Randall

Requirements: Commodore 64 (or 128 in 64 mode); or an Apple II-series computer with at least 64K RAM. Disk only.

Europe Ablaze is the third game from the Strategic Studies Group of Australia. Their first effort, *Reach for the Stars*, remains one of the most popular computer wargames ever released, and their second, *Carriers at War*, won the Charles Roberts Award at last year's Origins gaming convention for best computer game of the year. Add the fact that SSG's games are now being distributed by Electronic Arts, and we can see that SSG has quickly become one of the leading designers of computer wargames. And when you're at the top, people expect great things.

For those expecting excellence, *Europe Ablaze* will not disappoint. The game is a simulation of the World War II air war over Germany and England. The three scenarios included with the game cover the Battle of Britain, 1940 (the one with Churchill's famous speech); the summer 1943 U.S. and British bombing offensive; and the 1944 attempt to bomb Germany into submission.

Like *Carriers at War*, though, *Europe Ablaze* is not restricted to the scenarios provided. A detailed but remarkably easy scenario design kit allows you to alter the existing scenarios or add new ones of your own. One such scenario, which covers the Mediterranean bombing campaign of 1943, is

included in the design book. With sufficient research, historians and air war buffs can work up their own.

Like *Carriers at War, Europe Ablaze* is entirely menu-driven. By simply asking you to type Y or N, the menus guide you through all the game's activities, from formatting a disk to ordering an interception. You can command your squadrons to perform reconnaisance, execute sweeps and raids, or, at the heart of the game, fly bombing missions to the target of your choice. And you don't just send them someplace; you tell them how to get there and what to do. You can target bombs against ports, against communications facilities, against industry, or against population. And you can fly straight to the target or divide the flight into two or three "legs" to confuse the enemy. In other words, you must make the same kinds of choices your historical counterparts had to make.

Two Different Roles

To this end, *Europe Ablaze* is actually two games in one. If you want to avoid the detailed mission and squadron planning, you can assume the role of Commander-in-Chief. In this role, you issue general orders to each of your Air Fleets, and the computer carries out your orders. If you want to take your Commander-in-Chief's orders and carry out the actual missions, you can select the role of Air Fleet Commander. This role is more time-consuming, but because you have more to do it is also more interesting.

You need not restrict yourself to one or the other, however. At the beginning of the game, the program asks you which commands are to be human-controlled and which computer-controlled. If you're playing the game with friends (up to 12), each can take a different command, and the realism multiplies as each commander demands missions and materials to suit his own objectives. *Europe Ablaze* impressively establishes the levels of command; as Commander-in-Chief, you will be helpless once you've issued your orders, and as Air Fleet Commander, you must often make the best of orders you don't agree with. That's the way the Air Force works.

As mentioned earlier, those expecting excellence should be very satisfied by *Europe Ablaze*. But those hoping for innovation may not be. *Europe Ablaze* extends the menu-driven system of *Carriers at War*, smoothing it out and allowing the player a bit more freedom. But sometimes the game plays too much like its forerunner.

Still, we're beginning to see more and more refinements of existing war-game systems, and as long as designers refine—and not simply copy—the result will be games of superior quality. *Europe Ablaze* is a fine simulation that uses a proven game system. We can't ask for much more.

Europe Ablaze
Strategic Studies Group
(Distributed by Electronic Arts)
2755 Campus Drive
San Mateo, CA 94403
$49.95

Ultima IV: Quest For The Avatar For Apple And 64

James V. Trunzo

Requirements: Apple II-series computer with at least 64K RAM (Mockingboard sound enhancer optional); or a Commodore 64 or 128 (in 64 mode). Disk only. The Apple version was reviewed.

Just when you thought it was safe to venture forth into the land of Britannia, along comes *Ultima IV: Quest for the Avatar*. The sequel to *Ultima III* certainly appears to live up to its advance notice. I say *appears* because I've spent only a dozen or so hours adventuring in the world of Britannia, and therefore can't claim to be all-knowledgeable about the surprises lurking in this game. However, considering the tremendous scope of *Ultima IV*, if I waited until completely finishing the game before reviewing it, *Ultima X* would probably be on the market by then. The world of *Ultima IV: Quest for the Avatar* is approximately 16 times larger than that of its predecessors.

But map size is hardly the only difference between *Ultima IV* and the other *Ultimas*. It is a tribute to the designers' programming skills and creative genius that *Ultima IV* quickly establishes its own identity while continuing the by-now familiar play format employed in *Ultima I* through *III*.

While *Quest for the Avatar* retains many of the standard features of the previous programs, it also has a heavy philosophical bent that comes very close to moralizing. At the least, it puts quite an emphasis on virtues that lead to a "good" life: honesty, valor, charity, etc. The player should never lose sight of this emphasis when making decisions throughout the game. Of course, philosophical contemplations are well and good, but they aren't tremendously useful against the aggressive monster-types that beset you during your quest.

Recipes For Magic

Combat and magic are still of major importance in *Ultima IV*. The procedure for combat is unchanged, but a new level of sophistication has been reached for the use of magic. No longer can you simply cast a spell. Instead, reagents (ingredients) must be purchased and properly mixed before using a spell—and woe on you if you're struggling to prepare your magic while five trolls are attacking your party. The Book of Spells lists the ingredients you need, but in many cases it's up to you to discover the proper portions of each ingredient. What does it take to make a fireball—two parts bloodmoss and one part sulfurous ash, or vice versa?

There's more, of course. At the risk of revealing too much, be aware that in *Ultima IV* you do not pick your party of adventurers; they pick you. If you're unworthy of help from a powerful Paladin, for example, you'll have to gain more experience before receiving his aid. Even the creation of your player character is handled in a unique and fascinating way. You no longer simply state your preference for character type and race. I won't tell you what happens instead because it would rob you of one of the initial enjoyments when playing *Ultima IV*. After discovering this for yourself, you'll be glad I was discreet.

The package is similar to previous versions of the *Ultima* series. It includes a cloth map, a Book of Magic, a History of Britannia, and two game disks. All the material is top quality, and the manuals are eminently readable. If you get hopelessly stuck, a hint book will be available containing maps and clues. This makes it possible for less industrious adventurers (like me) to have a chance of completing the game in their lifetimes.

For those who have never experienced any of the *Ultima* games, note that it isn't necessary to have played the forerunners in order to enjoy *Ultima IV: Quest for the Avatar*. However, my bet is that once you play one, you'll want to play them all.

Ultima IV: Quest for the Avatar
Developed by:
Origin Systems, Inc.
Distributed by:
Electronic Arts
2755 Campus Drive
San Mateo, CA 94403
$64

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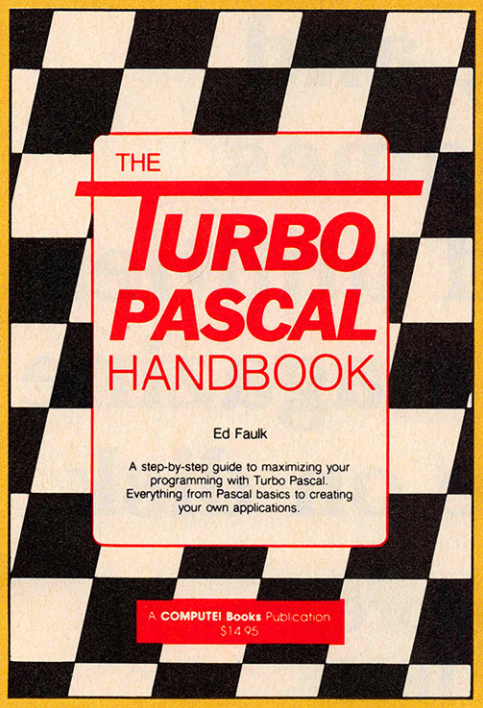

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Adding System Power To ST BASIC

Part 2

Kevin Mykytyn, Editorial Programmer

The VDISYS command lets you fill in the gaps in Atari ST BASIC by calling system routines to do jobs that would otherwise be impossible. Part 1 of this series explained the fundamentals of VDISYS and examined a general-purpose drawing routine. This part shows how VDISYS can perform two other important tasks—reading the screen position of the mouse pointer and sensing the status of the mouse buttons. An example program lets you create a custom shape for your ST's mouse pointer.

Have you ever tried to read the Atari ST's mouse controller from BASIC? If you have, you already know that BASIC lacks commands to read the mouse position or button status. Like certain other tasks, mouse reading can be done from BASIC only with the aid of VDISYS. Once you know how to read the mouse, you may also want to change the mouse pointer's appearance. This article explains how to do both.

Before you type in the example program below, here are some tips that make it easier to enter ST BASIC programs. First, although it may be obvious to some of you, it is far easier to enter a program from the Edit window than the Command window. (To move to the Edit window, type EDIT at the Command window's OK prompt or choose the Start Edit option from the Edit menu.) The Edit window's full-screen editor is much more convenient for entering program lines than the Command window's single-line interface. You can also run a program directly from the Edit window (type RUN or choose the Start option from the Run menu). When the program is finished, control returns to the Edit window, so you can immediately modify or add new lines to the program.

The Edit window has one feature that you may or may not appreciate. Until you press RETURN, the line you're working on appears in *ghost mode* (the letters look gray and fuzzy). The purpose of ghost mode is to show which lines you have changed. That's helpful to inexperienced programmers, but an annoyance in many cases, since ghosted letters are harder to read than normal ones. To disable ghost mode, enter this line in the Command window:

```
POKE SYSTAB+2,0
```

Another way to ease the task of program entry is to increase the speed of the cursor. This is done from the Control Panel. The second slider from the top (the one with a rabbit and a turtle) controls the cursor speed. To increase the speed, click on the slider and drag it to the left (toward the rabbit). To slow it down, drag the slider to the right. You can also turn the keyboard beeping sound off and on by clicking the C key icon in the Control Panel.

Redesigning The Pointer

Two more steps are required before typing in the pointer-editing program. First, set the computer to medium resolution (use the Set Preferences option). Second, turn off buffered graphics from BASIC's Run menu. If your ST has more than 512K of Random Access Memory (RAM) or the TOS operating system in Read Only Memory (ROM), the second step may or may not be necessary, but it can't hurt in any case.

Now enter Program 1 and save it to disk. It lets you change the mouse pointer from the familiar arrow shape to a custom design of your own. When you run the program, a grid appears on the left side of the screen, and the word DONE is shown on the right. To edit the pointer shape, move the mouse pointer into the grid, then click the button on any square you want to change. Clicking on a square toggles it on or off—if the square is on

(dark) when you click, it is turned off (erased) and vice versa.

Once you're satisfied with the new pointer, move the mouse out of the grid and click on the word DONE. The program then asks for the location of the new pointer's *hot spot*—a single dot that the computer uses to tell exactly what the pointer is pointing at. On the normal mouse pointer, the hot spot is located at the very tip of the arrow. But you can place it anywhere within your custom pointer shape.

After you locate the hot spot, the new pointer appears on the screen. At this point, the program asks whether you want to save the pointer shape data to a disk file for later use. If so, press Y and enter a filename when prompted. If you press any other key, the program ends without saving the shape. Program 2 (see below) provides a method for reloading the shape data from the disk file and making the custom pointer appear in a BASIC program of your own.

Reading The ST's Mouse

If you're unfamiliar with the usage of VDISYS, CONTRL, and PTSIN, you may want to read Part 1 of this article (April COMPUTE!) before going any further. It explains the fundamentals of calling VDI routines from ST BASIC.

As mentioned earlier, ST BASIC has no commands to read the mouse or the state of the mouse buttons directly. Fortunately, there is a VDI routine (appropriately named Readmouse) which gives this information. Only three steps are needed to call this routine. Since Readmouse has an opcode of 124, we first execute POKE CONTRL,124 to tell the ST which VDI routine to call (line 90 in Program 1). This routine doesn't involve any vertices or attributes, so CONTRL+2 and CONTRL+6 are POKEd with zeros. Once that brief preparation is complete, the statement VDISYS(0) actually calls the routine.

As you may recall, Part 1 explained how to pass information from BASIC to a VDI drawing routine. When that routine was done with its work (drawing a graphic shape), we didn't care whether it passed any information back in the other direction. But many VDI routines pass significant information back to BASIC. Thus, calling a routine like Readmouse involves a two-way information transfer. You must supply certain data before calling the routine; and when it returns control to BASIC, the routine sends other information back to you.

Part 1 also explained how the parameter blocks named PTSIN and INTIN are used to pass data from BASIC to a VDI routine. These parameter blocks are paralleled by PTSOUT and INTOUT, which perform the same operations in reverse. Though they're considered reserved variables (which you can use only in certain, predefined ways), PTSOUT and INTOUT each point to a block of special storage locations in memory called a *parameter block*. Like PTSIN, PTSOUT points to a temporary holding area for information about x and y position coordinates. Like the INTIN parameter block, INTOUT defines the area where other information (attribute data, etc.) is passed.

Position And Button Status

To read the mouse pointer's screen location, call the Readmouse routine and PEEK the memory locations defined by PTSOUT and PTSOUT+2. In Program 1, this is done at line 110. The statement X=PEEK(PTSOUT) transfers the value stored in PTSOUT in the variable x, representing the mouse pointer's horizontal position. Similarly, Y=PEEK(PTSOUT+2) makes y equal to the mouse pointer's vertical position.

To read the status of the mouse buttons, call the Readmouse routine and PEEK the locations defined by INTOUT and INTOUT+2. INTOUT returns information about the left button, and INTOUT+2 tells you the status of the right button. If a button is pressed, the value in the corresponding location is 1; if it's not pressed, the value is 0. Program 1 reads both mouse buttons at line 120. When the left button is pressed, the variable LBUTTON is set to 1; when the right button is pressed, the variable RBUTTON is set to 1. Table 1 outlines the information you need to use Readmouse.

Customizing The Pointer

Though the ST's familiar arrow pointer may be suitable most of the time, occasionally you might want it to look like something else. In a drawing program, for instance, why not reshape the pointer as a pencil or a paintbrush? Once you know how to modify the pointer's appearance, you can make it look like a pointing hand, a musical note, a scientific symbol, or whatever else is needed to give your program that unique, customized look.

The VDI routine that redraws the mouse pointer is called Set Mouse Form, usually abbreviated as SMF. Because the SMF routine requires a lot of information, its setup procedure is fairly complex. The first step, as always, is to POKE the opcode for the VDI routine into CONTRL. Since the opcode for SMF is 111, Program 1 performs POKE CONTRL,111 at line 210. Next, you must POKE the number

Table 1: Readmouse Parameters

Input Parameters	
POKE CONTRL,124	(opcode)
POKE CONTRL+2,0	(number of vertices)
POKE CONTRL+6,0	(number of attributes)
Output Parameters	
PEEK(PTSOUT)	(horizontal mouse position)
PEEK(PTSOUT+2)	(vertical mouse position)
PEEK(INTOUT)	(1 = left button pressed)
PEEK(INTOUT+2)	(1 = right button pressed)

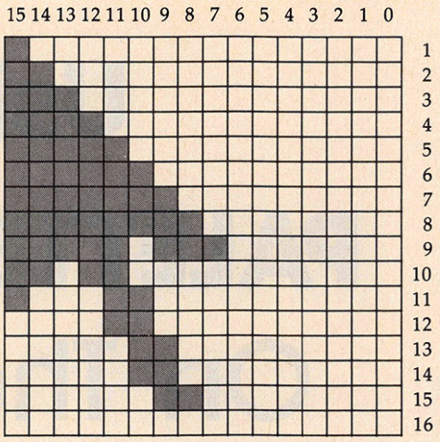
of vertices (0 in this case) and the number of attributes (37) into CONTRL+2 and CONTRL+6 (lines 210–220).

The mouse pointer can move anywhere on the screen, so there's no need to provide x and y coordinates for the shape as a whole. However, you must tell the system where, within that shape, it should put the hot spot. The hot spot's coordinates are defined relative to the upper-left corner of the new pointer shape. POKE the x coordinate value in INTIN and the y coordinate in INTIN+2. At the same time, you should also POKE a 1 into INTIN+4 (lines 220–230).

Who Was That Masked Mouse?

The mouse pointer you see on the screen is actually made of two separate parts—the pointer shape itself and a second shape called a *mask*. Both forms are the same size (16 pixels high and 16 pixels wide) and appear at the same place on the screen. Since the pointer and the mask can be different colors, this permits you to make a two-color mouse pointer. To create the illusion of solidity, for instance, you might draw the main body of the pointer in one color and add a darker shadow along its lower edges. To set the mask's color, POKE the desired color number into location INTIN+6. POKE the pointer's color into INTIN+8.

After you've defined the colors, you must supply shape information for both the pointer and the mask. Each shape requires 32 bytes (16 words) of data. The figure below illustrates how the 16 words of shape data go together to make up the entire shape.



Mouse Pointer Data

If you visualize the pointer shape within a 16 × 16 grid, the first 16-bit data word is in the top row of the grid, the second data word represents the second row, and so on. To pass the shape information to the SMF routine, you must first calculate the 16-bit values represented by the "on" bits within this grid. When that's done, the data for the mask is POKEd into locations INTIN+10, INTIN+12 ... INTIN+40. The pointer shape data is POKEd into locations INTIN+42 through INTIN+72. Don't be concerned if that sounds a bit confusing. Program 1 does all the calculations and POKEs for you automatically. For those who are interested, Table 2 outlines the information needed by the SMF routine.

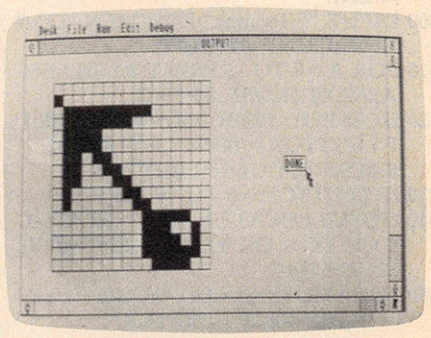
Saving Custom Pointers

Once you've created a custom pointer with Program 1, it appears on the screen and works just like the normal one. However, the pointer reverts to its usual shape as soon as you exit BASIC.

To help you incorporate custom pointers in your own BASIC programs, Program 1 lets you save all the pointer shape data in a disk file. Program 2 illustrates how to read the shape data from the disk file and recreate the custom pointer in another program.

The first two data items in the disk file are x and y coordinates for the pointer's hot spot. The next 16 data items are the 16 words (32 bytes) of shape data for the pointer and mask forms. After this data has been retrieved, it's simply a matter of performing the setup and calling the SMF routine just as we did in Program 1.

To incorporate this routine in your own program, replace the INPUT statement in line 10 with FN$="FILENAME" using your own filename in place of FILENAME. Of course, you could also convert the shape data into DATA statements contained in the program itself.



This drawing grid (created by Program 1) lets you create custom mouse pointers for use in your own ST BASIC programs.

Table 2: Set Mouse Form (SMF) Parameters

Input Parameters

```
POKE CONTRL,111     (opcode)
POKE CONTRL+2,0     (number of input vertices)
POKE CONTRL+6,37    (number of attributes)
POKE INTIN,X        (X=hot spot horizontal coordinate)
POKE INTIN+2,Y      (Y=hot spot vertical coordinate)
POKE INTIN+6,mask color
POKE INTIN+8,pointer color
POKE INTIN+10–INTIN+40,mask shape data
POKE INTIN+42–INTIN+72,pointer shape data
```

Program 1: ST Mouse Pointer Editor

```
10 FULLW 2:CLEARW 2:COLOR 1,1,1,1
20 DIM AR(16,16),SHAPE(30):FOR A=
   1 TO 16:FOR B=1 TO 16:AR(A,B)=0:
   NEXT B,A
30 FOR A=50 TO 306 STEP 16:LINEF A,
   20,A,148:NEXT
40 FOR A=20 TO 148 STEP 8:LINEF 50,
   A,306,A:NEXT
50 GOTOXY 48,8:PRINT "DONE":Q=43
   0:R=72:LINEF Q,R,Q+36,R:LINEF Q+
   36,R,Q+36,R+10
60 LINEF Q+36,R+10,Q,R+10:LINEF Q,
```

```
   R+10,Q,R
70 GOSUB READMOUSE:IF LBUTTON
   =TOGGLE THEN 70 ELSE TOGGLE
   =LBUTTON
80 IF LBUTTON THEN GOSUB FLIP:GO
   TO 70 ELSE GOTO 70
90 READMOUSE: POKE CONTRL,124
100 POKE CONTRL+2,0:POKE CONTR
   L+6,0:VDISYS (0)
110 X=PEEK(PTSOUT):Y=PEEK(PTSOU
   T+2)
120 LBUTTON=PEEK(INTOUT):RBUTT
   ON=PEEK(INTOUT+2)
130 RETURN
140 FLIP: GOSUB LOCATE
150 IF XP>24 AND XP<27 AND YP=
   8 THEN GOTO DEFINEIT
160 IF XP<1 OR XP>16 OR YP<1 OR YP
   >16 THEN RETURN
170 IF AR(XP,YP) THEN AR(XP,YP)=0:C
   OLOR 1,0:GOTO 190
180 AR(XP,YP)=1:COLOR 1,2
190 FILL XP*16+44,YP*8+18:RETURN
200 DEFINEIT: GOTOXY 43,12:PRINT "
   CHOOSE HOT SPOT":GOSUB HOT
   SPOT
210 POKE CONTRL,111:POKE CONTRL
   +2,0
220 POKE CONTRL+6,37:HX=XP:HY=
   YP
230 POKE INTIN,XP-1:POKE INTIN+2,
   YP-1:POKE INTIN+4,1
240 POKE INTIN+6,0:POKE INTIN+8,1
250 FOR A=10 TO 40 STEP 2:T=0
260 FOR B=16 TO 1 STEP-1:T=T-2^(1
   6-B)*(AR(B,A/2-4)=1):NEXT
270 POKE INTIN+A,T:POKE INTIN+A
   +32,T:SHAPE((a-10)/2)=t
280 NEXT:VDISYS (0):CLEARW 2:GOTO
   XY 32,0:PRINT "DEFINED"
290 PRINT "Do you want to save this sh
   ape?":A=INP(2):IF A<>121 THE
   N END
300 INPUT "Filename";FN$:OPEN "O",#
   1,FN$:PRINT #1,HX;HY
310 FOR A=0 TO 15:PRINT #1,SHAPE(
   A):NEXT:CLOSE #1:END
320 HOTSPOT: GOSUB READMOUSE:I
   F LBUTTON=TOGGLE THEN 32
   0 ELSE TOGGLE=LBUTTON
330 IF LBUTTON=0 THEN 320
340 GOSUB LOCATE:IF XP<1 OR XP>1
   6 OR YP<1 OR YP>16 THEN 340 EL
   SE RETURN
350 LOCATE: XP=INT((X-50)/16)+1:YP
   =INT((Y-40)/8)+1:RETURN
```

Program 2: Pointer Loader

```
10 DIM SHAPE(30):CLEARW 2:GOTOX
   Y 0,0:INPUT "Filename";FN$:OPEN "I
   ",#1,FN$
20 INPUT #1,HX,HY:FOR A=0 TO 15:IN
   PUT #1,SHAPE(A):NEXT
30 POKE CONTRL,111:POKE CONTRL
   +2,0
40 POKE CONTRL+6,37
50 POKE INTIN,HX-1:POKE INTIN+2,H
   Y-1:POKE INTIN+4,1
60 POKE INTIN+6,0:POKE INTIN+8,1
70 FOR A=10 TO 40 STEP 2:T=SHAPE(
   (A-10)/2)
80 POKE INTIN+A,T:POKE INTIN+A
   +32,T
90 NEXT:VDISYS (0):CLEARW 2:GOTOX
   Y 0,0:PRINT "Defined"
```

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Using PALETTE USING On The PCjr

John And Jeff Klein

The IBM PCjr's PALETTE USING command lets you quickly change all screen attributes and colors in any graphics mode for a variety of effects. This article explains the details of PALETTE USING and demonstrates its usefulness with programming examples. An IBM PCjr with Cartridge BASIC is required.

Though Cartridge BASIC for the PCjr is very similar to BASICA for the IBM PC, the PCjr has extra graphics capabilities which the PC does not enjoy. One of these involves the PALETTE and PALETTE USING commands, which control color attributes. Before you can use PALETTE USING, you need to know how the simpler PALETTE statement works.

The PCjr offers 16 different colors, numbered from 0–15. An *attribute* is a number associated with a particular color. To explain what an attribute actually does, let's look briefly at the PCjr's color management scheme.

When you turn on the PCjr, there's a simple, one-to-one relationship between colors and attributes. Attribute number 1 corresponds to color number 1 (blue), attribute 2 corresponds to color 2 (green), and so on. Table 1 shows this initial arrangement.

Table 1: Default PCjr Attributes

Color Number	Attribute	Visual Color
0	0	black
1	1	blue
2	2	green
3	3	cyan
4	4	red
5	5	magenta
6	6	brown
7	7	white
8	8	gray
9	9	light blue
10	10	light green
11	11	light cyan
12	12	light red
13	13	light magenta
14	14	yellow
15	15	high-intensity white

The PALETTE command lets you change this arrangement by assigning a different color to any single attribute. Here's the general form of the PALETTE statement:

PALETTE ***attribute, color***

Attribute tells the computer which attribute you're working with, and *color* indicates which

Figure 1: PAL Integer Array

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4

color you want to assign to that attribute. To take a simple example, say that you turn on the computer and draw some shapes in blue (color 1). This statement changes every blue object on the screen to red:

```
PALETTE 1,4
```

In this example, the 1 refers to attribute 1, and the 4 refers to color 4 (red). Before the statement executes, attribute 1 is assigned to color 1 (blue), the normal arrangement. After it executes, attribute 1 is reassigned so that it equals red. In an eyeblink, every blue object turns red. Likewise, the statement PALETTE 0,7 changes every shape that's initially black (color 0) to white (color 7). By performing a series of 16 PALETTE statements (FOR J=0 TO 15: PALETTE J,4: NEXT), you could change everything on the screen to red, regardless of its initial color.

In other words, PALETTE makes it possible to "rewire" the normal color scheme whenever you like. An object that starts out green can be changed to magenta; shapes that first appear in gray can be switched immediately to yellow, and so forth. If PALETTE were not available, such effects would be much more difficult and time-consuming; whenever you wanted a massive color change, you'd have to redraw every object of a given color in its new color.

After performing a number of PALETTE statements, you may want to restore the original color/attribute scheme. This can be done in two different ways, either by changing the screen mode, or by executing a PALETTE statement with no parameters (the keyword PALETTE followed by nothing).

USING A Shortcut

One disadvantage of PALETTE is that it affects only one attribute at a time. The more attributes you want to change, the more PALETTE statements you must perform.

Table 2: Attributes After PALETTE USING PAL(1)

Attribute	Array element linked with attribute	New color
0	PAL(1)	0
1	PAL(2)	4
2	PAL(3)	0
3	PAL(4)	4
–	–	–
–	–	–
15	PAL(16)	4

That's where PALETTE USING enters the picture. This special form of PALETTE can change all 16 attributes at once, assigning them to a set of 16 color values which are stored in an integer array. Here's the general format of the command:

```
PALETTE USING arrayname(starting position)
```

Arrayname identifies the array you want to use, and *starting position* tells the computer which array element belongs to attribute 0. The array can have any legal IBM array name, but it must be in existence before you execute PALETTE USING.

For example, let's say that you create an integer array named PAL with the contents shown in Figure 1 (array element 1 contains a zero value, element 2 contains the value 4, and so on).

Now assume that you execute the following statement:

```
PALETTE USING PAL(1)
```

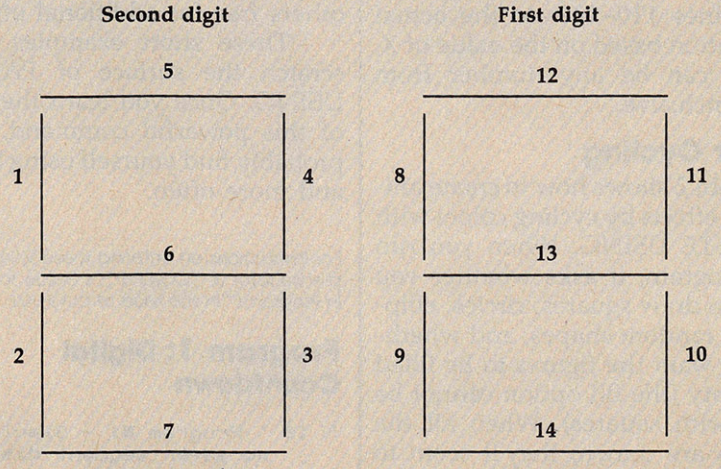
This single PALETTE USING command has the effect of reassigning all 16 attributes in one stroke. Table 2 shows the new color/attribute scheme which takes effect.

After a PALETTE USING, the values in the array replace the color numbers originally associated with each attribute. In this example, attribute 0 is still assigned to black (color 0), and attribute 4 is still assigned to red (4), but all the other odd attributes become black and all the even ones are changed to red. Since we specified a starting position of 1, the contents of array element 1 replace the color number for attribute 1; the other values follow in ascending numeric order.

In some cases, you may want to change some, but not all, of the 16 attributes with PALETTE USING. To retain the current color for a given attribute, make the corresponding array element equal to −1. For instance, if element PAL(2) equals −1 in the previous example, then attribute 1 retains its original color (blue), while the other 15 attributes are changed to black and red in even-odd order. Thus, the values you store in the integer array are limited to the range −1 to 15. The value −1 represents no change; values from 0–15 represent the colors shown in Table 1.

An interesting feature of PALETTE USING is its ability to start

Figure 2: Numeric Display Simulation



anywhere in the array and begin changing attributes from that particular point (rather than always starting at the first array element). For instance, say that you have 100 different 16-color patterns stored in a single integer array (with a total of 1600 elements). To cycle through 100 different configurations, you need only execute a series of PALETTE USING statements, changing the starting position with each new command. The first statement could use a starting position of 1, the next a starting position of 17, and so forth.

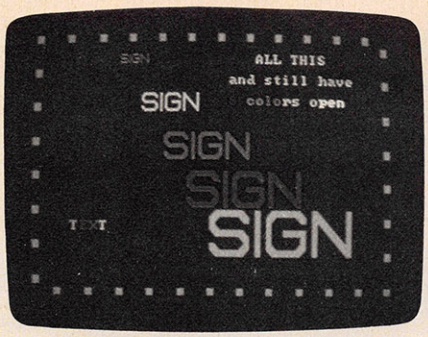
Digital Countdown

Once you learn about PALETTE USING, many different effects come to mind. Program 1 demonstrates just one possibility, simulating the seven-segment numeric display seen on most electronic calculators and watches. Of course, calculators and watches create their displays with very different methods, but they still form the numerals 0–9 by turning various line segments on or off, just as we'll do here. Program 1 creates the line segments with the attributes shown in Figure 2 (note that attributes 0 and 15 are not used).

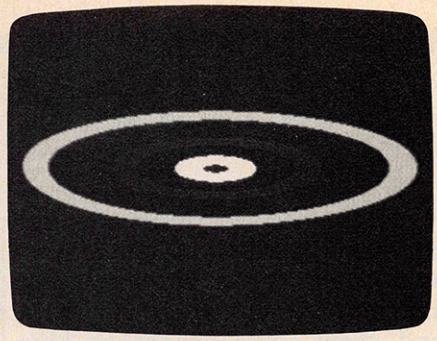
Line 20 creates the integer variable PAL, and line 50 READs the DATA values from lines 1000–1090 into the array. When that's done, the array contains all the patterns we'll need to form the digits 0–9. To display a new digit, we simply choose a different starting point for the next PALETTE USING command. As written, the program simply counts off seconds, but with a little additional programming, you can use it as a general routine to count any two-digit values. Lines 110–120 do the actual calculation based on the value of X, which can be any number from 0–99 inclusive.

Color Cycling

Program 2 shows how to create animated effects by cycling colors with PALETTE USING. When you run the program, it asks whether you want to draw squares, circles, ellipses, or random shapes, and whether you want the figures to be filled or empty (the fill option cannot be used with squares). When all the shapes are drawn, they'll seem to begin moving in a complex, tunnel-like effect. Though the figures appear to move in and out, the effect is entirely illusory. In fact, we're simply cycling through a pattern that includes the background color (black in this case). When a shape is colored the same as the background, it seems to disappear.



The IBM PCjr's PALETTE USING statement simplifies color control for graphic displays.



"Tunnel Vision" for the IBM PCjr creates a convincing 3-D effect with PALETTE USING commands.

This type of animation is fairly simple to create, provided that you begin with a clear mental picture of the final result. For complicated pictures, you may want to sketch the various shapes on paper beforehand, or use "The Screen Machine," a graphics-design program published in the April 1984 issue of *COMPUTE!'s PC and PCjr* magazine. Since one color must be reserved to match the background, you're limited to 15 different colors for visible shapes. Changing the color associated with the background attribute also changes the border color, so it's often a good idea not to change attribute 0.

Program 3 employs similar techniques to create a colorful animated sign. In this case, only eight attributes are affected, leaving eight others free for additional effects.

These short examples barely scratch the surface of PALETTE USING. Once you learn the basics of this powerful command, you'll probably find yourself using it more and more often.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

Program 1: Digital Countdown

```
PJ 10 ' Program #1 - Simulates t
      wo seven segment displays
IE 20 CLEAR,,,32768!:KEY OFF:SCR
      EEN 5:CLS:DEFINT P:DIM PAL
      (245):SOUND ON
PJ 30 C=0:X1=60:GOSUB 2000
AB 40 C=1:X1=150:GOSUB 2000
EO 50 FOR Z=0 TO 245:READ PAL(Z)
      :NEXT
BB 60 X=0:PALETTE USING PAL(230)
      :TIMER ON:ON TIMER(1) GOSU
      B 100
JO 70 GOTO 70
PA 100 X=X+1:IF X=60 THEN X=0
LC 110 Y=X-(INT(X/10)*10):PALETT
       E USING PAL(Y*23):SOUND 3
       000,.5,15,0
EM 120 Y=INT(X/10):PALETTE USING
       PAL(Y*23+7):RETURN
JN 1000 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,6,6,6,6,6,6,0,6,-1,-1
        ,-1,-1,-1,-1,-1,-1
ME 1010 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,0,0,6,6,0,0,0,-1,-1
        ,-1,-1,-1,-1,-1,-1
OF 1020 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,0,6,0,6,6,6,6,-1,-1
        ,-1,-1,-1,-1,-1,-1
PE 1030 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,0,0,6,6,6,6,6,-1,-1
        ,-1,-1,-1,-1,-1,-1
LN 1040 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,6,0,6,6,6,0,0,-1,-1
        ,-1,-1,-1,-1,-1,-1
NG 1050 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,6,0,6,0,6,6,6,-1,-1
        ,-1,-1,-1,-1,-1,-1
LH 1060 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,6,6,6,0,6,6,6,-1,-1
        ,-1,-1,-1,-1,-1,-1
OI 1070 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,0,0,6,6,6,0,0,-1,-1
        ,-1,-1,-1,-1,-1,-1
LD 1080 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,6,6,6,6,6,6,6,-1,-1
        ,-1,-1,-1,-1,-1,-1
OI 1090 DATA -1,-1,-1,-1,-1,-1,-
        1,-1,6,0,6,6,6,6,6,-1,-1
        ,-1,-1,-1,-1,-1,-1
BD 1100 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0
PO 2000 LINE (X1,30)-(X1+20,100)
        ,C*7+1,BF
FG 2010 LINE (X1,101)-(X1+20,170
        ),C*7+2,BF
AG 2020 LINE (X1+60,101)-(X1+80,
        170),C*7+3,BF
EE 2030 LINE (X1+60,30)-(X1+80,1
        00),C*7+4,BF
LE 2040 Y=0:X=0:FOR Z=1 TO 16
BK 2050 LINE (X1+X,30+Y)-(X1+79-
        X,30+Y),C*7+5
PB 2060 LINE (X1+X,170-Y)-(X1+79
        -X,170-Y),C*7+7
```

```
II 2070 Y=Y+1:X=X+1.3:NEXT
BM 2080 Y=0:X=0:FOR Z=1 TO 9
LM 2090 LINE (X1+X,100+Y)-(X1+79
        -X,100-Y),C*7+6,BF
JB 2100 Y=Y+1:X=X+2.4:NEXT:RETUR
        N
```

Program 2: Tunnel Vision

```
GN 10 ' Program #2 - Tunnel Anim
      ation
IB 20 CLEAR,,,32768!:KEY OFF:SCR
      EEN 5:CLS:RANDOMIZE TIMER
CB 30 DEFINT P:DIM PAL(479):LOCA
      TE 10,11:PRINT "ONE MOMENT
       PLEASE"
KE 40 SPEED=30
OI 50 FOR Z=0 TO 479:READ PAL(Z)
      :NEXT Z
IB 60 CLS:PALETTE:LOCATE 3,14:PR
      INT "MAIN MENU":LOCATE 8,1
      4:PRINT "1) SQUARES":LOCAT
      E 10,14:PRINT "2) CIRCLE":
      LOCATE 12,14:PRINT "3) ELL
      IPSE":LOCATE 14,14:PRINT "
      4) RANDOM SHAPES":LOCATE 1
      7,14:PRINT "CHOOSE ONE"
OG 70 A$=INPUT$(1):IF A$>"4" OR
      A$<"1" THEN 70
OP 80 LOCATE 20,14:PRINT "FILLED
       IN (Y/N) ?":AN$=INPUT$(1)
      :IF AN$<>"N" AND AN$<>"n"
      AND AN$<>"Y" AND AN$<>"y"
      THEN 80 ELSE IF AN$="y" TH
      EN AN$="Y" ELSE IF AN$="n"
       THEN AS$="N"
DC 90 CLS:ON VAL(A$) GOSUB 100,1
      30,160,190:GOSUB 270:GOTO
      60
FJ 100 ' *** SQUARES ***
CF 110 FOR Z=150 TO 10 STEP -10:
       IF AN$="N" THEN LINE (160
       -Z,100-Z/1.5)-(160+Z,100+
       Z/1.5),Z/10,B ELSE LINE (
       160-Z,100-Z/1.5)-(160+Z,1
       00+Z/1.5),Z/10,BF
NI 120 NEXT Z:LINE (157,98)-(163
       ,102),0,BF:RETURN
AC 130  ' *** CIRCLES ***
FP 140 FOR Z=150 TO 10 STEP -10:
       CIRCLE (160,100),Z,Z/10:I
       F AN$="Y" THEN PAINT STEP
       (0,0),Z/10,Z/10
GL 150 NEXT Z:CIRCLE (160,100),2
       ,0:PAINT STEP(0,0),0,0:RE
       TURN
MC 160 ' *** ELLIPSES ***
NG 170 FOR Z=150 TO 10 STEP -10:
       CIRCLE (160,100),Z,Z/10,,
       ,3/12:IF AN$="Y" THEN PAI
       NT STEP(0,0),Z/10,Z/10
EJ 180 NEXT Z:RETURN
EI 190 ' *** RANDOM SHAPES ***
FK 200 FOR Z=1 TO 15
EB 210 ON INT(RND*4+1) GOSUB 230
       ,240,250,260
DO 220 NEXT Z:RETURN
QN 230 LINE (RND*320,RND*200)-(R
       ND*320,RND*200),Z:RETURN
IL 240 CIRCLE (RND*320,RND*200),
       RND*50,Z:IF AN$="Y" THEN
       PAINT STEP(0,0),Z,Z:RETUR
       N
PF 250 CIRCLE (RND*320,RND*200),
       RND*50,Z,,,RND*2:IF AN$="
       Y" THEN PAINT STEP(0,0),Z
       ,Z:RETURN
NE 260 IF AN$="Y" THEN LINE (RND
       *320,RND*200)-(RND*320,RN
       D*200),Z,BF:RETURN ELSE L
       INE (RND*320,RND*200)-(RN
       D*320,RND*200),Z,B:RETURN
PF 270 ' *** MAIN ***
HH 280 FOR Z=1 TO 30:FOR SLOW=1
       TO SPEED:NEXT
JM 290 PALETTE USING PAL((Z-1)*1
       6)
HA 300 A$=INKEY$:IF A$<>"" THEN
       RETURN ELSE NEXT Z:GOTO 2
       80
MC 1000 DATA -1,-1,-1, 0,-1, 5,-
        1, 0,-1,-1,-1,-1,-1,-1,
        4,-1
QO 1010 DATA -1,-1,-1,-1, 1, 2,1
        4,-1,-1,-1,-1,-1,-1, 4,-
        1, 0
FP 1020 DATA -1,-1,-1, 1,-1, 0,-
        1,14,-1,-1,-1,-1, 4,-1,
        0,-1
HJ 1030 DATA -1,-1, 1,-1, 0,-1,
        0,-1,14,-1,-1, 4,-1, 0,-
        1,-1
PA 1040 DATA -1, 1,-1, 0,-1,-1,-
        1, 0,-1,14, 4,-1, 0,-1,-
        1,-1
PP 1050 DATA -1,-1, 0,-1,-1,-1,-
        1,-1, 0, 6, 6, 0,-1,-1,-
        1,-1
FL 1060 DATA -1,-1, 1,-1,-1,-1,-
        1,-1, 4, 4,14,14,-1,-1,-
        1,-1
KI 1070 DATA -1, 0,-1, 1,-1,-1,-
        1, 4,-1, 0, 0,-1,14,-1,-
        1,-1
IN 1080 DATA -1,-1, 0,-1, 1,-1,
        4,-1, 0,-1,-1, 0,-1,14,-
        1,-1
NP 1090 DATA -1,-1,-1, 0,-1, 5,-
        1, 0,-1,-1,-1,-1, 0,-1,1
        4,-1
AF 1100 DATA -1,-1,-1,-1, 4,-1,
        1,-1,-1,-1,-1,-1,-1, 0,-
        1,14
ON 1110 DATA -1,-1,-1, 4,-1, 0,-
        1, 1,-1,-1,-1,-1,-1,-1,
        0,-1
MH 1120 DATA -1,-1, 4,-1, 0,-1,
        0,-1, 1,-1,-1,-1,-1,-1,1
        4,-1
KL 1130 DATA -1, 4,-1, 0,-1,-1,-
        1, 0,-1, 1,-1,-1,-1,14,-
        1, 0
BF 1140 DATA -1,-1, 0,-1,-1,-1,-
        1,-1, 0,-1, 1,-1,14,-1,
        0,-1
CK 1150 DATA -1,-1, 4,-1,-1,-1,-
        1,-1,-1, 0,-1, 2,-1, 0,-
        1,-1
OK 1160 DATA -1, 0,-1, 4,-1,-1,-
        1,-1,-1,-1,14,-1, 1,-1,-
        1,-1
PA 1170 DATA -1,-1, 0,-1, 4,-1,-
        1,-1,-1,14,-1, 0,-1, 1,-
        1,-1
AG 1180 DATA -1,-1,-1, 0,-1, 4,-
        1,-1,14,-1, 0,-1, 0,-1,
        1,-1
IF 1190 DATA -1,-1,-1,-1, 0,-1,
        4,14,-1, 0,-1,-1,-1, 0,-
        1, 1
II 1200 DATA -1,-1,-1,-1,-1, 0,
        6, 6, 0,-1,-1,-1,-1,-1,
        0,-1
MB 1210 DATA -1,-1,-1,-1,-1,14,1
        4, 4, 4, 0,-1,-1,-1,-1,
        1,-1
JE 1220 DATA -1,-1,-1,-1,14,-1,
        0, 0,-1, 4, 0,-1,-1, 1,-
        1, 0
PE 1230 DATA -1,-1,-1,14,-1, 0,-
        1,-1, 0,-1, 4,-1, 1,-1,
        0,-1
IO 1240 DATA -1,-1,14,-1, 0,-1,-
        1,-1,-1, 0,-1, 5,-1, 0,-
        1,-1
BI 1250 DATA -1,14,-1, 0,-1,-1,-
        1,-1,-1,-1, 1,-1, 4,-1,-
        1,-1
HA 1260 DATA -1,-1, 0,-1,-1,-1,-
        1,-1,-1, 1,-1, 0,-1, 4,-
        1,-1
IM 1270 DATA -1,-1,14,-1,-1,-1,-
        1,-1, 1,-1, 0,-1, 0,-1,
        4,-1
OI 1280 DATA -1, 0,-1,14,-1,-1,-
        1, 1,-1, 0,-1,-1,-1, 0,-
        1, 4
CK 1290 DATA -1,-1, 0,-1,14,-1,
        1,-1, 0,-1,-1,-1,-1,-1,
        0,-1
```

Program 3: Animated Sign

```
IA 10 ' Program #3 - Animated Si
      gn
BA 20 CLEAR,,,32768!:KEY OFF:SCR
      EEN 5:CLS:DEFINT P:DIM P(9
      5)
BH 30 C=1:FOR X=0 TO 310 STEP 8.
      75:LINE(X,0)-(X+5,5),C,BF:
      LINE(X,195)-(X+5,200),4-C,
      BF:C=C+1:IF C=4 THEN C=1
OB 40 NEXT
JA 50 C=3:FOR Y=0 TO 190 STEP 8.
      850001: LINE(0,Y)-(5,Y+5),
      4-C,BF:LINE(306,Y)-(311,Y+
      5),C,BF:C=C+1:IF C=4 THEN
      C=1
OD 60 NEXT
HE 70 S$="BR6 BD1 H1 L4 G1 D1 F1
       R4 F1 D1 G1 L4 H1 BU5 BR6
      ;"
EN 80 I$="ND6;"
FC 90 G$="BD1 BR6 H1 L4 G1 D4 F1
       R4 E1 U2 NL3 BU3;"
OG 100 N$="ND6 F6 U6;"
OO 110 FOR Z=1 TO 5:FOR A=1 TO Z
       :Y=Z*30+A-15:FOR B=1 TO Z
       :X=Z*20+B+50:S=Z*4:C=Z+3
PO 120 DRAW "BM=X;,=Y; C=C; S=S;
        XS$;BR2;XI$;BR2;XG$;BR2;
       XN$;"
KP 130 NEXT B,A,Z
CG 140 LOCATE 3,25:COLOR 13,0:PR
       INT "ALL THIS":LOCATE 5,2
       2:PRINT "and still have":
       LOCATE 7,22:A$="8 colors
       open"
PD 150 FOR Z=1 TO 7:COLOR Z+8,0:
       PRINT MID$(A$,(Z-1)*2+1,2
       );:NEXT
IO 160 LOCATE 19,5:A$="TEXT":FOR
        Z=1 TO 4:COLOR 9-Z,0:PRI
       NT MID$(A$,Z,1);:NEXT
MG 170 FOR Z=0 TO 95:READ P(Z):N
       EXT Z
HO 180 FOR Z=0 TO 5:PALETTE USIN
       G P(Z*16):NEXT:GOTO 180
DG 1000 DATA -1,-1, 4, 0, 6, 2,
        3, 4, 5,-1,-1,-1,-1,-1,-
        1,-1
HC 1010 DATA -1, 4, 0,-1, 5, 6,
        2, 3, 4,-1,-1,-1,-1,-1,-
        1,-1
GD 1020 DATA -1, 0,-1, 4, 4, 5,
        6, 2, 3,-1,-1,-1,-1,-1,-
        1,-1
EP 1030 DATA -1,-1, 4, 0, 3, 4,
        5, 6, 2,-1,-1,-1,-1,-1,-
        1,-1
LI 1040 DATA -1, 4, 0,-1, 2, 3,
        4, 5, 6,-1,-1,-1,-1,-1,-
        1,-1
LC 1050 DATA -1, 0,-1, 4,15,15,1
        5,15,15,-1,-1,-1,-1,-1,-
        1,-1
```

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Applesoft List Enhancer

Steven Roth

Tired of program listings that whiz across the screen at unreadable speeds? This short utility for Apple II computers lets you scroll through a listing at your own pace, one screenful at a time. For all Apple II-series computers with DOS 3.3 and ProDOS.

LIST is one of the most frequently used commands in Applesoft BASIC, yet it has some inconvenient features. The program listing scrolls upward too fast to read, unless you repeatedly press CTRL-S. If you pass the program lines you want to see, you have to LIST the program again.

"Applesoft List Enhancer" is a machine language program that solves both of these problems. It divides the program listing into pages, and each page consists of one screenful of the listing. Instead of scrolling through the listing in only one direction, you now page through it, either forward or backward.

Type in and save the program below, then run it. This BASIC program automatically creates a machine language file on disk named ALE. (Don't use the name ALE for the BASIC program or you'll get a FILE TYPE MISMATCH error.) Once that's done, you don't need the BASIC program again except to create new copies of ALE.

Enter BRUN ALE to install and activate the List Enhancer. Now load any Applesoft BASIC program. To list it, type an ampersand (&) followed by an optional starting line number. If you don't enter any line number, the program is listed from the beginning.

The right and left arrow keys let you page forward or backward through the listing. Press the right arrow key to display the next screenful of program lines; the left arrow key displays the previous page. To exit listing mode so you can edit a line, press either the ESC key or CTRL-C.

Applesoft LIST Enhancer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
10 100 FOR I = 24576 TO 24847: R
       EAD A: POKE I,A:CK = CK +
        A: NEXT
1D 110 IF CK < > 33557 THEN PRIN
       T "ERROR IN DATA STATEMEN
       TS.": STOP
40 120 PRINT CHR$ (4)"BSAVE ALE,
       A$6000,L$110"
2D 130 DATA 169,32,141,245,3,169
       ,16,141
52 140 DATA 246,3,169,96,141,247
       ,3,96
D9 150 DATA 32,12,218,32,26,214,
       165,80
71 160 DATA 141,32,97,165,81,141
       ,33,97
24 170 DATA 32,88,252,160,0,132,
       6,200
66 180 DATA 132,30,132,249,177,1
       55,240,75
8A 190 DATA 200,177,155,170,200,
       177,155,132
D0 200 DATA 9,133,8,134,7,32,36,
       237
1C 210 DATA 164,9,169,32,32,92,2
       19,165
E0 220 DATA 36,201,33,144,15,230
       ,30,165
82 230 DATA 30,201,23,240,48,32,
       142,253
61 240 DATA 169,5,133,36,200,177
       ,155,208
5E 250 DATA 81,168,177,155,170,2
       00,177,155
50 260 DATA 134,155,133,156,32,1
       42,253,230
A1 270 DATA 30,165,30,201,23,240
       ,14,160
08 280 DATA 1,208,177,230,6,230,
       6,169
60 290 DATA 0,133,249,240,17,230
       ,6,230
68 300 DATA 6,164,6,165,7,153,32
       ,97
45 310 DATA 200,165,8,153,32,97,
       32,12
DB 320 DATA 253,201,155,240,18,2
       01,131,240
A0 330 DATA 14,201,149,240,101,2
       01,136,240
17 340 DATA 58,32,58,255,76,150,
       96,76
A4 350 DATA 208,3,16,144,56,233,
       127,170
CA 360 DATA 132,9,160,208,132,15
       7,160,207
78 370 DATA 132,158,160,255,202,
       240,7,32
37 380 DATA 44,215,16,251,48,246
       ,169,32
B2 390 DATA 32,92,219,32,44,215,
       48,5
17 400 DATA 32,92,219,208,246,32
       ,92,219
25 410 DATA 76,64,96,165,6,201,2
       ,240
5F 420 DATA 192,56,233,4,133,6,1
       66,6
C7 430 DATA 189,32,97,133,80,232
       ,189,32
D9 440 DATA 97,133,81,32,26,214,
       32,88
97 450 DATA 252,160,1,132,30,132
       ,249,76
CA 460 DATA 44,96,165,249,208,22
       4,240,153
```

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Loading And Linking Commodore Programs

Part 3

Jim Butterfield, Associate Editor

This month's installment shows how one program can automatically load and link to any other program. The methods described here work on any eight-bit Commodore computer with either disk or tape.

There are three major ways of connecting Commodore programs together. *Chaining* allows several programs to perform a job, each program continuing the work that a previous program has done. *Load-linking* enables one program to activate another, with the new program starting fresh on a new task. *Overlaying* allows a main program to call in additional subroutines, data tables, or display information. This article discusses load-linking.

When a first program has finished a job, it may decide to load-link to a second program to do a succeeding task. The new program is not a continuation of the previous program—it's a brand new job and won't share any information from the earlier program unless it happens to use a common data file. Load-linking is harder to achieve on Commodore computers than chaining (see Part 2 of this article, April COMPUTE!). You must do a little extra work to load-link.

Why Load-Linking?

It's common, especially on non-Commodore machines, to have a disk start with a menu program which lets a user pick another program to run. The menu program has to load-link the chosen program, since the new program is not a continuation of the menu. Newcomers to Commodore computers often try to chain from the menu program to the other program. However, chaining requires the first program to be the larger of the two, and menu programs are almost always very short.

At other times, when a group of programs work with one or several data files, it's common for these programs to run independently of each other. Each may use the files in different ways, with data stored in various kinds of arrays for each job. Independent programs call for load-linking.

Sometimes, a series of modules are arranged to work together as a unit. There may be a main program, some machine language programs in varying locations, perhaps a high-resolution graphics screen, and possibly a special character set. The Commodore B128 (called the 700 series in Europe, and not to be confused with the Commodore 128) often requires a transfer sequence program in order to run machine language programs. All the various parts need to be arranged in the proper areas of memory. A special program called a *bootstrap* or *boot* brings everything in. When the bootstrap program has completed its work, often you want to erase it from memory after it sets the main program into operation. Load-linking can accomplish this job, too.

Two Methods

There are two major ways to load-link programs. One technique is used at the end of the first program, setting up the load of the second. It's a variation of the dynamic keyboard technique. The alternative method is used at the beginning of the second program, cleaning up some of the things that have happened during the loading process.

The dynamic keyboard method is probably the simplest. Essentially, it simulates a user typing on the keyboard, giving LOAD and RUN commands. When you type LOAD as a direct command, the new program comes in fresh. It scraps the old program and retains

no variables or other data. That's what we want with a load-link, of course. RUN then sets the new program off to a fresh start.

The pointer cleanup method corrects conditions that result from program chaining. The start-of-variables pointer needs to be corrected so it is set directly behind the last byte loaded; then a CLR command erases any leftover variables and fixes up the other pointers. We'll try each method in turn.

Dynamic Keyboard

The dynamic keyboard technique is often described as "making the computer type on its own keyboard." To do this, a program stuffs characters into the computer's keyboard buffer and resets the buffer counter. When the computer discovers these characters in the buffer, it thinks they were actually typed on the keyboard and executes the commands they spell out.

Since the keyboard buffer normally holds only about nine or ten characters, we can't store a complete load sequence there. But we can use Commodore's screen-editing capability. We print a command on the computer's screen, move the cursor back onto the command line, then store one character (a carriage return, character 13) in the buffer. To perform LOAD followed by RUN, we print two command lines and store two RETURNs in the buffer. The effect is the same as if you typed in the LOAD and RUN commands by hand. The new program starts as a fresh, independent job—you'll have performed a successful load-link.

The keyboard buffer and its counter occupy various memory locations in different Commodore computers. You'll need to use the appropriate addresses for your machine. The following table will help:

To execute two command lines with this method, we'll POKE a value of 2 into the counter and a value of 13 (RETURN) into the first two locations of the buffer. The following example uses Commodore 64 addresses.

Dynamic Keyboard Example

Let's write two simple programs and let the menu program select which one to run. Type in this simple square root program:

```
100 PRINT "TABLE OF SQUARE ROO
    TS"
110 FOR J=1 TO 20
120 PRINT J, SQR(J)
130 NEXT J
```

You can try running the program if you want. It's not very exciting, but it does work. Now save it with the filename SQUARE (don't substitute any other filename). Type NEW and enter this simple cube root program:

```
100 PRINT "TABLE OF CUBE ROOTS
    "
110 X=1/3
120 FOR I=1 TO 20
130 PRINT I, I↑X
140 NEXT I
```

Again, you might try running the program. Save it with name CUBE when you're satisfied that it works. Type NEW again. Now we'll write a simple loading program that uses the dynamic keyboard technique to perform load-linking. This program runs as listed on the VIC-20 and Commodore 64. For another type of machine, use the table above to change the POKE addresses in lines 280, 290, and 300.

```
100 DATA SQUARE,CUBE
110 READ A$(1),A$(2)
120 PRINT "WHICH ROOTS DO YOU
    {SPACE}WANT--"
130 FOR J=1 TO 2
140 PRINT A$(J)
150 NEXT J
160 INPUT "WHICH (1 OR 2)";N
170 IF N<1 OR N>2 GOTO 120
180 PRINT CHR$(147)
190 PRINT
200 PRINT
210 PRINT "LOAD";CHR$(34);A$(N
    );CHR$(34);",8"
220 PRINT
230 PRINT
240 PRINT
250 PRINT
260 PRINT "RUN"
270 PRINT CHR$(19)
280 POKE 198,2
290 POKE 631,13
300 POKE 632,13
310 END
```

In this case, the menu program is longer than the programs it loads. But that doesn't matter. This method works the same regardless of the length of the programs involved. You will see the LOAD and RUN commands appear on the screen.

Pointer Cleanup Method

The previous method puts extra commands in the first program to load the second. Now we'll look at another method that adds commands to the start of the second program. At this point, the new program has been chained—the old variables and their pointers still exist. To start out fresh, we must erase the old variables and make sure that new variables go into the proper memory area. What we're doing is changing a chain into a load-link.

Our task is to set the start-of-variables pointer to the correct address and then perform CLR to erase the old variables. On the B128 and Commodore 128 in 128 mode, there's a slight difference. Here, we don't need to set the start-of-variables, since variables are held in a different memory bank. Instead, we set a different pointer (called end-of-BASIC) which doesn't exist on the other machines.

Now that we know which pointer to change, we must decide what value to put there. The value will be the address of the last byte loaded, plus one. Immediately after a load, we can find this address still in a pointer. Here's a table to show the various locations:

	Key Counter	Start of Buffer
VIC-20, Commodore 64	198	631
Commodore 128 in 128 mode	208	842
Commodore 16, Plus/4	239	1319
PET/CBM with 4.0 BASIC	158	623
Original ROM PETs	525	527
B-128 (Model 700)	209	939

	Pointer to be changed	Pointer where value is found
VIC-20, Commodore 64	45/46	174/175
Commodore 128 in 128 mode	4624/4625	174/175
Commodore 16, Plus/4	45/46	157/158
PET/CBM with 4.0 BASIC	42/43	201/202
Original ROM PETs	124/125	229/230
B-128 (Model 700)	47/48	150/151

After the pointer is fixed, be sure to perform CLR to reset all the other variable pointers. Again, these steps must be taken at the very beginning of the new program.

Pointer Cleanup Example

Here's an example similar to the previous one which demonstrates the second method. This is the menu program:

```
100 DATA SQUARE1,CUBE1
110 READ A$(1),A$(2)
120 PRINT "WHICH ROOTS DO YOU
   {SPACE}WANT--"
130 FOR J=1 TO 2
140 PRINT A$(J)
150 NEXT J
160 INPUT "WHICH (1 OR 2)";N
170 IF N<1 OR N>2 GOTO 120
180 LOAD A$(N),8
```

Notice that this menu program is much shorter than the first example. We'll do the extra work when we write the programs to be loaded. Save the menu program, then enter NEW and type these lines:

```
70 POKE 45,PEEK(174)
80 POKE 46,PEEK(175)
90 CLR
100 PRINT "TABLE OF SQUARE ROO
   TS"
110 FOR J=1 TO 20
120 PRINT J, SQR(J)
130 NEXT J
```

This is similar but not identical to the first square root program. The difference is the three extra lines at the beginning. Don't try to run this program yet; instead, save it with the filename SQUARE1. Enter NEW a second time and enter this simple cube root program:

```
70 POKE 45,PEEK(174)
80 POKE 46,PEEK(175)
90 CLR
100 PRINT "TABLE OF CUBE ROOTS
   "
110 X=1/3
120 FOR I=1 TO 20
130 PRINT I, I↑X
140 NEXT I
```

Save this program with the filename CUBE1. If you have a computer other than the Commodore 64 or VIC-20, remember to change the POKE and PEEK values in lines 70 and 80 of both these programs according to the table above.

Now load the menu program and run it. You've seen two different ways to perform load-linking. A program can get another program off to a clean start by using either of these techniques.

Better Branching In Applesoft

Mark Russinovich

Are you ready to update the Applesoft BASIC on your Apple II-series computer? This handy utility adds extra flexibility by letting you branch to line numbers computed by variables or even complex expressions. For both DOS 3.3 and ProDOS.

Though it's been used to write a tremendous number of programs, Applesoft BASIC has some significant shortcomings compared to more recent versions of BASIC. One of these is the inability to use a variable or BASIC expression as the object of a GOTO, GOSUB, or RESTORE command. Applesoft BASIC requires you to use a line number as the destination of a GOTO, GOSUB, or RESTORE.

There are two disadvantages to this. First, line numbers contain no clue to the purpose of the branch: GOSUB DELAY makes the purpose of a subroutine more obvious to everyone than GOSUB 1000. Second, branching statements that are limited to constants can't be modified while a program is executing. Unlike line numbers, variables can change as a program runs, letting you modify the destination of a command just by changing the value of the variable. For example, you could use GOSUB CHOICE*1000 to branch to subroutines at lines 1000, 2000, or 3000 depending on whether the variable CHOICE equals 1, 2, or 3.

Improved GOTO And GOSUB

"Enhancer" lets you substitute variables and even complex expressions as the object of GOTO, GOSUB, and RESTORE in Applesoft BASIC. To use it, first enter Program 1 and be sure to save a copy. Program 1 is a BASIC program that creates the machine language routine for Enhancer on disk, using the filename APPLE.ENHANCER. (Be careful to use some name *other than* APPLE.ENHANCER for Program 1 itself; otherwise, you'll get a FILE TYPE MISMATCH error when you run it.)

After you've created the APPLE.ENHANCER file, you won't need Program 1 again, except to make additional copies of the machine language. To load and activate the utility, add this line to the beginning of any BASIC program:

```
10 PRINT CHR$(4)"BRUN APPLE.
   ENHANCER"
```

Make sure the Enhancer machine language file is on the disk in the current drive. As soon as your

program executes this line, it can use the features of APPLE.ENHANCER. You can still use the normal form of GOTO and GOSUB (GOTO 100, GOSUB 20005, or whatever), but in addition, you can also use this format:

& GOTO *expression*
& GOSUB *expression*

Note the ampersand (&) symbol that precedes the GOTO or GOSUB. In place of *expression*, you can substitute any legal Applesoft variable name or expression. Here's a short example to show how the new commands work:

```
A8 10 BEGIN = 20
7B 20 INPUT "CHOOSE 1 OR 2 ";CHO
      ICE
B5 30 IF CHOICE < 1 OR CHOICE >
      2 THEN & GOTO BEGIN
6D 40 & GOSUB CHOICE * 1000
FA 50 PRINT "DONE."
F1 60 END
D1 1000 PRINT "FIRST ROUTINE"
D5 1010 RETURN
2B 2000 PRINT "SECOND ROUTINE"
D6 2010 RETURN
```

Notice how the improved GOSUB serves as a substitute for ON-GOSUB. Depending on what value CHOICE has, the program branches to line 1000 or 2000. Likewise, the improved GOTO command can replace an ON-GOTO command.

RESTORE To A Destination

The RESTORE statement in Applesoft normally stands by itself; it simply resets the READ pointer to the beginning of the program. If you wish to READ a particular piece of data midway through the list, you first READ past every preceding DATA item in the program. With APPLE.ENHANCER in place, you can use this more convenient command:

& RESTORE *expression*

Again, you must include the ampersand before the command; replace *expression* with any legal Applesoft expression or variable. Now you can access any DATA line in the program instantly.

For instance, say that a program has many DATA statements containing information for three different graphics screens. Ordinarily, you'd have to READ through all the DATA for screens 1 and 2 before reaching the DATA for screen 3—a process that takes time and increases the possibility of errors. The improved RESTORE command allows you to zero in on the precise DATA line you want, without time-consuming delays.

Program 2 demonstrates all the features of these new commands. Without these features, the program would be considerably longer and less flexible.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

Program 1: APPLE.ENHANCER Filemaker

```
ED 10 FOR I = 768 TO 887: READ A
      : POKE I,A:CK = CK + A: NE
      XT
7A 20 IF CK < > 14482 THEN PRINT
       "ERROR IN DATA STATEMENTS
      .": STOP
E1 30 PRINT CHR$ (4)"BSAVE APPLE
      .ENHANCER,A$300,L$77"
EE 40 DATA 169,76,141,245,3,169,
      16,141
A8 50 DATA 246,3,169,3,141,247,3
      ,96
E9 60 DATA 160,0,177,184,217,115
      ,3,240
88 70 DATA 11,200,192,3,240,3,76
      ,20
C2 80 DATA 3,32,201,222,140,118,
      3,230
BA 90 DATA 184,208,2,230,185,32,
      103,221
95 100 DATA 172,118,3,192,1,240,
      10,192
75 110 DATA 2,240,35,32,82,231,7
      6,65
A4 120 DATA 217,169,3,32,214,211
      ,165,185
AA 130 DATA 72,165,184,72,165,11
      8,72,165
BF 140 DATA 117,72,169,176,72,32
      ,82,231
63 150 DATA 32,65,217,76,210,215
      ,32,82
96 160 DATA 231,32,26,214,56,165
      ,155,233
43 170 DATA 1,164,156,176,1,136,
      133,125
A5 180 DATA 132,126,96,171,176,1
      74,0,0
```

Program 2: Better Branching Demo

```
ED 10 PRINT CHR$ (4)"BRUN APPLE.
      ENHANCER"
53 20 TEXT : HOME
EF 30 & RESTORE 100
CD 40 FOR I = 1 TO 3: READ A: &
      GOSUB 50 + A * 10: NEXT I
F0 50 END
FC 60 PRINT "THIS IS STATEMENT 2
      ": RETURN
7E 70 PRINT "THIS IS STATEMENT 3
      ": RETURN
7E 80 PRINT "THIS IS STATEMENT 1
      ": RETURN
F0 90 DATA THIS IS UNWANTED DATA
55 100 DATA 3,1,2
```


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Random Numbers
In Machine Language For Commodore 64

Neil Boyle

Here are two different methods for obtaining random numbers from machine language on the Commodore 64. Even if you're not a machine language programmer, you may find the explanation of the RND function useful in BASIC programming.

Sooner or later, nearly every programmer needs to generate random numbers. They're useful for introducing an element of uncertainty in games, as well as many other applications. Random numbers are easily available in BASIC with the RND function, but it's not so easy to generate these numbers in machine language. Two different methods are available on the Commodore 64: The first involves the BASIC RND function, and the second uses the SID (Sound Interface Device) chip.

BASIC's RND Function

The BASIC routine which performs RND is at memory location $E097 (decimal 57495) in the Commodore 64's Read Only Memory (ROM). This function generates values of different types, based on a *seed* number. Random numbers generated by the RND function are not truly random; rather, they are part of a very long, repeating number series (hence, the term *pseudo-random* numbers). However, they are usable as random numbers in most programs.

There are three different ways to use RND in BASIC. If you supply a positive number inside the parentheses—for instance, RND(1)—the first seed value used is the one copied from ROM to locations $8B–$8F when you turn the computer on. Each subsequent seed value is generated by scrambling the previous one. The RND function looks at the sign of the number in parentheses to see whether it's positive, but does not use the number itself. Thus, since RND(1234) and RND(1) both use positive values, both expressions produce exactly the same result.

What this means in practice is that RND with a positive number produces exactly the same number sequence each time you turn on the computer. To demonstrate, enter SYS 64738 to reset the computer, then enter the following line in direct mode (without a line number):

```
FOR J=1 TO 5:PRINT RND(1):NEXT
```

The computer prints these numbers:

```
.185564016
.0468986348
.827743801
.554749226
.897233831
```

Now reset the computer and enter the same line, substituting a different positive number in the parentheses. As you'll see, positive values generate the same results whether you use RND(1) or RND (65536). Since the reset stores the same values in the seed locations, and RND's scrambling method is predictable, the same numbers show up every time.

If you supply a zero inside the parentheses, RND gets values from the computer's internal timer A and the time-of-day clock on CIA chip #1 to use as the seed. Since the clock values are constantly changing, this would seem to be a way to generate more truly random numbers. However, because the time-of-day clock operates with binary coded decimal numbers, certain values never appear in the seed. Thus, the randomness of RND(0) is questionable. To illustrate this, enter and run the following one-line program:

```
10 POKE 1024 + (RND(0) * 1000), 160:
   GOTO 10
```

The many unfilled character spaces on the screen represent values that are never generated by RND(0).

When you supply a negative number in the parentheses, RND uses the value itself as the seed. For instance, enter the following line in direct mode:

```
X=RND(-654321):PRINT RND(1)
```

The result is always .333675369. If you substitute a different negative number, RND generates a different yet predictable result. This can be useful when testing a program: To generate the same series of numbers each time, set the seed with a negative number, then use RND with a positive number. In cases where you want a wholly unpredictable number series, the best method is to start with

X=RND(−TI) to begin with an unknown seed value, then use positive RND arguments thereafter. Since the seed value depends on how many sixtieths of a second have elapsed since you turned on the computer (or reset the software clock with TI$), the results are unpredictable enough to satisfy most ordinary needs.

Calling RND From ML

To call the RND function from within an ML program, execute JSR $E09A. The value held in the accumulator register when you call the routine determines what RND does. If the accumulator holds a negative byte value ($80–$FF), then the value in floating point accumulator 1 (FAC1) is used as the seed. If the accumulator holds zero, RND uses values from timer A and the time-of-day clock, just as in BASIC. If the accumulator value is positive ($00–$7F), then the seed value in locations $8B–$8F is used.

Thus, your choices for ML programming are essentially the same as for BASIC, except that the system variable TI is not available as an argument. An alternative to using TI is to load the byte values from the software clock ($A0–A2) directly into the seed addresses ($8B–8F), thus giving a fairly random seed. If you'd rather not bother with loading the accumulator, you can perform JSR $E0BE to go directly to the routine which uses the stored seed value.

As you probably know from using RND in BASIC, the function always returns a floating point number between 0 and 1. In machine language, it is usually more convenient to use a single byte value in the range 0–255. Unfortunately, some of the randomness of the BASIC floating point number comes from scrambling the bytes in FAC1; this is lost when single bytes are used. One alternative is to convert the floating point number to an integer and use one or more bytes of the integer. But this is somewhat awkward. Nonrepeating random numbers involving all possible single byte values seem to be produced in locations $63 and $64 of FAC1 after a call to $E09A with the accumulator set appropriately. The values found in locations $62 and $65 do not include all the values from 0–255 and therefore should not be used.

SID's Random Number Generator

The 64's SID chip also has the ability to generate random values and is very easy to use. All you need to do is select the noise waveform for the SID's voice 3 oscillator and set voice 3's frequency to some nonzero value (the higher the frequency, the faster the random numbers are generated). It is not necessary to gate (turn on) the voice. Once this is done, random values appear in location $D41B. The parameters need only be set once, as shown in this example. (You'll need a machine language assembler to enter this and the following example; the semicolons and the comments which follow them are optional.)

```
LDA #$FF   ; maximum frequency value
STA $D40E  ; voice 3 frequency low byte
STA $D40F  ; voice 3 frequency high byte
LDA #$80   ; noise waveform, gate bit off
STA $D412  ; voice 3 control register
RTS
```

Once this code is executed, the SID chip continuously produces random byte values, which you can retrieve with a statement like LDA $D41B. This method works only on the Commodore 64 and 128, since only those two computers have a SID chip. Values obtained from the SID chip do seem to be random: Each of the values in the range 0–255 occurs at about the same frequency, and the series does not repeat in the first 34,000 values.

In many cases, you'll want to obtain random numbers only within a certain range. In BASIC, this is done with a statement like RND(1)*(U−L)+L. Here the variables U and L stand for the upper and lower limits, respectively, of the number range we want. This statement produces integer numbers within that range, excluding the first and last values in the range (for instance, if U=30 and L=1, then 30 and 1 do not appear in the series). To include the first and last values, use a statement like INT(RND(1)*(U−L+1)+L.

In machine language, we're usually interested in single byte values: integers in the range 0–255. Should larger values be needed, you can always generate two or more bytes and combine them. Getting numbers within a certain range is simply a matter of generating numbers until you find one that falls in the range you want. For instance, the following routine generates numbers within the range $10–$40 (before performing this routine, you must set up the SID chip as shown above):

```
RAND LDA $D41B ; get random value
                 from 0–255
     CMP #$31  ; compare to
                 U−L+1
               ; U−L+1 = $31 =
                 $40−$10+$01
     BCS RAND  ; branch if value >
                 U−L+1
     ADC #$10  ; add L
     RTS
```

This routine generates random numbers until one is found that falls between 0 and the difference between the high and low values. Then the low value is added to the result to give a value between the low and high limits, inclusive. If the range is very small, many numbers may have to be generated before you find one that's suitable.

You can decrease the delay by ANDing the random number with a value that removes the unwanted higher bits. For instance, if the difference between the low and high limits is $0A, then AND the random value with $0F to remove the four high bits, then test whether it falls within the range. One useful special case deserves mention. To generate an integer in the range −1 to 1 inclusive, use the BASIC statement INT(RND(1)*3)−1. To get a value between $01 and $FF in machine language, AND the random value with $03 and use a routine like the one shown above, where L=$FF and U−L+1=$03.

The method you use to generate random numbers depends on your needs. In machine language, if repeatable values aren't needed, it's simplest to use the SID chip. Should repeatable values be required (for testing a routine, etc.), set the chosen seed in the seed locations $8B–$8F, call the ROM routine at $E0BE, then use the value found in locations $63 or $64 for the random number. Due to its questionable randomness, the timer/clock method is not recommended.©

Amiga Puzzle

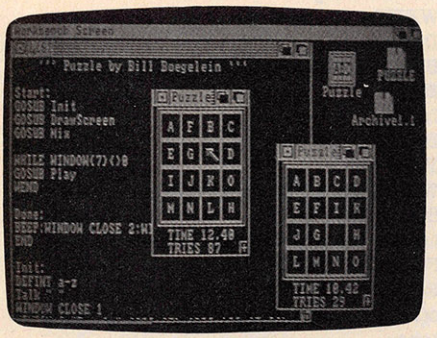
Bill Boegelein

The following programs provide you with an entertaining puzzle game that pops up as a small window on the Workbench screen. But more importantly, they demonstrate some interesting and powerful programming techniques in Amiga BASIC.

A popular game that used to keep kids occupied for hours in the back of the station wagon was known as the "slide puzzle." This was simply a plastic frame with 15 numbered or lettered tiles arranged in a 4 × 4 pattern with one square left vacant. The object was to slide one tile at a time into the vacant slot in an attempt to restore the puzzle to its proper numeric or alphabetic order. "Amiga Puzzle" is the Amiga BASIC equivalent of the slide puzzle.

Amiga Puzzle works on any Amiga with Amiga Microsoft BASIC (not ABasiC—Amiga BASIC is available as a free upgrade if your computer was shipped with ABasiC). To get started, run Amiga BASIC, enter Program 1 below, and save a copy on disk. Be sure to set Preferences for a 60-column screen before running Amiga Puzzle. When you run the program, it pops open as a small window on the Workbench screen and scrambles the tiles. When the program announces "Ready" using the Amiga's built-in speech capability, you can begin.

To move a tile into the vacant slot, point to the tile with the mouse and press the left mouse button. If you try to cheat by moving a tile diagonally, the program will scold you. The gadget in the lower-right corner of the window, normally reserved for window resizing, has been replaced with a plus sign in Amiga Puzzle. Clicking on this gadget rescrambles the puzzle and starts a new game. The other gadgets (front/back, the move bar, and close window) are all active as usual.



This photo shows two copies of "Amiga Puzzle" running simultaneously, an example of the Amiga's multitasking capabilities.

As a final touch, the Puzzle window displays the elapsed time and number of moves since the start of the game.

How It Works

Amiga Puzzle was adapted from a similar puzzle game available on the Macintosh. Those of you familiar with Microsoft BASIC 2.0 on the Macintosh will immediately see many similarities in Amiga BASIC. In fact, many Macintosh BASIC programs can be converted to Amiga BASIC with little effort. Both languages support windows, pull-down menus, labels, many types of graphics commands, and other features.

Amiga Puzzle is divided into seven subroutines named Done, Init, DrawScreen, Mix, Play, CheckCheat, and More. There are also two small subprograms, Talk and Position. Here are descriptions of what these subroutines do:

Init: initializes variables, user-defined functions, and loads the puzzle's characters A–O into the two-dimensional array *c()*.

DrawScreen: displays the puzzle's squares and characters.

Mix: mixes only adjacent squares and keeps track of the blank square's position in variables *blankX* and *blankY*.

Play: the main subroutine where the current mouse position is compared to coordinates of each square stored in the three-dimensional array *rat*.

CheckCheat: makes sure the attempted move is a legal one (adjacent squares only, no diagonal moves).

More: checks if the mouse is clicked on the plus-sign gadget in Amiga Puzzle's lower-right corner. If so, the program starts a new game by jumping back to Start.

Done: ends the program and returns control to BASIC.

Special Features

Most of the program is standard Microsoft BASIC. The only lines that merit special attention are the user-defined functions in the Init subroutine. One function operates the puzzle's timer, and the other determines if the puzzle has been solved.

A quick way to time any event is to define a function that subtracts the current time from the initial starting time. This is done with the function FNlaps. The current time is obtained from TIMER and the

initial time stored in the variable *starttime*.

The other defined function, FNwin, determines if the puzzle has been solved by comparing the letter in each tile—stored in the array *c()*—with the characters A–O. Each letter in the correct position returns a value of −1 (true). So the puzzle has been solved when all 15 letters are sorted, returning a value of −15.

A very powerful feature of Amiga BASIC is its subprogram capability (see "Requester Windows in Amiga BASIC," COMPUTE!, March 1986). In effect, subprograms let you add new commands to the language. The word TALK is not a command in Amiga BASIC, but has been added to Amiga Puzzle as a subprogram. It lets you execute both a SAY command and the text-to-speech TRANSLATE$ function by simply typing TALK followed by the desired string. Similarly, POSITION is a subprogram that expects parameters of the X and Y coordinates as the location to PRINT the desired string.

Program 2, "MakeIcon," lets you create a special icon for Amiga Puzzle. This is optional, of course, since Amiga BASIC automatically assigns a standard icon when you save the program. MakeIcon recreates the special icon I designed with the Amiga's Icon Editor (a new feature that's included with the free upgrade to version 1.1 of the operating system). The icon data is converted from the hexadecimal values in the DATA statements into single-byte values and stored in the file *Puzzle.info* (all Amiga icon files end with *.info*). In addition to the icon's shape and color, the special data also contains information that makes Amiga BASIC the program's *default tool*. That means when the icon is clicked on the Workbench screen, Amiga BASIC is automatically loaded and run prior to loading and running the game.

Multitasking With BASIC

Since multitasking is built into the Amiga's operating system as a standard feature, no special programming techniques are required to write a BASIC program that's capable of running simultaneously with other tasks. Feel free to move Amiga Puzzle over or under other windows running different programs without causing interference. If your computer has at least 512K RAM, you can even click on the Amiga Puzzle icon a second time and run two of the games at once.

Program 1: Amiga Puzzle

```
Start:←
GOSUB Init←
GOSUB DrawScreen←
GOSUB Mix←
WHILE WINDOW(7)<>0←
GOSUB Play←
WEND←
Done:←
BEEP:WINDOW CLOSE 2:WINDOW 1←
END←
Init:←
DEFINT a-z←
Talk " " ←
WINDOW 1,"Puzzle",(230,45)-(230+13
8,45+96),30←
tries=0:RANDOMIZE TIMER←
FOR y=0 TO 3←
FOR x=0 TO 3←
c(x,y)=x+y*4+ASC("A") ' Load charac
ters←
NEXT x←
NEXT y←
blankX=x-1:blankY=y-1←
c(blankX,blankY)=ASC(" ")←
DEF FNlaps!=((TIMER-starttime!)\60)
+(((TIMER-starttime!) MOD 60)/100)←
DEF FNa=(c(0,0)=65)+(c(1,0)=66)+(
c(2,0)=67)+(c(3,0)=68)←
DEF FNb=(c(0,1)=69)+(c(1,1)=70)+(
c(2,1)=71)+(c(3,1)=72)←
DEF FNc=(c(0,2)=73)+(c(1,2)=74)+(c
(2,2)=75)+(c(3,2)=76)←
DEF FNd=(c(0,3)=77)+(c(1,3)=78)+(
c(2,3)=79)+(c(3,3)=80)←
DEF FNwin=(FNa+FNb+FNc+FNd
) 'Won if = -15←
RETURN←
DrawScreen:←
FOR y=0 TO 3←
FOR x=0 TO 3←
Position (x+1)*3,(y+1)*2,CHR$(c(x,y
)) ' Print characters←
x1=x*30+10:y1=y*18+3 ' Draw boxes
←
LINE (x1,y1)-(x1+30,y1+18),1,b←
LINE (x1-1,y1-1)-(x1+30+1,y1+18+1)
,1,b←
LINE (10-5,3-3)-(4*30+10+5,4*18+3+
3),1,b←
moreX=128:moreY=89←
LINE (moreX,moreY)-(moreX+10,more
Y+10),1,bf ←
Position 14,11,"+" ' New game gadget←
rat(x,y,0)=x1:rat(x,y,1)=y1←
NEXT x←
NEXT y←
Position 3,10,"TIME 0.00" ←
Position 3,11,"TRIES 0"←
RETURN←
Mix:←
x=blankX:y=blankY←
FOR mixing=333 TO 1 STEP -1 ←
IF (mixing AND 1)=0 THEN←
x=INT(RND*4):y=blankY ' Even←
ELSE ←
y=INT(RND*4):x=blankX ' Odd←
END IF←
GOSUB CheckCheat←
NEXT mixing←
Talk "Ready."←
starttime!=TIMER←
RETURN←
Play:←
LOCATE 10,8:PRINT USING "##.##";FNl
aps!;←
WHILE MOUSE(0)<>0←
mouseX=MOUSE(3):mouseY=MOUSE(
4)←
FOR y=0 TO 3←
FOR x=0 TO 3←
IF (mouseX>rat(x,y,0) AND mouseX<r
at(x,y,0)+30) AND (mouseY>rat(x,y,1
) AND mouseY<rat(x,y,1)+18) THE
N GOSUB CheckCheat:RETURN←
NEXT x←
NEXT y←
GOSUB More←
WEND←
RETURN←
CheckCheat:←
IF (ABS(x-blankX)>1 OR ABS(y-blankY)
>1) OR ((x<>blankX AND y<>blankY)
) THEN←
IF mixing=0 THEN Talk "Cheater." 'Ch
eating←
ELSE 'Not cheating←
SWAP c(x,y),c(blankX,blankY)←
Position (x+1)*3,(y+1)*2,CHR$(c(x,y))
←
SWAP x,blankX:SWAP y,blankY←
Position (x+1)*3,(y+1)*2,CHR$(c(x,y))
←
END IF←
IF mixing=0 THEN←
tries=tries+1←
LOCATE 11,8:PRINT tries;←
WHILE MOUSE(0)<>0:WEND←
IF FNwin=-15 THEN Talk "We have a wi
nner.":GOTO More←
END IF←
RETURN←
More:←
WHILE MOUSE(0)<>0 OR FNwin=-15 'A
nother game?←
mouseX=MOUSE(3):mouseY=MOUSE(
4)←
IF MOUSE(0)=0 AND (mouseX>more
X AND mouseX<moreX+10) AND (mou
seY>moreY AND mouseY<moreY+10
) THEN GOTO Start←
IF WINDOW(7)=0 THEN Done←
WEND←
RETURN←
SUB Talk(a$) STATIC←
SAY TRANSLATE$(a$)←
END SUB←
SUB Position(x,y,a$) STATIC←
LOCATE y,x:PRINT a$;←
END SUB←
```

Program 2: MakeIcon

```
WIDTH 60←
PRINT:PRINT SPC(20);"Creating Puzzl
e Icon":PRINT ←
DEFINT a-z←
CLOSE←
OPEN "Puzzle.info" FOR OUTPUT AS 2←
FOR ii=1 TO 98←
READ long$←
```

```
FOR i=1 TO 8 STEP 2←
byte$=MID$(long$,i,2)←
PRINT byte$;←
HX byte$←
tmp=VAL(byte$)←
checksum=checksum+tmp←
PRINT #2,CHR$(tmp);←
NEXT i←
NEXT ii←
CLOSE←
KILL "Puzzle.info.info" 'Delete icon's ic
on←
IF checksum<>12063 THEN BEEP:PRI
NT:PRINT "Error in data statements."←
END←
SUB HX(a$) STATIC ' STR$ hex to dec (m
ax=FFFF)←
a$=UCASE$(a$):n=0:ans=0 ←
FOR i=1 TO LEN(a$)←
c=ASC(MID$(a$,i,1))←
n=VAL(CHR$(c))←
IF c>ASC("9") THEN n=(VAL(CHR$(
c-17)))+10←
ans=ans*16+n←
NEXT i←
a$=STR$(ans)←
END SUB←
' Puzzle Icon data←
DATA E3100001,00000000,00800062,0
0280017 ←
DATA 00040003,00010001,B8C00000,0
0000000 ←
DATA 00000000,00000000,00000000,0
0000000 ←
DATA 044C0001,B8F00000,00000000,0
07C0000←
DATA 00560000,00000000,00000000,1
0000000←
DATA 00000028,00170002,00021600,0
3000000←
DATA 00000000,00000000,3FFFFFFF,F
C002000←
DATA 00000400,27FFFFFF,E4002404,0
8102400←
DATA 24040810,24002404,08102400,2
7FFFFFF←
DATA E4002418,7E0F2400,243C3319,A
400243C←
DATA 33302400,27663E30,E400247E,3
3302400←
DATA 24C33319,A40024C3,7E0F2400,2
7FFFFFF←
DATA E4002404,08102400,24040810,2
4002404←
DATA 08102400,27FFFFFF,E4002000,0
0000400←
DATA 3FFFFFFF,FC000000,00000000,0
0000000←
DATA 00000000,00000000,00000000,0
0000000←
DATA 00000000,00000000,00000000,0
0000000←
DATA 00000000,00000000,00000000,0
0000000←
DATA 00000000,00000000,00000000,0
0000000←
DATA 00000000,00000000,00000000,0
0000000←
DATA 00000000,00000000,00000000,0
0000000←
DATA 00000000,00000000,00000000,0
0000000←
DATA 00000000,00000000,00000000,0
0000000←
DATA 00000000,00000000,000C3A41,6
D696761←
DATA 42415349,43000000←
```

©

DEBUT

Atari BASIC Debugging Tool

Gary W. Swanberg

Here's a powerful debugging utility that lets Atari BASIC programmers analyze and manipulate variables, search for BASIC keywords, produce printed documentation of important program information, and call up disk directories without leaving BASIC. It works on all Atari 400/800, XL, and XE computers with at least 40K RAM, a disk drive, and Atari DOS 2.0 or 2.5.

"DEBUT," a utility for debugging Atari BASIC programs, was inspired by the "Atari Wedge" (COMPUTE!, December 1982). It uses the Wedge technique to provide BASIC with direct-mode commands for listing and locating variables, dumping variable values, and replacing one variable with another. It also searches for BASIC keywords and includes a DIR command for listing the disk directory. Output is easily redirected from the screen to the printer, disk drive, or any other output device. And because DEBUT is written in machine language, it remains completely transparent—BASIC programs can be loaded, modified, tested, and saved without interference.

Preparing DEBUT

The program following this article creates DEBUT as an AUTORUN.SYS file that runs with two of the three revisions of Atari BASIC (revisions B and C). If PRINT PEEK(43234) returns 162, then you have revision A, in which case you must substitute the following lines for the corresponding lines in Program 1:

```
200 DATA 255,255,0,31,157,31,175,164,
    41,168
202 DATA 76,98,164,76,144,164,76,92,181,
    76
204 DATA 12,181,76,53,181,76,159,186,76,
    137
206 DATA 171,76,188,175,76,155,171,68,69,
    66
```

(Revision A is the original BASIC cartridge made for the 400/800 and 1200XL computers. Revision B is the BASIC built into the 600XL and 800XL. Revision C is built into the 65XE and 130XE and also is available as a cartridge from Atari.)

Type in and save the BASIC program, then insert the disk on which you want to create DEBUT's AUTORUN.SYS file and type RUN. Make sure an AUTORUN.SYS file—such as Atari *SpeedScript* or *SpeedCalc*—doesn't already exist on the disk or it will be

replaced. After the AUTORUN.SYS file is created, you won't need to run the BASIC program again, except to create copies of DEBUT on other disks. To start DEBUT, turn the computer off, make sure a disk with the DEBUT AUTORUN.SYS file is in the drive, then turn the computer on. DEBUT loads automatically and announces its presence with the message DEBUT. This message appears whenever you press SYSTEM RESET, reminding you that DEBUT is active.

DEBUT protects itself by resetting MEMLO (the pointer to the bottom of free memory, locations 743 and 744) and by trapping the DOS command. As in the Atari Wedge, typing KILL gets rid of the utility and enables DOS.

Note: DEBUT works with Atari DOS 2.0 and 2.5, but may not work with other types of DOS, especially after a SYSTEM RESET. Be sure that you have one of these versions before typing in the program.

Using DEBUT

Once DEBUT is up and running, you have four new commands at your disposal for debugging and documenting BASIC programs—plus the DIR command. You type the command and press RETURN, just as you would with any direct-mode BASIC statement. Type DIR, for example, to list the disk directory, or use the form DIR D:*filespec* to list specific files. The ? and * wildcard characters are allowed, and drive numbers (D2:, D3:, etc.) can be specified as well. (D: defaults to drive 1.)

Now you're ready to load one of your BASIC programs and try the four main commands:

FIND	(Find a variable or BASIC keyword.)
REP	(Replace one variable with another.)
XREF	(List variables and cross-reference line numbers.)
VIEW	(View the values of all variables.)

These commands act on your entire BASIC program unless you specify a range of line numbers using the form *starting line,last line.* You may specify either or both. When specifying only the last number, precede it with a comma, or DEBUT thinks it's a starting number. The line range parameter is optional, so it follows the other arguments to the command, as we'll explain below.

All commands can also use the *output switch*—a slash appended to the command followed by the name of the device to which you want to redirect output (P for Printer, D for Disk, C for Cassette, etc.). This sends the command's output to the device rather than to the screen. To send the disk directory listing to the printer, for example, type DIR/P. This option uses channel 1 for output, closing the channel when it's done. Files created on disk or cassette are ASCII files which can be viewed with most Atari word processors or ENTERed into memory with BASIC.

We'll see more examples as we take a detailed look at each command.

The FIND Command

With FIND, you can quickly identify any lines in your program that contain a certain variable or BASIC keyword. Here is the general format:

FIND ***[/output device] target [starting line,last line]***

where */output device* is the optional switch for redirecting output from the screen; *target* is the variable name or BASIC keyword you want to find; and *starting line,last line* is the optional line number range for the search.

FIND lists every line in which the target appears. The target can be a statement name (keywords that begin a statement, such as PRINT, PLOT, and POKE), a function name (such as RND, COS, and PEEK), or a variable name. Include the right parenthesis as part of subscripted variable names, and the dollar sign as part of string variable names. (Remember: X, X(, and X$ are three distinct variables.)

FIND does not locate keywords that are neither statements nor functions—THEN and TO, for instance. GOSUB and GOTO are missed when they appear as part of the ON-GOSUB or ON-GOTO statements. Also, FIND won't locate any operators, such as OR, AND, +, and /, to name a few.

FIND *does* locate ERROR lines, however; use FIND * for this purpose.

Directing output to the disk drive (FIND/D:*filename*) presents an interesting possibility—the file thus created can later be retrieved using BASIC's ENTER command, allowing you to sift lines out of one program to create another.

Perhaps you've discovered that keywords can sometimes be used as variable names in Atari BASIC. FIND assumes that if it's spelled like a keyword, it *is* a keyword. You can force FIND to search for variables only by preceding the variable name with the greater-than symbol (>). Thus, FIND LEN comes up with all occurrences of the LEN function, while FIND >LEN lists occurrences of a variable called LEN. This option is needed only if your target variable could be confused with a keyword. (Be careful when choosing variable names in Atari BASIC. LET NOTE=66 creates a legitimate variable, but if you try to access its value—for example, SOUND 0,NOTE,10,10—BASIC treats it as NOT E, while FIND, without the > option, would go off looking for the keyword NOTE.)

When you specify a line number range with the FIND command, only those lines within that range are listed. Here are some examples:

FIND X(

(List all lines in the program containing the *array variable* X.)

FIND TEMP 100

(List all lines containing the variable name TEMP, beginning at line 100.)

FIND/P CHR$,100

(List all lines through line 100 containing the function CHR$ and send the listing to the printer.)

FIND * 100,200

(List all lines from 100 through 200 that contain ERRORs.)

FIND/D:NEWFILE.ASC PRINT,20000

(Create a disk file named NEWFILE.ASC to hold the listing of all lines through line 20000 that contain the keyword PRINT.)

The XREF Command

As you write an Atari BASIC program, newly declared variables are added to an area of memory called the *variable name table.* XREF lists the contents of this table and cross-

references the lines in which each variable appears. Here is the general format:

XREF ***[/output device] [starting line,last line]***

where */output device* is the optional switch for redirecting output from the screen; and *starting line,last line* is the optional line range parameter.

Often, XREF finds variables in the variable name table that don't actually appear in your program. You can recognize these unused variables because XREF lists them with no line number references. Unused variables can happen when you delete all occurrences of a certain variable from a program, or when you misspell a variable or command and BASIC thinks you're creating a new variable. These unused variable names clutter up the variable name table, which might become a factor in a long program since the table is limited to 128 names.

XREF can help you eliminate this deadwood. If a large number of unused variables show up, you can clear them out by LISTing the program to disk, typing NEW, and then re-ENTERing the program. (LIST and ENTER reconstruct the variable name table, whereas SAVE and LOAD preserve it.)

When you specify a line number range with XREF (for instance, XREF 1000,2000), only those variables and line references within that range are listed. At the foot of the listing, both the count of listed variables and the total number of variables in the name table are displayed.

XREF/P creates a hardcopy of the variable listing—useful documentation. XREF also makes it easy to spot misspelled variable names. No longer must you trace through a recalcitrant program line by line only to find that your mysterious bug is due to the slip of a finger. And if you're as poor a typist as I am, you'll be making frequent use of the REP command described below.

Here are a few examples:

XREF

(List and cross-reference all variables in the program.)

XREF 2000,2999

(List and cross-reference all variables in the subroutine in lines 2000 through 2999.)

XREF ,10000

(List and cross-reference all variables up to line 10000.)

XREF/D:VARLIST

(List and cross-reference all variables in the program, and send the list to the disk file VARLIST.)

The REP Command

Now it's easy to replace those cryptic variable names with new names of crystal clarity—or, depending on your motives, vice versa. REP acts in a flash, replacing old variable names with new variable names. It's handy for making corrections and tightening up code—but be careful. With or without such a command, the more ambitious your program, the wiser it is to save backup copies and document changes as you make them.

Here is the general format:

REP ***[/output device] oldvar newvar [starting line,last line]***

where */output device* is the optional switch for redirecting output from the screen; *oldvar* is the old variable name; *newvar* is the new variable name (separated by a space, not a comma, from *oldvar*); and *starting line,last line* is the optional line number range. (The only output produced by the output switch is a message telling you how many variables were changed.)

REP does not let you replace keywords or mismatched variable types (for instance, you can't change A$ to A). Also, REP *requires that the new variable already exists in the variable name table.* To add a new variable to the table, simply use it in any BASIC statement, even in direct mode. (If you want to create a new variable SUM, for instance, you can just type SUM=0 and press RETURN.)

If you don't include the optional line number range, REP works on the entire program. If you specify a range of lines, it replaces the old variable name only within those lines. Watch out for this, since it may cause a conflict elsewhere in your program.

Here are some examples:

REP CB CHECKBALANCE

(Replace all occurrences of the variable CB with the new variable name CHECKBALANCE.)

REP CLIENTNAME$ CN$

(Replace all occurrences of the variable CLIENTNAME$ with the new variable name CN$.)

REP I(INDEX(

(Replace all occurrences of the array variable I() with the array variable INDEX().)

REP SUM TOTAL 3000,3999

(Replace all occurrences of the variable SUM with the new variable name TOTAL within the subroutine in lines 3000 to 3999.)

Variables are stored as one-byte tokens in Atari BASIC. REP looks up the old and new variable names in the name table to determine their tokens, then replaces every old token (within range) with the new one. The old name remains in the name table (type XREF to see for yourself) and keeps the value it had at the time of the change.

The VIEW Command

BASIC's PRINT statement lets you examine variable values in direct mode as you test and debug a program, but it can be cumbersome when you're juggling lots of variables, especially subscripted variables. Of course, there's an easier way.

DEBUT's VIEW command lists all variables and their values, including strings and arrays, without requiring you to name each one. Type VIEW to quickly display the values, or use the optional output switch to generate hardcopy that you can analyze with the proverbial fine-toothed comb.

Here is the format of the command:

VIEW ***[/output device] [starting line,last line]***

where */output device* is the optional switch for redirecting output from the screen; and *starting line,last line* is the optional range of line numbers.

Here is the format of the VIEW command's output:

VARIABLE=*value*
STRING$ *current length,maximum length*
"string contents"
ARRAY(*rows,cols*
10 20 30 40
2 4 6 8
3 5 7 11

Scalar variable values are displayed in a pretty straightforward

manner—the variable name is followed by its value. Strings are listed with additional information—the current and maximum length. String contents are printed in quotes below the name.

For subscripted variables, VIEW lists the row and column dimensions corresponding to the indexes you assign with the DIM statement, plus one. (Because indexing starts at zero—ARRAY(0,0) is a valid array element—the actual size of each dimension is one greater than the value you give.) Values are listed by column and row; sample values are shown in the example above. A singly subscripted variable is really a one-column array; its values are listed vertically. If a string or array has not been dimensioned, only the name prints. Unused variables aren't listed at all.

The output switch and range option work with this command as they do with all others. For example:

VIEW/P

(Prints a hardcopy of all the variables and their values.)

VIEW/P 200,300

(Prints a hardcopy of the variables and values in lines 200 through 300.)

Additional Hints

The DEBUT commands are an aid to debugging, but they won't do the whole job for you. Use them along with other techniques (such as tracing the program's execution with temporary PRINT statements) to close the gap between what you're telling BASIC to do, and what you *want* it to do.

Since the optional disk output produced by these commands is compatible with any word processor that handles ASCII text, you can easily produce program documentation with DEBUT. For example, you could save the XREF listing to disk, and use a word processor to add explanations of each variable. Every minute spent documenting a program pays off threefold should you ever have to go back and modify it.

The DEBUT command formats are tolerant of extra spaces, and command words can be abbreviated—just type the first letter followed by a period. In fact, the period alone is all you need for DIR. The output switch is unaffected by abbreviations—DIR/P, D./P, and ./P all do the same thing. In addition, the FIND command accepts abbreviated keywords as its target. For example, FIND FOR, FIND F., and F.F. all seek out the keyword FOR. Sound confusing? Experiment. You'll find the shortcuts which are most useful to you.

Notes For ML Programmers

It would be nice if DEBUT had a renumbering command, program trace capabilities, or even a few more DOS commands. Machine language programmers can add such new commands by patching entries into DEBUT's command table, which reserves 25 bytes for just this purpose.

A command table entry consists of your machine language routine's address *minus one*, followed by the command name. The address is stored in high byte/low byte order. The command name is in ASCII code exactly as you'd type it, except that the rightmost byte must have the most significant bit on (inverse video). Add entries starting at location 8149 (hex $1FD5), but don't use more than the 25 bytes or you'll overwrite DEBUT. Your code can be appended to the DEBUT AUTORUN.SYS file by using the DOS copy with append feature.

DEBUT does some preprocessing before your routine gets control. As a result, you'll be able to abbreviate your commands, with DEBUT abbreviations taking precedence. The output switch works as well, opening channel 1 to the output device and storing the channel number at location 181 ($B5) before branching to your routine. If the command line requires further parsing, your routine will find it at location 1408 ($580); the offset to the first argument (if any) will be in location 242 ($F2). Your machine language routine should end with an RTS instruction if you wish it to return through DEBUT to BASIC.

DEBUT calls on several routines in Atari BASIC and accesses various BASIC tables whose addresses have changed in the later releases, which accounts for the slightly different version of the program for BASIC revision A. DEBUT commands will *not* trigger the notorious lockup bug of revision A and (especially) revision B. For those with an interest in the inner workings of Atari BASIC, I highly recommend *The Atari BASIC Source Book* (COMPUTE! Books), as well as the aforementioned "Atari Wedge" article by Charles Brannon (reprinted in *COMPUTE!'s Third Book of Atari* as "The Wedge: Adding Commands to Atari BASIC").

DEBUT: Atari BASIC Debugging Tool

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
CF 10 ? "INSERT DISK - PRESS
      RETURN WHEN READY"
HG 20 IF PEEK(764)<>12 THEN
   20
PC 30 OPEN #1,8,0,"D:AUTORUN
   .SYS"
CD 40 ? "CREATING DEBUT AUTO
   RUN.SYS FILE"
KB 50 FOR I=1 TO 1304:READ B
   YTE:PUT #1,BYTE:NEXT I
EN 60 ? "AUTORUN.SYS CREATED
   ":END
BM 70 DATA 255,255,0,31,157,
   31,159,164,36,168
CJ 80 DATA 76,84,164,76,130,
   164,76,142,181,76
FK 90 DATA 62,181,76,103,181
   ,76,153,186,76,129
GD 100 DATA 171,76,167,175,7
   6,147,171,68,69,66
BK 110 DATA 85,84,155,53,46,
   48,155,165,12,141
NK 120 DATA 86,31,165,13,141
   ,87,31,169,0,141
DL 130 DATA 241,31,169,85,13
   3,12,169,31,133,13
GO 140 DATA 160,31,169,31,32
   ,3,36,32,91,31
AM 150 DATA 169,46,141,231,2
   ,169,36,141,232,2
IB 160 DATA 96,32,88,31,76,5
   1,31,160,0,185
PL 170 DATA 26,3,201,69,240,
   8,200,200,200,192
EL 180 DATA 34,208,242,96,20
   0,169,158,153,26,3
OG 190 DATA 169,31,153,27,3,
   162,15,189,0,228
NF 200 DATA 157,158,31,202,1
   6,247,169,241,141,162
AG 210 DATA 31,169,31,141,16
   3,31,24,173,4,228
MG 220 DATA 105,1,141,243,31
   ,173,5,228,105,0
DI 230 DATA 141,244,31,96,17
   4,31,215,31,32,108
PB 240 DATA 68,73,210,32,178
   ,86,73,69,215,33
NB 250 DATA 95,88,82,69,198,
   33,212,70,73,78
MG 260 DATA 196,34,23,82,69,
   208,34,93,75,73
BG 270 DATA 76,204,32,76,68,
   79,211,0,0,0
NL 280 DATA 242,31,45,36,32,
   73,242,8,201,155
```

```
BE 290 DATA 240,5,238,241,31
,40,96,152,72,138
HH 300 DATA 72,165,194,201,9
3,208,92,174,241,31
EH 310 DATA 240,87,169,155,1
57,128,5,162,0,142
DI 320 DATA 241,31,134,242,3
2,64,35,169,31,160
NF 330 DATA 174,162,2,32,4,3
1,176,61,134,242
LM 340 DATA 189,128,5,73,47,
72,208,8,32,215
AN 350 DATA 35,48,22,32,47,3
5,160,255,132,204
LN 360 DATA 140,254,2,200,13
2,203,132,153,132,154
MN 370 DATA 132,245,32,91,32
,104,208,3,32,10
OL 380 DATA 36,169,0,141,254
,2,76,83,160,177
FF 390 DATA 149,72,200,177,1
49,72,76,64,35,104
KK 400 DATA 170,104,168,169,
155,40,96,72,162,112
NM 410 DATA 32,12,36,160,173
,169,32,32,38,36
CN 420 DATA 104,201,155,240,
3,32,28,36,162,112
BE 430 DATA 169,6,32,227,35,
162,112,169,5,160
EE 440 DATA 128,157,73,3,133
,150,132,149,32,38
CA 450 DATA 36,169,5,32,14,3
6,48,8,32,16
DG 460 DATA 31,32,222,34,208
,225,162,112,76,12
LL 470 DATA 36,68,58,42,46,4
2,155,32,243,34
OD 480 DATA 32,195,35,240,10
6,32,38,35,32,92
LB 490 DATA 35,176,89,32,213
,34,32,16,31,32
NF 500 DATA 107,34,240,70,14
4,76,32,28,31,32
GJ 510 DATA 182,221,32,217,3
4,162,226,32,241,35
BB 520 DATA 169,44,32,19,31,
162,228,32,241,35
AJ 530 DATA 38,210,144,60,32
,213,34,169,34,32
DK 540 DATA 219,34,162,226,3
2,25,31,240,17,160
NC 550 DATA 0,177,224,32,19,
31,32,222,34,240
ED 560 DATA 30,32,118,34,208
,232,169,34,32,219
IF 570 DATA 34,76,28,33,169,
61,32,19,31,32
DE 580 DATA 252,35,32,222,34
,240,4,230,203,208
HF 590 DATA 145,76,213,34,32
,40,221,165,228,133
NB 600 DATA 234,165,229,133,
235,32,213,34,162,232
PM 610 DATA 32,25,31,240,223
,162,234,32,25,31
MN 620 DATA 240,231,166,224,
164,225,32,137,221,32
DH 630 DATA 252,35,32,217,34
,32,222,34,240,207
GJ 640 DATA 160,6,32,118,34,
136,208,250,240,221
BA 650 DATA 208,2,133,245,32
,243,34,32,195,35
LM 660 DATA 240,59,32,38,35,
32,92,35,176,35
EH 670 DATA 32,197,34,230,20
5,198,205,208,3,32
EF 680 DATA 209,34,162,237,3
2,241,35,32,217,34
HM 690 DATA 230,175,165,175,
201,6,208,245,32,81
BE 700 DATA 35,144,228,176,7
,165,245,240,3,32
GM 710 DATA 197,34,32,222,34
,240,37,230,203,208
AK 720 DATA 192,32,213,34,32
,213,34,32,239,35
AM 730 DATA 169,33,160,201,3
2,3,36,165,203,73
FA 740 DATA 128,168,169,0,32
,245,35,169,33,160
IJ 750 DATA 205,76,3,36,96,3
2,79,70,160,32
PO 760 DATA 76,73,83,84,69,6
8,155,240,64,230
HA 770 DATA 242,201,62,240,3
0,170,169,55,224,42
BH 780 DATA 240,7,198,242,32
,131,34,176,5,133
KO 790 DATA 204,76,2,34,32,1
41,34,176,6,105
NJ 800 DATA 61,133,203,16,7,
32,173,34,176,23
AN 810 DATA 133,203,32,246,3
4,32,92,35,176,13
GF 820 DATA 32,10,31,32,222,
34,240,5,32,81
FC 830 DATA 35,144,243,96,24
0,49,32,173,34,176
DN 840 DATA 44,133,203,32,10
9,34,133,245,32,64
EN 850 DATA 35,32,173,34,176
,29,133,246,32,109
BL 860 DATA 34,197,245,208,2
0,32,246,34,32,92
HN 870 DATA 35,176,12,165,24
6,145,138,32,122,34
FA 880 DATA 32,170,35,144,24
4,32,239,35,169,34
GJ 890 DATA 160,85,76,3,36,3
2,67,72,65,78
CB 900 DATA 71,69,68,155,173
,86,31,133,12,173
EF 910 DATA 87,31,133,13,76,
116,228,165,203,41
EC 920 DATA 127,32,22,31,165
,210,74,96,162,224
KF 930 DATA 208,2,162,153,24
6,0,208,2,246,1
HF 940 DATA 96,173,1,31,172,
0,31,162,2,208
AM 950 DATA 8,173,3,31,172,2
,31,162,0,32
NO 960 DATA 4,31,176,12,189,
128,5,201,32,240
BI 970 DATA 6,201,155,240,2,
56,96,134,242,165
EH 980 DATA 175,24,96,165,13
1,164,130,162,0,32
LE 990 DATA 4,31,176,238,32,
154,34,144,5,32
NL 1000 DATA 7,31,144,246,9,
128,96,32,122,34
PM 1010 DATA 32,213,34,32,21
3,34,32,16,31,169
EF 1020 DATA 5,133,205,169,1
55,208,2,169,32,76
BI 1030 DATA 19,31,164,17,20
8,2,198,17,152,96
DA 1040 DATA 32,0,216,176,7,
32,210,217,164,212
AN 1050 DATA 165,213,96,56,1
02,203,169,127,160,2
55
GB 1060 DATA 32,34,35,200,13
2,162,132,163,32,64
DD 1070 DATA 35,201,44,240,1
6,32,230,34,176,24
JL 1080 DATA 132,162,133,163
,32,64,35,201,44,208
NG 1090 DATA 13,230,242,32,2
30,34,176,6,48,4
GM 1100 DATA 133,165,132,164
,165,136,133,138,165
,137
NO 1110 DATA 133,139,96,166,
242,202,232,189,128,
5
LO 1120 DATA 201,32,240,4,20
1,155,208,244,134,24
2
GO 1130 DATA 166,242,189,128
,5,201,32,208,3,232
AK 1140 DATA 208,246,134,242
,201,155,96,24,165,2
07
JC 1150 DATA 101,138,133,138
,144,2,230,139,160,0
EI 1160 DATA 177,138,133,237
,200,177,138,133,238
,56
CB 1170 DATA 165,164,229,237
,165,165,229,238,176
,2
BM 1180 DATA 56,96,200,177,1
38,133,207,165,237,2
29
HI 1190 DATA 162,165,238,229
,163,144,206,200,177
,138
DA 1200 DATA 133,156,200,177
,138,197,204,240,34,
201
MO 1210 DATA 2,144,190,201,5
5,240,186,200,177,13
8
JA 1220 DATA 197,203,240,19,
201,14,240,17,201,15
PN 1230 DATA 240,17,201,22,2
40,167,200,196,156,2
08
DJ 1240 DATA 233,240,211,24,
96,169,6,208,3,200
DC 1250 DATA 177,138,24,200,
132,170,101,170,168,
208
DF 1260 DATA 213,165,203,41,
127,133,175,165,131,
164
PO 1270 DATA 130,162,0,32,13
,31,160,0,177,149
NI 1280 DATA 96,162,1,134,18
1,32,10,36,32,26
MH 1290 DATA 36,169,8,157,74
,3,169,0,157,75
AE 1300 DATA 3,169,3,208,31,
162,153,181,1,180
IE 1310 DATA 0,133,213,132,2
12,32,170,217,32,230
DN 1320 DATA 216,165,244,164
,243,133,150,132,149
,76
NM 1330 DATA 16,31,162,16,16
9,12,157,66,3,32
HE 1340 DATA 86,228,152,16,2
,132,207,96,230,242
HE 1350 DATA 165,242,24,105,
128,168,169,0,105,5
LO 1360 DATA 157,69,3,152,15
7,68,3,96,224,2
PN 1370 DATA 225,2,41,31
```

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MODified Shapes For IBM

Paul W. Carlson

Ever wonder how to use the MOD operator in IBM BASIC? Here's a short explanation of MOD operations that create some stunning graphics displays as well. The programs run on any IBM PC with color/graphics adapter and BASICA or PCjr with Cartridge BASIC.

Though you may never have seen it used, IBM BASIC's MOD operator is a powerful tool for performing certain arithmetic operations. Simply put, MOD gives the integer (whole number) remainder of an integer division. For example, 17 MOD 3 = 2 because 17 divided by 3 equals 5 with a remainder of 2. Likewise, 30 MOD 5 = 0 since 5 divides into 30 evenly with a remainder of zero.

To see some applications of MOD arithmetic, type in, save, and run Programs 1–4 below. Each generates a different geometric display (see photos), using MOD in various ways to simplify the graphics calculations.

Although some dialects of BASIC don't include a MOD operator, the INT function can be used for the same purpose. In Microsoft BASIC, the expression K-INT(K/J)*J gives exactly the same result as the IBM BASIC expression K MOD J. If your computer's BASIC doesn't have MOD but does have a line-drawing command (the Commodore 128 and Atari fall into this category), you may find it interesting to convert the programs to run on your machine.

What Does MOD Do?

One of the most common uses of MOD is to test whether a value is odd or even. The expression X MOD 2 yields a 1 if X is odd, or 0 if X is even. Program 2 uses MOD for this purpose in line 20, branching to line 40 only when the variables I and J are both odd or even.

Another common use of MOD is to make a variable equal to a repeating sequence of consecutive integers. Consider these statements:

```
10 C=0
20 C=C MOD 3+1
30 PRINT C
40 GOTO 20
```

In this case the variable C cycles repeatedly through the series 1-2-3. Program 1 uses MOD in this manner to select the right color for each side of the rotating triangles.

MOD is also useful when arrays must be treated as circular rather than linear. For example, say you have a numeric array X composed of three array elements, and that elements X(1), X(2), and X(3) contain the X coordinates for the vertices (corners) of a triangle. In this case, if X(*m*) is the X coordinate for the beginning of a side, then the expression X(*m* MOD 3+1) gives the X coordinate for the end of that side. This sort of expression appears in Programs 1, 2, and 3, which compute the variable NJ with MOD. The result becomes an index into the arrays containing the vertex coordinates whenever the program needs to know the values for the end of a side.

How The Programs Work

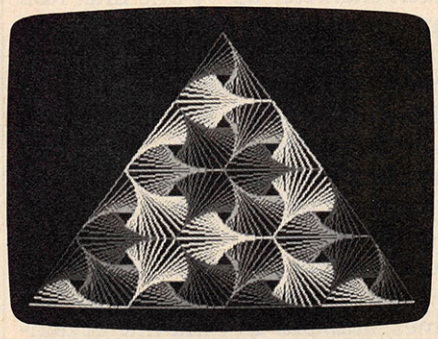
After running the example programs, you may want to know how to produce similar displays of your own. The following explanation applies to Programs 1, 2, and 3, which have been made as similar as possible for comparison purposes.

The variable SU selects the spot on the side of a figure where the figure's corner will land after it is rotated and redrawn. If you're not sure what the last sentence means, try changing SU to a slightly different value and rerunning the program: You'll see exactly what it does. The variables I and J represent the row and column of the figure. The arrays X and Y contain the relative vertex coordinates for the current rotation. The arrays XD and YD contain relative vertex coordinates for the next rotation. N is the current rotation, M is the current side of a polygon, and NJ performs the function described above.

Here is a line-by-line description of the various sections in each program:

Lines 10–50	Loop through J columns and I rows. Skip over some combinations of I and J (Programs 1 and 3). Change values in the Y array to plot some polygons upside-down (Programs 1 and 2).
Line 60	Loop through N rotations. Compute the absolute coordinates of the first vertex.
Line 70	Loop through M sides. Compute the absolute coordinates for the next vertex.
Line 80	Plot the side. Make the absolute coordinates of the beginning of the next side equal to the absolute end coordinates of the side just plotted.
Line 90	Compute the relative coordinates of the vertex that fall on this side in the next rotation.
Line 100	Move the values from the array of relative coordinates for the next rotation into the array of relative coordinates for the current rotation.

Program 4 works somewhat differently from the other three programs. After saving and running this program, remove the statement C=1 from line 50 and run it again. This time the colors take on a spiral pattern. Can you explain why? (Hint: Ten areas are painted with three colors each time through the FOR A=10 TO 360 loop, and 10 MOD 3 = 1.)

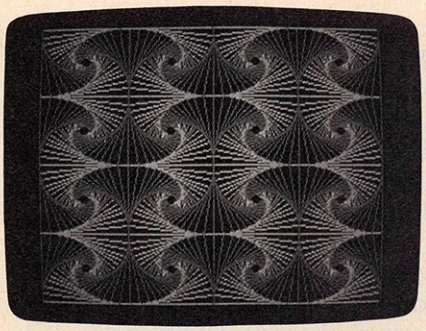


"MODified Shapes For IBM" shows how to easily generate complex graphics displays like this.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

Program 1

```
DK 10 SU=.1:RU=1-SU:KEY OFF:SCRE
      EN 1:COLOR 0,1:II=1:C=1
FO 20 FOR J=0 TO 3:II=-II:JJ=1:F
      OR I=0 TO 6:JJ=-JJ:IF I<J
      OR I>6-J THEN 110
EB 30 IF J<2 OR I>2 THEN C=C MOD
      3+1
FP 40 IF J=3 THEN C=C MOD 3+1
GI 50 X(1)=0:X(2)=39:X(3)=78:Y(1
      )=0:Y(3)=0:IF II=JJ THEN Y
      (2)=48 ELSE Y(2)=-48
EO 60 FOR N=1 TO 11:X1=3+X(3)+I*
      39:Y1=175-Y(3)-J*48+II*JJ*
      24
DL 70 FOR M=1 TO 3:X2=3+X(M)+I*3
      9:Y2=175-Y(M)-J*48+II*JJ*2
      4:C=C MOD 3+1
FD 80 LINE(X1,Y1)-(X2,Y2),C:X1=X
      2:Y1=Y2:NJ=M MOD 3+1
FK 90 XD(M)=RU*X(M)+SU*X(NJ):YD(
      M)=RU*Y(M)+SU*Y(NJ):NEXT M
KB 100 FOR P=1 TO 3:X(P)=XD(P):Y
       (P)=YD(P):NEXT P,N
CF 110 NEXT I,J
PP 120 IF INKEY$="" THEN 120 ELS
       E CLS:SCREEN 0:WIDTH 80:K
       EY ON:END
```



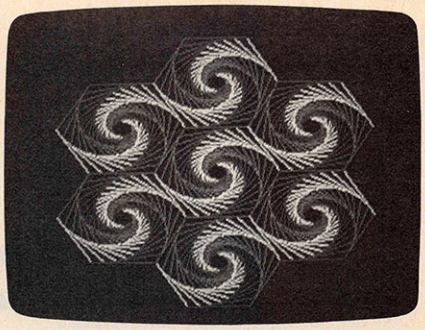
The MOD operator simplifies the calculations needed to produce this display.

Program 2

```
LG 10 SU=.12:RU=1-SU:KEY OFF:CLS
      :SCREEN 1:COLOR 0,1
MI 20 FOR I=0 TO 3:FOR J=0 TO 3:
      IF I MOD 2=J MOD 2 THEN 40
ME 30 Y(1)=49:Y(2)=0:Y(3)=0:Y(4)
      =49:GOTO 50
IE 40 Y(1)=0:Y(2)=49:Y(3)=49:Y(4
      )=0
HH 50 X(1)=20:X(2)=20:X(3)=89:X(
      4)=89
FO 60 FOR N=0 TO 18:X1=X(4)+I*69
      :Y1=Y(4)+J*49
PL 70 FOR M=1 TO 4:X2=X(M)+I*69:
      Y2=Y(M)+J*49
BK 80 LINE(X1,Y1)-(X2,Y2),M MOD
      2+1:X1=X2:Y1=Y2:NJ=M MOD 4
      +1
FK 90 XD(M)=RU*X(M)+SU*X(NJ):YD(
      M)=RU*Y(M)+SU*Y(NJ):NEXT M
EQ 100 FOR P=1 TO 4:X(P)=XD(P):Y
       (P)=YD(P):NEXT P,N,J,I
EP 110 IF INKEY$="" THEN 110 ELS
       E CLS:SCREEN 0:WIDTH 80:E
       ND
```

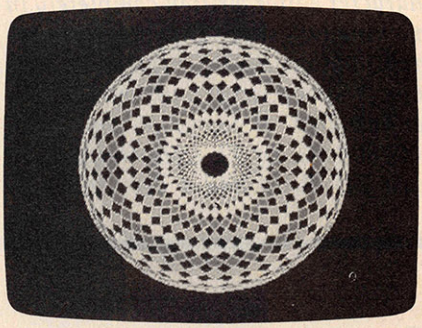
Program 3

```
PN 10 SU=.2:RU=1-SU:KEY OFF:CLS:
      SCREEN 1:COLOR 0,1
HF 20 FOR J=0 TO 2:FOR I=0 TO 2:
      IF J=0 AND I<>1 THEN 110
ML 30 IF I=1 THEN E=31 ELSE E=0
```



This screen is produced with only a dozen program lines.

```
DA 40 X(1)=0:X(2)=25:X(3)=75:X(4
      )=100:X(5)=75:X(6)=25
KB 50 Y(1)=31:Y(2)=0:Y(3)=0:Y(4)
      =31:Y(5)=62:Y(6)=62
CG 60 FOR N=0 TO 20:X1=35+X(6)+I
      *75:Y1=223-Y(6)-J*62-E
AC 70 FOR M=1 TO 6:X2=35+X(M)+I*
      75:Y2=223-Y(M)-J*62-E
JG 80 LINE(X1,Y1)-(X2,Y2),M MOD
      3+1:X1=X2:Y1=Y2:NJ=M MOD 6
      +1
FK 90 XD(M)=RU*X(M)+SU*X(NJ):YD(
      M)=RU*Y(M)+SU*Y(NJ):NEXT M
NB 100 FOR P=1 TO 6:X(P)=XD(P):Y
       (P)=YD(P):NEXT P,N
CF 110 NEXT I,J
PP 120 IF INKEY$="" THEN 120 ELS
       E CLS:SCREEN 0:WIDTH 80:K
       EY ON:END
```



A multicolored screen display with help from MOD.

Program 4

```
MK 10 KEY OFF:CLS:SCREEN 1:COLOR
      0,0:FOR K=0 TO 9:READ F(K
      ):NEXT
DL 20 FOR A=10 TO 360 STEP 10
NG 30 X=160+48*COS(A*.017453):Y=
      100+40*SIN(A*.017453)
QM 40 CIRCLE(X,Y),60:NEXT
OI 50 FOR A=10 TO 360 STEP 10:C=
      1:FOR K=0 TO 9:C=C MOD 3+1
FD 60 X=160+1.2*F(K)*COS(A*.0174
      53):Y=100+F(K)*SIN(A*.0174
      53)
PJ 70 PAINT(X,Y),C,3:NEXT K,A
NI 80 IF INKEY$="" THEN 80 ELSE
      CLS:SCREEN 0:WIDTH 80:KEY
      ON:END
KI 90 DATA 26,34,41,51,61,68,78,
      84,87,89
```

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Custom Characters For Atari *SpeedScript*

Charles Brannon, Program Editor

Atari SpeedScript's *large-sized character set with true descenders is designed for maximum readability. Since it is built into* SpeedScript, *though, it's difficult to change. Now, with the accompanying program, you can add your own custom font to* SpeedScript—*even special characters for foreign languages. To help you design your own sets, last month we published "Atari FontMaker," a versatile character editor written completely in machine language. This month's program automatically creates a new copy of* SpeedScript *with your custom set installed. It works on any Atari 400/800, XL, or XE computer with at least 24K RAM and a disk drive.*

When you're writing, you probably don't think about the technical miracles that make word processing possible. The characters on the screen seem as fixed as those on paper, but they're actually displayed from a section of memory. If you can change this memory, you can change the shape, form, and order of the characters.

Normally, the Atari's character set is permanently and unalterably stored in Read Only Memory (ROM). But you can tell the video chip to look elsewhere for the character patterns, so it's possible to substitute your own set. Atari *SpeedScript* uses just such a technique, coupled with a special Atari character mode, to display large, well-formed characters.

One way to design your own characters is to sketch them on grid paper, convert the resulting binary patterns into numbers, and then substitute these numbers in the section of *SpeedScript* that modifies the character set.

Fortunately, there's an easier way. You can use a character set editor (or *font* editor) to "draw" the desired characters with a joystick. The font editor converts the patterns into numbers for you and saves the new set on disk for later use. There are many font editors available for the Atari, but relatively few of them let you design characters for the unusual ANTIC 3 mode that *SpeedScript* uses. This mode displays a taller character grid so you can design characters with true *descenders* (the protruding tails on letters such as j and y).

Last month's COMPUTE! introduced "Atari FontMaker," a full-featured font editor written completely in machine language. FontMaker lets you design custom fonts for all Atari character modes, including ANTIC mode 3. The FontMaker article included some instructions for creating *SpeedScript* ANTIC 3 characters, and also some tips for designing more readable characters. After designing a new character set with FontMaker, you can use Program 1, "*SpeedScript* Characterizer," to automatically create a new copy of *SpeedScript* with your custom font. The custom characters appear each time you load the modified copy of *SpeedScript*.

Making A *SpeedScript* Font

If you want to convert a normal character set for use with *SpeedScript* (perhaps one that you've designed with another font editor), start by loading the set into FontMaker. Press G to switch to the ANTIC 3 mode. (The G command cycles through the graphics modes, and the first mode after the default GRAPHICS 0 mode is ANTIC 3.) You'll recognize this mode because the normal characters appear split, with their lower portions shifted to the top of the character grid.

Use FontMaker's *roll up* command (CTRL-cursor up) to move each character up by one line. Roll up automatically wraps the lowercase descenders. If you want to make two-line descenders such as those found in the *SpeedScript* font, roll the lowercase letters up by two notches, erasing the last line of any characters that intrude into the descender zone, such as the lowercase h. Then *shift up* (SHIFT-cursor up) all the uppercase characters by two lines, and add an extra line of definition to each character so they have the same baseline as the lowercase characters. As you work, refer to the "quick brown fox" sentence displayed by FontMaker to see how your characters match up. When you're done, save your new font on disk with the S (Save) command.

One additional preparatory step is required if your copy of *SpeedScript* came from the May 1985

COMPUTE! DISK. A version of *SpeedScript* typed in and saved with MLX (or from the companion disk for the book *SpeedScript: The Word Processor for Atari Computers*) appears on disk as one continuous block and requires no special preparation. The COMPUTE! DISK version is stored in an alternative format—as a collection of linked segments. (For a discussion of the differences between these formats, see Bill Wilkinson's "Insight: Atari" column in the April 1986 issue.) This causes a problem because Program 1 expects to load *SpeedScript* as a continuous file.

The solution is to use Program 2, a corrected version of the file unification program from the April "Insight" column, to convert the linked segment file into a continuous block file. If you're unsure about the origin of your copy of *SpeedScript*, it won't hurt to process it with the file unifier program anyway. If the file was already a continuous block, Program 2 just produces a duplicate copy. (One way to tell the difference: In DOS 2.0 format the desired continuous block version of *SpeedScript* is 67 blocks long, while the linked segment version requiring conversion is 66 blocks long.)

Now you're ready to merge your redefined character set with *SpeedScript*. Type in and save the *SpeedScript* Characterizer (Program 1) below. After you run it, insert the disk containing your copy of *SpeedScript* (the unified copy produced by Program 2 if you have the COMPUTE! DISK version) and type in the filename you use for *SpeedScript* (AUTORUN.SYS, for example). Characterizer loads *SpeedScript* into a memory buffer.

Next, insert the disk containing your character set and enter its filename. After this character set is loaded, insert the disk that will store the new copy of *SpeedScript*. Type in the filename you'd like to call it. (For safety's sake, be very careful not to replace your existing copy of *SpeedScript*. If you have to name *SpeedScript* as AUTORUN.SYS to run it with Atari DOS 2.0 or 2.5, use another disk or rename the original copy of *SpeedScript* something else before you try to use Program 1.)

Finally, boot up the new *SpeedScript* and behold your custom character set. Try typing all the characters to make sure they are well-formed. If you made a mistake, you can always edit the character set and reinstall it.

Keep in mind that *SpeedScript* uses the heart character to pad out the end of each line with spaces. If you don't want to see a screenful of hearts, make sure you've blanked out the heart character in your set. Also, *SpeedScript* normally uses the left arrow (cursor-left) for the return mark at the end of each paragraph, so you may want to change this to some personalized symbol. If you don't want to see return marks, blank out this character, or perhaps change it to a single tiny dot so you can easily delete what would otherwise be an invisible character.

Program 1: *SpeedScript* Characterizer

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
JK 10  OPEN #3,4,0,"K:"
LG 15  DIM CIO$(7):CIO$="hhh*
       LV":CIO$(4,4)=CHR$(170
       ):CIO$(7)=CHR$(228)
AL 100 DIM SF$(14),T$(40),SS
       $(10000),CS$(14)
CJ 110 GRAPHICS 17:POKE 82,0
       :SETCOLOR 4,0,10:SETC
       OLOR 2,0,2:SETCOLOR 0
       ,3,4:SETCOLOR 1,5,14
LJ 120 ? #6;"{SPEEDSCRIPT 3.0
       ":? #6;"{CHARACTERIZER
       "
IK 130 POKE 87,0:? "{ENTER SP
       EEDSCRIPT(3 SPACES)FI
       LENAME:}"
AN 140 INPUT SF$:IF SF$="" T
       HEN RUN
FM 150 IF LEN(SF$)>2 THEN IF
        SF$(2,2)=":" OR SF$(
       3,3)=":" THEN 170
CP 160 T$=SF$:SF$="D:":SF$(3
       )=T$
EA 170 TRAP 180:OPEN #2,4,0,
       SF$:TRAP 40000:GOTO 1
       90
OE 180 ? "error trying to op
       en":? SF$:? "PRESS {RE
       TURN}":GET #3,A:RUN
IC 190 LET READ=1:X=32:SADR=
       ADR(SS$):MAXLEN=9999:
       GOSUB 970:SS$(TRUELEN
       )=CHR$(0):CLOSE #2
LC 200 ? CHR$(125);"{ENTER NA
       ME OF}":? "{CHARACTER S
       ET:}"
KC 210 INPUT CS$:IF CS$="" T
       HEN 200
EP 220 IF LEN(CS$)>2 THEN IF
        CS$(2,2)=":" OR CS$(
       3,3)=":" THEN 240
CE 230 T$=CS$:CS$="D:":CS$(3
       )=T$
DH 240 TRAP 250:OPEN #2,4,0,
       CS$:TRAP 40000:GOTO 2
       60
NP 250 ? CHR$(125);"error tr
       ying to open":? CS$:?
        "PRESS {RETURN}":GET #
       3,A:CLOSE #2:GOTO 200
PF 260 LET READ=1:X=32:MAXLE
       N=1024:SADR=ADR(SS$)+
       262:GOSUB 970:CLOSE #
       2
PN 270 ? CHR$(125);
JO 280 ? "{ENTER NEW NAME}":?
       "{FOR SPEEDSCRIPT.}"
LA 290 INPUT SF$:IF SF$="" T
       HEN 200
FG 300 IF LEN(SF$)>2 THEN IF
        SF$(2,2)=":" OR SF$(
       3,3)=":" THEN 320
CM 310 T$=SF$:SF$="D:":SF$(3
       )=T$
DG 320 TRAP 335:OPEN #2,8,0,
       SF$:TRAP 40000
GF 330 LET READ=0:X=32:MAXLE
       N=LEN(SS$):SADR=ADR(S
       S$):GOSUB 970:GOTO 34
       0
AL 335 IF PEEK(195)<>1 THEN
       ? CHR$(125);"{CAN'T WR
       ITE FILE}":CLOSE #2:GO
       TO 280
FP 340 POKE 82,2:GRAPHICS 0:
       ? "Good luck!"
GP 350 END
IN 899 GOTO 899
MB 970 REM {CIO Load/Save Fil
       e:#2 opened. READ=0 fo
       r write, READ=1 for r
       ead}
AM 980 REM File#2,$20
EF 990 ICCOM=834:ICBADR=836:
       ICBLEN=840:ICSTAT=835
AL 1000 H=INT(SADR/256):L=SA
       DR-H*256:POKE ICBADR
       +X,L:POKE ICBADR+X+1
       ,H
FC 1010 H=INT(MAXLEN/256):L=
       MAXLEN-H*256:POKE IC
       BLEN+X,L:POKE ICBLEN
       +X+1,H
MD 1020 POKE ICCOM+X,11-4*RE
       AD:A=USR(ADR(CIO$),X
       )
BK 1025 TRUELEN=PEEK(ICBLEN+
       X)+256*PEEK(ICBLEN+X
       +1)+1
BG 1030 POKE 195,PEEK(ICSTAT
       ):RETURN
```

Program 2: File Unifier

Program by Bill Wilkinson

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
EE 1000 REM ** BINARY FILE U
        NIFIER **
DF 1010 BUFSIZE=FRE(0)-300
AH 1020 DIM BUF$(BUFSIZE)
IF 1030 DIM FILEOLD$(40),FIL
        ENEW$(40)
FJ 1040 FILL=0
NO 1050 PRINT "I need two fi
        le names: An existin
        g"
EA 1060 PRINT "  object file
         and a new file whic
        h"
EE 1070 PRINT "  will get th
        e 'unified' object c
        ode."
FG 1080 PRINT
AA 1090 PRINT "Existing file
        ? ";
```

```
CL 1100  INPUT #16,FILEOLD$
NI 1110  PRINT "{5 SPACES}New
          file? ";
DI 1120  INPUT #16,FILENEW$
FG 1130  OPEN #1,4,0,FILEOLD$
NP 1140  GET #1,HDR1:GET #1,H
         DR2
PD 1150  IF HDR1=255 AND HDR2
         =255 THEN 1180
PF 1160  PRINT :PRINT "Existi
         ng file: invalid for
         mat"
KA 1170  END
GL 1180  OPEN #2,8,0,FILENEW$
BI 1190  PUT #2,HDR1:PUT #2,H
         DR2
IN 1200  GET #1,SEGLOW:GET #1
         ,SEGHIGH
BC 1205  REM ** Process a new
          origin
AE 1210  BUFPTR=0
OI 1220  BUF$=CHR$(0):BUF$(BU
         FSIZE)=CHR$(0)
GL 1230  BUF$(2)=BUF$:REM zap
          buffer
MF 1240  PUT #2,SEGLOW:PUT #2
         ,SEGHIGH
DE 1250  SEGSTART=SEGLOW+256*
         SEGHIGH
DI 1255  REM ** Process a seg
         ment
ID 1260  GET #1,ENDLOW:GET #1
         ,ENDHIGH
GP 1270  SEGEND=ENDLOW+256*EN
         DHIGH
HC 1280  SEGLEN=SEGEND-SEGSTA
         RT+1
HI 1290  FOR PTR=1 TO SEGLEN
JL 1300  GET #1,BYTE:BUF$(BUF
         PTR+PTR)=CHR$(BYTE)
PK 1310  NEXT PTR
ML 1320  TRAP 1490
JB 1330  GET #1,SEGLOW:GET #1
         ,SEGHIGH
PD 1340  TRAP 40000
KB 1350  IF SEGLOW=255 AND SE
         GHIGH=255 THEN GET #
         1,SEGLOW:GET #1,SEGH
         IGH
DG 1360  SEGSTART=SEGLOW+256*
         SEGHIGH
IO 1370  GAP=SEGSTART-SEGEND-
         1
HD 1380  IF GAP>FILL OR GAP<0
          THEN 1420
JM 1390  BUFPTR=BUFPTR+SEGLEN
         +GAP
DL 1400  IF BUFPTR+256>BUFSIZ
         E THEN 1420
MI 1410  GOTO 1260
BA 1420  GOSUB 1440
MF 1430  GOTO 1210
BF 1435  REM ** Dump buffer
LH 1440  PUT #2,ENDLOW:PUT #2
         ,ENDHIGH
OJ 1450  FOR PTR=1 TO LEN(BUF
         $)
LF 1460  PUT #2,ASC(BUF$(PTR)
         )
AB 1470  NEXT PTR
KN 1480  RETURN
LA 1485  REM ** Error encount
         ered
EA 1490  IF PEEK(195)=136 THE
         N 1520
NL 1500  PRINT "Unexpected er
         ror, number ";PEEK(1
         95)
JO 1510  END
JA 1515  REM ** End of file
CM 1520  GOSUB 1440:REM write
          out buffer
KA 1530  END                  ©
```

64 Autobooter

Terry Roper

Now you can throw away your list of start-up SYS addresses for different machine language programs. Using a unique loading method, this clever utility lets you transform a BASIC or machine language program into an autobooting *program that runs as soon as it loads—no matter where it normally loads into memory. In addition, the autobooting program can survive many system crashes that would destroy a conventionally loaded program. A disk drive is required.*

"64 Autobooter" can add autobooting—the ability to run automatically after loading—to many different BASIC and machine language programs. While you may be familiar with other autoboot utilities, the most common techniques have significant drawbacks: Either they require a separate boot file to load and run the main program, or they increase the size of your program significantly. But Autobooter programs don't suffer from either problem. The autobooting file is all in one piece and is only 257 bytes longer than the original program. Even better, Autobooter programs can survive unscathed in situations that would erase or scramble programs loaded the normal way.

Creating Autoboot Files

Type in 64 Autobooter and save a copy before you run it. Using the program is just a matter of responding to a few prompts. First, you type a filename for the program you wish to convert. This file may be any program file on disk, but it may not exceed 7,935 bytes in length (more on this later). As a rough guide, 7,935 bytes take up about 31 blocks on the disk directory.

After you supply the filename, the disk drive makes two passes through the program file. The first pass counts every byte of the file to make sure that it's within the 7,935-byte limit and calculates the load address for the new Autobooter version. The second pass stores the file in memory. When the drive stops, you are asked whether the program is BASIC or machine language (ML). If the program is all BASIC (or it begins with a BASIC line like SYS 2061), type B to choose BASIC. If it is an ML program that loads at some address *other than* the start of BASIC, enter the normal SYS address when prompted.

Finally, you'll be prompted to enter a filename for the new autobooting file. At this point, the program writes the autobooting file back to disk, using the last filename you specified. The new file consists of a copy of the original file plus 257 bytes (about one disk block) of machine language. This one-block addition is the only penalty you pay for the convenience of using Autobooter files.

When this process is complete, the new file is ready to use. An autobooting file is a self-sufficient, autobooting version of the original, but with some unusual differences. The most unusual fact is that all Autobooter files share exactly the same ending address, even though nearly all of them have different load addresses. And loading ML files with the Autobooter method does not disturb the computer's start-of-variables pointer at locations 45–46 ($2D–2E). So you can load an ML program with the assurance that any BASIC program previously in memory will still run and save correctly.

An Impressive Demonstration

Here's a short demonstration that shows how useful 64 Autobooter can be. Choose a BASIC program that you would like to convert to Autobooter form. It can be any program, as long as the original file contains fewer than 7,935 bytes.

Follow the procedure for converting the program to Autobooter format, then perform these steps:

1. Type NEW.

2. Type LOAD "FILENAME",8,1 (replace FILENAME with the filename of your autobooting file). The program should load and run automatically; if it doesn't, reload 64 Autobooter and check for typing errors.

3. When you're satisfied that your program is running as usual, stop the program by pressing RUN/STOP (or RUN/STOP–RESTORE if necessary).

4. Now it's time to get tough. Type NEW, then LIST to confirm that the program is gone. Type POKE 1,0 and press RETURN. The program should be running once again, even though that POKE is one that normally locks up the computer.

5. Press RUN/STOP to stop the program, then load any other BASIC program into memory. This ensures that the first program is completely overwritten by new data.

6. Type POKE 1,0 and press RETURN. Immediately, the autobooted program reappears in memory and begins to run. You should be able to VERIFY at this point with normal results.

What's going on here? For one thing, you've seen how durable these files can be. Even after you destroy the program in its normal location, you can resurrect it instantly with POKE 1,0. Another advantage is that you no longer need to memorize different SYS addresses for every machine language program. Regardless of where an Autobooter program normally loads, whether it's BASIC or ML, you can restart it with POKE 1,0.

It's not hard to see how this would come in handy. For instance, suppose you're using a BASIC program. Suddenly, the need arises to run a program that occupies the same memory area. If the original program is in Autobooter format, this presents no problem at all. Load the second program and run it as usual. When you're finished, type POKE 1,0 to restore the autobooted program.

A second advantage has to do with loading ML files. Under ordinary circumstances, loading an ML program into high memory after loading a BASIC program can cause an OUT OF MEMORY error when you try to run the BASIC program. If the ML program is an Autobooter file, you'll avoid this error.

Wraparound Addressing

By now you might be wondering how these unusual features are possible. We mentioned earlier that Autobooter files may not exceed 7,935 bytes in length. This is necessary for two reasons. The 257-byte ML program attached to your original file must always load into memory beginning at location $FF00 (65280). The rest of your original file comes into memory directly below the ML code in the area from $E000–$FEFF (57344–65279). As you may know, loading a program into this zone causes it to be stored in the RAM underlying the Kernal ROM chip.

Why is it so crucial to load the last 257 bytes at $FF00? If you're paying close attention, you may have noticed that 257 plus $FF00 equals more than 65535, the highest address that the 64's microprocessor can refer to. After you load the byte that goes into location $FFFF, there are still two bytes to load. Since it's impossible to use a higher address, the computer wraps around to the bottom of its addressing range and loads the last two bytes into addresses $00 and $01.

Loading a file in this wraparound fashion has two important consequences. It allows you to change the contents of the 64's on-chip I/O port (location 1) as well as the vector to its main IRQ handler ($FFFE–$FFFF). Let's look at location 1 first. The chief function of location 1 is to control whether the 64 "sees" ROM and I/O chips or the underlying RAM at memory locations above $A000 (40960). Under normal circumstances, the computer sees BASIC ROM at locations $A000–BFFF, I/O chips at locations $D000–DFFF, and the Kernal ROM at locations $E000–FFFF. When you load an Autobooter file into memory, it loads the value $35 into location 1, switching out the ROM in locations $E000–$FFFF and exposing the underlying RAM.

Once the ROM is switched out, the microprocessor can see the rest of the Autobooter file that was just loaded. Among other things, this file loaded new information into locations $FFFE–$FFFF. This pair of locations contains a *vector*, or two-byte address, which points to the 64's main IRQ/BRK handler routine in ROM. Sixty times every second, and whenever the computer encounters a BRK instruction, the computer jumps to the address pointed to by this vector. Autobooter files replace the normal vector with a new one that points to the new ML that we just loaded into underlying RAM.

The rest of the ML program moves the autobooted program to its normal load address, switches ROM back in (by putting a value of $37 in location 1), and runs the program as usual. (Incidentally, the Commodore 128 normally has a value of $77 in location 1 while it's in 64 mode. This has no effect on Autobooter files, but does prevent certain commercial programs from working properly. Pressing CAPS LOCK restores the normal value of $37, which fixes the problem in at least some of the cases.)

Mysterious VERIFY Errors

Although the computer normally resets the computer's start-of-variables pointer after every load, 64 Autobooter does this job on its own. If the program is ML which doesn't load at the start of BASIC, the start-of-variables pointer is not changed. This lets you load ML programs without disturbing any BASIC program in memory. If the Autobooter file is BASIC, the pointer is set to the end of the program text as usual.

Some Autobooter files may give you mysterious VERIFY errors. Don't panic—it's not uncommon for ML programs to alter themselves once run. Naturally, a file that's been modified isn't the same as the original file on disk. If a BASIC program was saved from an abnormal location it won't VERIFY either; this is due to the relinking process that occurs after every BASIC program is loaded. A good method for initial testing of ML files is to create them as usual but enter 42100 instead of the normal SYS address. This returns you to BASIC

without starting your program; the file should VERIFY correctly.

Here's a subtle bug to look out for. Suppose you have the following program:

```
100 A0 = 828: POKE AO, 0
```

This defines the variable A0, but not the variable AO (with the letter O instead of a zero). Since undefined numeric variables always equal zero, the POKE is directed to location 0, the data direction register for location $01. If you run this program and then try to start an autobooting program with POKE 1,0, it fails because the new bit pattern at location 0 prevents any new value from being stored in location 1. Hit RUN/STOP–RESTORE to fix both locations, then try again.

As a matter of fact, it doesn't hurt to hit RUN/STOP–RESTORE before activating any autobooting program. Many ML programs change the IRQ vector at locations $0314–$0315. If you try to activate an Autobooter file under these conditions, the computer will probably crash as soon as the interrupt is reenabled.

Finally, while some cartridges don't interfere with Autobooter files, others cause erratic behavior. Cartridges can reconfigure the computer in many different ways, so you'll have to find out by trial and error whether a particular Autobooter file works with a given cartridge.

64 Autobooter

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
BC 100 POKE 55,0:POKE 56,48:CL
       R
HR 110 PRINT:PRINT "AUTO BOOTM
       AKER":IFPEEK(24591)=164
        THEN150
GP 120 PRINT:PRINT"JUST A MOME
       NT..."
DE 130 FOR J=12288 TO 12744:RE
       AD D:S=S+D:POKE J,D:NEX
       T
JE 140 IF S<>51414 THEN PRINT:
       PRINT"MISTYPED DATA":EN
       D
GF 150 OPEN 15,8,15:SYS 12288
GX 160 PRINT:PRINT"FILE FOR AU
       TO BOOTMAKER";
SJ 170 GOSUB370:PRINT:PRINT"ME
       ASURING YOUR FILE"
AJ 180 OPEN 5,8,5,"0:"+N$+",P,
       R":GOSUB350:IF E1$<>"00
       " THEN160
CR 190 SYS 24834:CLOSE 5:B=PEE
       K(24578)+256*PEEK(24579
       ):PRINT B;"BYTES"
AG 200 IF B>7935 THEN PRINT CH
       R$(18);STR$(B-7935)"
       {2 SPACES}BYTE OVERFLOW
        ":GOTO160
CR 210 PRINT:PRINT"READING FIL
       E INTO MEMORY"
PF 220 OPEN 5,8,5,"0:"+N$+",P,
       R":SYS24834:CLOSE 5
BH 230 FOR J=0 TO 31:POKE24592
       +J,PEEK(24112+J):POKE24
       624+J,PEEK(22032+J)
HH 240 POKE 22032+J,0:NEXT
CE 250 PRINT:PRINT"BASIC OR ML
        (B/M)";:GOSUB370
QR 260 IF N$="B" THEN POKE 245
       82,1:POKE 24583,8:GOTO3
       00
EH 270 POKE 24587,1:PRINT:PRIN
       T" JUMP TO ADDRESS";:GO
       SUB370
JG 280 H%=(VAL(N$)-1)/256:L%=(
       VAL(N$)-1)-H%*256
FR 290 POKE 24588,L%:POKE 2458
       9,H%
BF 300 PRINT:PRINT"PREPARING T
       O WRITE NEW FILE"
XK 310 PRINT"INSERT ANOTHER DI
       SK IF DESIRED"
SA 320 PRINT:PRINT"NEW FILENAM
       E";:GOSUB370:PRINT#15,"
       I0"
PE 330 OPEN 5,8,5,"0:"+N$+",P,
       W":GOSUB350:IF E1$<>"00
       "THEN300
JF 340 SYS 24950:CLOSE5:CLOSE1
       5:END
PP 350 INPUT#15,E1$,E2$,E3$,E4
       $:IF E1$="00"THENRETURN
MP 360 PRINT CHR$(18);E1$","E2
       $","E3$","E4$:CLOSE5:RE
       TURN
MC 370 T=POS(T)
FF 380 FORJ=0TO25:WAIT 197,64:
       NEXT:POKE 198,0:PRINT T
       AB(T)
AJ 390 N$="":INPUT N$:IF N$=""
       THENPRINT:PRINT:PRINT:G
       OTO380
AS 400 RETURN
KS 410 DATA 162,0,189,18,48,15
       7,0,96
BG 420 DATA 189,18,49,157,0,97
       ,232,208
XK 430 DATA 241,96,0,0,0,0,0,0
CK 440 DATA 0,0,4,93,255,0,227
       ,167
KB 450 DATA 115,164,0,0,0,0,0,
       0
RM 460 DATA 0,0,0,0,0,0,0,0
KK 470 DATA 0,0,0,0,0,0,0,0
FJ 480 DATA 0,0,0,0,0,0,0,0
BX 490 DATA 0,0,0,0,0,0,0,0
JJ 500 DATA 0,0,0,0,0,0,0,0
EX 510 DATA 0,0,0,0,0,0,0,0
AS 520 DATA 0,0,0,0,0,0,0,0
DX 530 DATA 0,0,162,250,154,16
       2,7,189
KH 540 DATA 8,255,72,202,16,24
       9,64,162
MG 550 DATA 47,224,32,176,12,1
       89,16,255
KJ 560 DATA 157,48,253,189,48,
       255,157,16
MM 570 DATA 245,189,196,255,15
       7,0,2,202
KQ 580 DATA 16,231,173,11,255,
       208,14,173
CC 590 DATA 2,255,105,1,133,45
       ,173,3
HG 600 DATA 255,105,8,133,46,1
       74,4,255
XG 610 DATA 172,5,255,134,251,
       132,252,174
KD 620 DATA 6,255,172,7,255,13
       4,253,132
GM 630 DATA 254,160,0,174,3,25
       5,240,14
PX 640 DATA 177,251,145,253,20
       0,208,249,230
SQ 650 DATA 252,230,254,202,20
       8,242,174,2
EE 660 DATA 255,240,8,177,251,
       145,253,200
CF 670 DATA 202,208,248,76,0,2
       ,169,55
CM 680 DATA 133,1,88,169,0,32,
       189,255
JG 690 DATA 169,15,168,162,8,3
       2,186,255
CQ 700 DATA 32,192,255,169,15,
       32,195,255
CG 710 DATA 104,208,11,32,51,1
       65,162,44
DA 720 DATA 160,2,134,122,132,
       123,169,13
PC 730 DATA 76,210,255,138,0,0
       ,0,0
RH 740 DATA 0,0,0,0,92,255,92,
       255
KR 750 DATA 80,255,47,53,173,1
       78,97,73
XG 760 DATA 255,141,178,97,174
       ,179,97,172
PC 770 DATA 180,97,134,251,132
       ,252,162,5
PB 780 DATA 32,198,255,32,228,
       255,141,6
ME 790 DATA 96,32,228,255,141,
       7,96,160
GF 800 DATA 0,32,228,255,44,17
       8,97,48
JK 810 DATA 7,145,251,44,178,9
       7,16,22
XM 820 DATA 238,2,96,208,3,238
       ,3,96
QA 830 DATA 56,173,179,97,233,
       1,141,179
PR 840 DATA 97,176,3,206,180,9
       7,32,183
EF 850 DATA 255,41,64,208,8,20
       0,208,209
PB 860 DATA 230,252,76,37,97,1
       73,178,97
RQ 870 DATA 240,19,56,173,181,
       97,237,2
DM 880 DATA 96,141,4,96,173,18
       2,97,237
DF 890 DATA 3,96,141,5,96,76,2
       04,255
JQ 900 DATA 56,169,0,237,2,96,
       133,251
HD 910 DATA 169,96,237,3,96,13
       3,252,162
BA 920 DATA 5,32,201,255,173,4
       ,96,32
KA 930 DATA 210,255,173,5,96,3
       2,210,255
MG 940 DATA 160,0,177,251,32,2
       10,255,230
GM 950 DATA 251,208,2,230,252,
       165,252,201
QG 960 DATA 97,208,239,165,251
       ,201,2,208
SX 970 DATA 233,76,204,255,0,0
       ,96,0
AP 980 DATA 255
```

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Upgrading The Apple ESCape Key

Robert Jacques Beck

With this short routine, you can reprogram the Apple's ESCape key (or any other key) to perform a variety of special functions within Applesoft BASIC. It works with any Apple II-series computer using Applesoft BASIC and DOS 3.2, DOS 3.3, or ProDOS.

Have you ever wished you could detect special escape codes in Applesoft BASIC? For instance, say that you have an Applesoft program that uses INPUT to ask you for a disk filename. In many cases, it would be handy to view the disk catalog before entering the filename. But that's impossible under normal circumstances—you can't type a CATALOG command while the computer's waiting for a response to INPUT.

"ESCape Key Upgrade," listed below, lets you add a special escape key function to display the catalog automatically whenever you press ESCape. With a little extra programming, you can use the same routine to give special meaning to any other key or keypress sequence on your Apple II computer.

Hit ESC For A CATALOG

Type in and save Program 1, then run it for a demonstration. The first ten lines install and activate a short machine language routine; line 110 performs an ordinary INPUT command. When the INPUT prompt appears, press ESC. The computer immediately displays a disk catalog, just as if you'd stepped outside program mode for a moment and typed CATALOG in immediate mode. Of course, you're not limited to a catalog display; by substituting different commands after the THEN statement in line 120, you can perform other commands, branch to a subroutine, or do whatever else you like.

The ESC key is ideally suited for this purpose, since it's located near the upper-left corner of the keyboard and is rarely used except for editing. Program 1 checks ESC after an INPUT statement, but this technique works just as well after any GET statement. If you want a program to respond to ESC more quickly, you needn't wait for an INPUT or GET. Try the technique known as *polling* (periodically testing) the keyboard. For instance, your program might call the following subroutine at regular intervals:

```
900 IF PEEK (-16384) < 128 TH
    EN RETURN: REM RETURN IF
    NO KEY WAS PRESSED
910 POKE -16368,0
920 IF PEEK (-16384) = 27 THE
    N PRINT CHR$(4) "CATALOG"
930 RETURN
```

The first line of this routine checks whether a key has been pressed since the last keyboard check was made. Only if the answer is yes does the routine go on to test for the ESC key specifically (this prevents the computer from reacting twice to the same keypress). With this routine in place, you can check ESC whenever you like by inserting GOSUB 900 at the appropriate spot in a program.

Checking Other Keys

Testing for keys other than ESC is quite easy. Take a look at line 60 of Program 1. The second value in the DATA statement represents CHR$(27), the ASCII value of the ESC key. To test for a different key, replace the 27 in line 60 with the ASCII code of the desired key, then make the same substitution in line 120 as well. For example, to test for the letter A instead of ESC, substitute a 65 for 27 in lines 60 and 120. If you rerun the program and press A at the INPUT prompt, the computer displays a disk catalog exactly as before.

What about reprogramming more than one key at a time? Let's check for three special key combinations: The ESC key will display the catalog for drive 1, CTRL-A will catalog drive 2, and CTRL-C will home the cursor. The first step is to add these lines to Program 1 (note that line 120 is replaced with a new line):

```
58 DATA 201,1,240,10 : REM CO
   NTROL A
59 DATA 201,3,240,6 :REM CONT
   ROL C
120 IF PEEK (-16384) = 27 THE
    N PRINT CHR$(4) "CATALOG,
    D1": GOTO 110
130 IF PEEK (-16384) = 1 THEN
     PRINT CHR$(4) "CATALOG,D
    2": GOTO 110
140 IF PEEK (-16384) = 3 THEN
     HOME: GOTO 110
```

The second number in each DATA statement represents the ASCII code for a particular keypress. The last number in each DATA statement must equal the last num-

ber in the following line plus 4; since line 59 ends with the value 6, line 58 must end with the value 10 (6+4), and so forth. Lines 130 and 140 add the IF statements needed to test for CTRL-A and CTRL-C. Following this pattern, you can add your own key definitions.

Reprogrammed keys behave just like the RETURN key, causing INPUT to respond immediately. However, there are some minor restrictions. First, in a multiple INPUT command such as INPUT A$,B$,C$, the computer detects reprogrammed keys only after the last entry (C$ in this case). Second, if the INPUT command expects numeric input, you must always enter some number before typing the special key.

One disadvantage of checking for ESC is that normal ESC editing functions are disabled. The normal keyscan can be restored by pressing CTRL-RESET, but it's better form for your program to leave the computer in its standard state when it ends. To accomplish this, add the appropriate line below to your program at a point just before the end:

For DOS 3.2 or 3.3:
POKE 56,27:POKE 57,253:CALL 1002

For ProDOS:
PRINT CHR$(4);"IN#0"

A Short Diversion

Though you can use this routine without knowing how it works, machine language programmers may appreciate a closer examination. In simple terms, it diverts the computer from its normal keyscan routine to a new one that we install in RAM. To understand the details of this process, you'll need to know something about how the Apple's keyboard is normally scanned.

The Apple reads its keyboard with a routine known as RDCHAR (located at $FD35). RDCHAR in turn calls another routine known as RDKEY which retrieves an ASCII code from the keyboard and stores it in the microprocessor's accumulator. Then the computer adds 128 to the key code and stores the resulting value in the *keyboard data byte* (location $C000, which is expressed in decimal integer form as −16384). You can subtract 128 from the keyboard data byte with a GET, an INPUT, or by PEEKs or POKEs to the keyboard *status* byte; Apple calls this location ($C010 or decimal −16386) the keyboard *strobe*. After RDKEY is finished, RDCHAR checks to see if the key pressed was the ESC key. If so, it branches to a special routine. The ESC keypress itself is always ignored except as a signal indicating that the next keypress should be processed specially—as an escape code rather than a normal keypress.

Instead of obtaining the keycode on its own, RDKEY jumps to yet another routine, KEYIN, which actually does the work. KEYIN ordinarily begins at location $FD1B. This final bit of code is not called as a subroutine; instead, the computer performs an indirect jump instruction, passing control to the address stored in zero page locations 56–57 ($38–$39). Apple documentation refers to this pair of locations as the *keyboard input switch*. The important points to remember are that the keyboard data byte (−16384) can be PEEKed from BASIC, and that you can divert the computer to a different keyscan routine by changing two bytes in zero page.

Replacing the ROM version of KEYIN with a customized version is straightforward. Lines 10–70 of Program 1 POKE the new routine into memory beginning at address 768. Line 80 checks a memory location in the ProDOS global page, which begins at address 48640. If this location contains the value 76, ProDOS is active, so the standard input routine is changed using the command IN#A768, which tells ProDOS to get its input from the routine beginning at address 768. (That routine begins with a byte of 216, the CLD opcode, to let ProDOS know that this is a valid machine language routine.)

Lines 90 and 100 perform the input redirection for DOS 3.2 and 3.3. First, the high and low bytes of the routine's starting address ($300, or decimal 768) are POKEd into locations 56 and 57. (Since this routine is relocatable, you could put it any other place that isn't used by your main program.) Then the CALL 1002 in line 100 tells DOS to use the new KEYIN routine in place of the usual code. If you're interested, Program 2 contains the source code for this routine.

The first instruction in Program 2 is necessary for ProDOS. The next eight lines simply mimic the normal KEYIN routine. These instructions continuously generate a random number by incrementing locations $4E–$4F until a key is pressed. When you press a key, the computer moves the keycode found in the keyboard data byte into the accumulator, then clears the keyboard status byte. At that point, the normal version of KEYIN would return to RDCHAR, which would check the keycode to see if it is ESC. The custom KEYIN routine does the check right away. If ESC was pressed, we replace the accumulator's contents with the ASCII code for a carriage return (with the high bit set).

Program 1: ESCape Key Upgrade

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
AC 10 J = 768
2F 20 READ A: IF A < > 256 THEN
      POKE J,A:J = J + 1: GOTO 2
      0
31 30 DATA 216,230,78,208,2,230,
      79,44,0
1E 40 DATA 192,16,245,145,40,173
      ,0,192
8E 50 DATA 44,16,192,72,41,127
A7 60 DATA 201,27,240,2 : REM ES
      CAPE KEY
66 70 DATA 104,96,104,169,141,96
      ,256
EA 80 IF PEEK (190 * 256) = 76 T
      HEN PRINT CHR$ (4);"IN#A76
      8": GOTO 110
3D 90 POKE 56,0: POKE 57,3
92 100 CALL 1002
2E 110 INPUT "ENTER CHOICE ";A$
CC 120 IF PEEK ( - 16384) = 27 T
      HEN PRINT CHR$ (4)"CATALO
      G": GOTO 110
```

Program 2: New KEYIN Routine

This source code listing is for illustrative purposes only. It requires an assembler to be typed in.

```
        CLD          ; Valid ML routine.
START   INC $4E
        BNE NEXT
        INC $4F
NEXT    BIT $C000
        BPL START
        STA ($28),Y
        LDA $C000
        BIT $C010
        PHA          ; Save key code
        AND #$7F     ; Set high bit to zero
        CMP #$1B     ; Is it ESC?
        BEQ RETURN; If yes, branch.
        PLA          ; Not ESC, so replace
        RTS          ; original code, exit.
RETURN  PLA          ; Tidy up stack.
        LDA #$8D     ; Carriage return.
        RTS
```

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INSIGHT: ST

Bill Wilkinson

Exploring The ST

Hi—welcome to "Insight: ST," COMPUTE!'s new monthly column for the Atari ST-series computers. Over the coming months, we're going to help you become more familiar with the ins and outs of the Atari ST, its operating system, GEM, and ST BASIC. The ST series is the most powerful line of computers ever released by Atari—one of the most powerful in the industry, in fact—so there's a great deal to learn and explore.

Before getting started, I want to reassure those of you who still own and use the eight-bit Atari 400/800, XL, and XE computers. Veteran readers will recognize that I've been writing the "Insight: Atari" column on these machines for the past five years in COMPUTE!. This new column *does not* mean that we're dropping Insight: Atari. In fact, I plan to continue writing Insight: Atari in addition to Insight: ST for the next few months. Eventually I'll turn over Insight: ST to someone more specialized in ST BASIC. Don't be surprised, though, to find occasional ST tidbits in Insight: Atari as well. Both columns will be of continuing interest to all Atari enthusiasts.

The ST In Perspective

Just what *is* an Atari ST computer? Even if you already own an ST, I may have some surprising answers for you.

From a hardware viewpoint, the ST is most commonly compared to the Apple Macintosh and the Commodore Amiga. Indeed, it shares characteristics with both. All three use a Motorola 68000-series microprocessor, 3½-inch floppy disk drives, bit-mapped screen display, a range of peripheral interfaces, and more—generally the things we've come to expect from today's advanced personal computers. Both the ST and the Amiga have one advantage over the Macintosh: color graphics (though admittedly only the Amiga uses a sophisticated graphics processor chip to display true sprites).

Even the user interfaces of the three machines are similar: All have a system of icons, multiple screen windows, and a mouse controller to visually display and manipulate the contents of disks and perform general "maintenance" chores.

Finally, as long as we're making comparisons, we should be fair and mention that the Macintosh has much, much more software available for it than either of its competitors. But that situation is changing rapidly, even as I write.

What makes the ST stand out from other computers? Well, the Atari marketing department has a whole series of answers, but let me tell you the ones which impress me. First and foremost is the built-in hard disk port. It's capable of transferring data to or from a hard disk (or a network or external RAM disk or whatever) at a rate of up to *1,300,000 bytes per second.* That means you could, in theory, fill the 512K RAM memory of a 520ST in under half a second.

The Allure Of Speed

Theory is nice, but what does this mean in practice? Well, for me (or any other programmer) it means that after writing source code with a text editor, I can save the source file to disk, exit the editor, load a compiler, compile the source code I just saved, link the resulting object code with both system and GEM libraries, and maybe (if I swallow fast) finish eating a bite or two of a sandwich. Elapsed time: between 10 and 15 seconds, depending on the size of the program. On an IBM PC with a hard disk, it would take four to six times as long. And on the Macintosh, most external hard disks aren't much faster than the ST's floppies.

Thanks to its fast processor and amazing hard disk speed, for sheer computing power there is probably no "home" computer available which can touch the ST. Exception: If you're doing heavy work with floating-point math (for example, scientific or engineering computing), an IBM PC with 8087 floating-point chip will win hands down. (Are you listening, Atari?)

The only other hardware features which are distinctively Atari are the built-in MIDI (Musical Instrument Digital Interface) ports, the cartridge slot, and the absolutely beautiful *black-and-white* display. Now MIDI will be of interest to musicians, and the cartridge port may have some interesting future applications (perhaps a way to get that fast floating-point chip?), but the surprise here is the 640 × 400 monochrome display. Why do I rave about this on a machine with advanced color graphics?

Although I enjoy color displays, I will probably never create one. I'm not particularly artistic and I don't write games. But I *do* write programs. Which means I appreciate an easy to read, rock-steady display. Atari went to the trouble to equip the ST with a completely separate monochrome video port, and its quality is nothing short of amazing. And, besides, it costs $200 less than a color system. (But be forewarned: Many games only run on a color monitor. Poor software design, in my opinion, but that's how it is.)

Next month, we'll begin turning the Atari ST inside out and exploring the intricacies of TOS, its multilevel operating system. ©

AmigaView

Charles Brannon

New Amiga Software

Welcome to the premiere of COMPUTE!'s Amiga column. For the last two years, I've been writing "Horizons," a Commodore column in COMPUTE!'s GAZETTE, and I'm very excited to be writing a new column for the Amiga. While other publications concentrate primarily on Amiga reviews and using your Amiga with commercial software, this column will have a strong bent toward programming techniques, tricks, and tips.

Nonprogrammers will find information on using the operating system (both the Workbench and AmigaDOS) to its fullest. We'll also pass along late-breaking Amiga developments.

Amiga Steals The Show

Although Commodore didn't exhibit at the recent Comdex or Winter Consumer Electronics Show, the Amiga did make a big appearance in early February at The Commodore Show II in San Francisco. This show was hosted by the West Coast Commodore Association, one of the largest Commodore user groups. Thousands of enthusiastic Commodore owners turned out to look at the latest offerings of software and hardware companies. In fact, the show was so popular that the fire marshal finally had to lock the doors to prevent the crowd from exceeding the building's occupancy limit.

About half the show was dedicated to the Amiga, and the Amiga was clearly the show-stealer. Commodore sponsored a large booth which was lent to developers for product demonstrations. This was the first time many Commodore owners got a chance to see the Amiga working with actual software instead of the same old demo programs, so there was quite a bit of interest. And more than a few people at the show were Amiga owners themselves, scouring the floor for everything they could find.

They didn't go home empty-handed. Lots of companies were displaying their latest Amiga wares. (Keep in mind that I'm writing this column in mid-February, so check with your dealer on the availability of promised titles.)

Activision wowed showgoers with *The Music Studio*, a complete music composition system. Using Commodore's MIDI (Musical Instrument Digital Interface) adapter, the Amiga and *The Music Studio* were playing a complex nine-part harmony on a keyboard synthesizer. Besides MIDI compatibility, other features of *The Music Studio* are a sound editor/synthesizer, standard music notation, beginner's music notation, a sound library, up to 15 instruments per song, full editing capability, a staff that scrolls during play, and the ability to print out lyrics along with the sheet music. Many of these options are accessible from pull-down menus. The suggested retail price is $59.95.

From C To Shining C

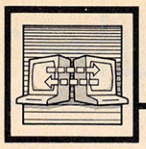
Aztec C, by Manx Software (Eaton Town, New Jersey), is a new alternative to *Lattice C* which supposedly compiles faster and generates smaller, faster-running code than the Lattice compiler. With its built-in libraries, *Aztec C* is compatible with all Amiga function calls. A new translation utility lets you translate existing Lattice source code to *Aztec C*. *Aztec C* is available in several levels, from a simple bare-bones C system for beginners who want to learn C to the full-power Commercial System designed for developers writing commercial software.

A couple of companies were taking orders for their memory expansion boards. Skyles Electric Works (Mountain View, California) sells a 256K module that plugs into the front memory port for $149.95. Comspec Communications (Toronto, Ontario) sells a 256K board for $130 and offers two megabytes (2,048K) for $1,196. StarPoint Software (Yreka, California) sells a 256K board for $120, and it even comes with the schematics.

Two companies are introducing touch tablets for the Amiga. These flat pads let you draw with a pen to transmit screen coordinates to the Amiga. You can use the pad as a substitute for the mouse with graphics software for more natural freehand drawing and effortless tracing. Kurta Corp. (Phoenix, Arizona) sells a full line of digitizer pads, from the $375 *Penmouse+* to a drafting-table size professional system. Software is included to interface the tablet with the Amiga operating system. Anakin Research (Rexdale, Ontario) has a high-resolution tablet called the *EASYL* with software that works in all Amiga screen modes. In 640 × 400, it's a lot like drawing with a pen on a white piece of paper. It also works with Electronic Art's *Deluxe Paint*. It sells for around $500.

Micro-Systems Software (Boca Raton, Florida) is selling *Analyze!*, a spreadsheet ($99.95), *Online!*, an already-popular telecommunications program ($69.95), and *BBS-PC*, a bulletin board system that lets anyone with an auto-answer modem set up their own BBS ($99.95). All three packages are available now.

I've seen a list of over 100 Amiga products that are promised by the first quarter of 1986. Even more projects are under development and "soon to come." As more machines sell, and as more products jell, the Amiga will escape this temporary shortage of software and expansion hardware. Every machine has had to run this gauntlet, but the Amiga may emerge as a particularly strong runner. ©



Telecomputing Today

Arlan R. Levitan

Online Etiquette

Manners are "in" this year. Since I can't turn on a television or radio without running into a self-styled expert on genteel behavior, I figure I might as well get into the act with my patented "Proper Pointers for Bulletin Board Paparazzi."

When logging onto a BBS, remember that you are a guest in the system operator's (sysop's) electronic house. Sysops have the right to lay whatever ground rules they see fit for their personal domains. If you have any problems with the house rules, feel free to register a mild-mannered and polite complaint with the management, but be prepared to find another game in town more to your liking if the house does not relent.

Give your real name when asked to log in. Using the name of heavy metal groups, five-letter expletives, or such hackneyed titles as "Hacker," "Cracker," or "Whacker" are considered passé and a harbinger of the imminent demise of the rest of your brain cells. If the bulletin board you are accessing encourages the use of *noms-de-plume*, stick with an obscure or bizarre moniker. My favorites are the names of ex-postal ministers of Liechtenstein.

Don't be a data glutton. Downloading every new file that shows up on a BBS may keep you off the streets, but ties up many boards an inordinate amount of time. Logging off and back on with a different name after your time limit has expired is tantamount to hogging the shower until all of the hot water is gone. Show your discrimination and taste by carefully examining the descriptions of files that are available for downloading, and choose only those that are of real interest or utility to you.

Anyone Need A Ginsu?

If there is a message section on the BBS, make an effort to read the latest messages and participate in the flow of conversation. The content of messages you leave should be consistent with any statement of direction that the sysop has established. The right of free speech notwithstanding, leaving a message offering to trade a set of Ginsu knives for a Veg-A-Matic may be considered a breach of protocol on a board dedicated to discussions of artificial intelligence and the search for UFOs.

Try to instill some degree of content into every message you leave. Politeness is a virtue, but responding to every bit of assistance with the single word "Thanks" wastes pointer space within the BBS indexes and often leaves other folks wondering just what you were thanking someone for when the original message rolls off the message base.

Leaving public messages that give away solutions to particularly difficult problems in the latest adventure game is somewhat less sporting than standing in front of the audience at a movie theater and announcing the conclusion before the film begins. If you must request help with such programs, solicit assistance in the form of a phone call or letter.

Obscenity is not only "out," it's boring. Ask anyone who's read the unexpurgated Watergate transcripts. Questioning the lineage of the sysop or attempting to crash the board because you don't like a particular policy or rule is a waste of your time and as welcome as an IRS audit.

Sibling Rivalry

Perhaps the most difficult thing for many people is abstaining from the various "My computer is bigger/better/faster than yours" message threads. These discussions usually exhibit all the charm of a dozen or so bull elks ramming their heads together during the rutting season.

The most recent examples are the dozens of Amiga versus Atari ST shouting matches that have been jamming both public bulletin boards and commercial information services all over the country. For the most part, the opposing sides are made up of loyal Atari and Commodore followers who are anxious to defend the honor of their long-time corporate allegiances—holdovers from the Atari 800 versus Commodore 64 debates. What makes all of these arguments and insults somewhat ludicrous is that the Amiga's custom chips are largely the work of Jay Miner, who designed the graphics chips in the Atari 2600 and eight-bit Atari computers. So the Amiga is actually a mid-1980s Atari, while the Atari ST computers—the product of Jack Tramiel & Sons—are really mid-1980s Commodores.

If all the energy that has been spent on these types of discussions were channeled into more productive pursuits, I have no doubt that many of the real mysteries of the universe could have been solved—including where all of the jackets for my floppy disks keep vanishing to.

Finally, and perhaps most important, is to cultivate an attitude of gentle tolerance toward those who insist on pontificating and regaling you with their personal vision of the "right" way to do things. Having made it through this list of dos and don'ts, you're well on your way to that end. ©

Fred D'Ignazio, Associate Editor

Training For Tomorrow's Jobs: High-Tech Skills And Beyond

The reindustrialization of the United States is underway. The U.S. economy is rapidly modernizing its smokestack industries and converting them to futuristic, high-tech companies. High-tech tools—including robots, computers, office automation, and telecommunications—are steadily becoming part of the daily working environment in most U.S. companies. According to a recent issue of the *Kiplinger Washington Letter*, "Even old-line manufacturers are becoming high-tech companies, using computers to orchestrate what goes on where and when in their plants. Formerly machines replaced brawn. Now they replace brains or skilled help."

For instance, in Rochester, Michigan, just east of Pontiac, older companies are swiftly going high-tech. Electronic Data Systems, recently acquired by General Motors, is transferring operations to Rochester. Chrysler Labs is expanding its operations. And a multimillion-dollar high-tech industrial park is under construction.

That means new jobs are opening up in Rochester. But are Rochester's schoolchildren receiving the training they'll need for these jobs?

High-Tech Thinking

Rochester already has more computers in its schools, per capita, than any other city in the country. However, according to Dr. Anne Porter Jaworski, a teacher at Rochester's Oakland University, "Training on computers and other high-tech machines will not guarantee future jobs for our children. We must also teach our children higher-level thinking and communications skills. By the time they become adults, all other skills will be automated, and the jobs will be done by machines."

Jaworski's Canadian colleague, Craig Stirton, a former schoolteacher, agrees: "I've talked with executives from several large companies. They are seriously worried about the kinds of skills young people have when they leave school. The companies have been forced to supplement their new employees' formal schooling with creative-thinking and communication-skill seminars. I think it's time children began learning these skills as part of their basic education."

In Tennessee, General Motors is building what may become the largest high-tech industrial complex in the world. Known as the Saturn Project (after the Saturn, GM's car of the future), it will give a major boost to the Tennessee economy and employ thousands of workers. Tennessee hopes that the Saturn workforce will be drawn from people already living in Tennessee. But according to William D. Hoglund, Saturn's president, applicants must pass a rigid test. They must be competent in language and math, in computer and other high-tech skills, and they must be "risk takers" and demonstrate "a commitment to creative change and growth, and lifelong learning."

Anticipating GM's and other corporations' new human resource needs, Tennessee Governor Lamar Alexander initiated a statewide Better Schools program in 1984, funded by a one-cent sales tax. Through this program, Alexander and the state board of education are revamping the curriculum in Tennessee's schools. Children who graduate from high school in coming years will have a solid foundation in ten different areas, including the basics (reading, writing, arithmetic), computers, and other job-related skills, such as accounting, telecommunications, and engineering.

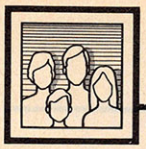
Dr. James Kelley of Tennessee's Department of Education is confident that public schools can provide the training young people need to meet Saturn's challenge. Stirton and Jaworski agree. "In Tennessee," Kelley says, "we are putting renewed emphasis on high-level thinking skills as part of present subject areas like math and reading."

Engrossed In Learning

In Michigan, Stirton and Jaworski have designed a learning program, called a "transformational environment," that would focus on these high-level skills beginning with elementary school pupils. According to Stirton, "We want a place where children would be so engrossed in their activities that they would become oblivious to everything around them."

"This kind of peak experience is common to hobbies," adds Jaworski, "but I don't see why it couldn't happen in school." It could be part of an activity center in a classroom or a special class during the day or after school, she explains. "The energy released would be tremendous. Children would feel exhilarated by doing something they defined as a goal for themselves. Many teachers are already doing this. We should all be communicating together, and we need support from parents."

To get in touch with Stirton and Jaworski, write: Craig Stirton, 6275 Atherly Crescent, Mississauga, Ontario, Canada L5N 2J1 (his CompuServe I.D. is 72777,1054); or Dr. Anne Porter Jaworski, School of Human and Educational Services, Oakland University, Rochester, MI 48063. To learn more about Tennessee's Better Schools program, write Dr. James Kelley, Assistant Commissioner for General Education, Tennessee Department of Education, Suite 200, Cordell Hull Building, Nashville, TN 37219. ©



Computers and Society

David D. Thornburg, Associate Editor

Computer Ethics

Over the past two years I've been hearing more and more concern about ethics in this country—with special emphasis on the ethical considerations associated with computer technology. The debate ranges from concern about the displacement of human workers by robots to the issues surrounding the copying of commercial software.

To take just one example, I recently spoke at a computing conference in which I was asked what my feelings were about the unauthorized copying and distribution of commercial software. In this particular case, the questioner was a teacher whose budget was very tight. My response was simply this: Unlike murder, which is only a state crime, the illicit copying of commercial software is a federal offense. I don't think much of murder, and I don't think much of those who deprive hard-working software companies of their just rewards for their efforts. While it might be interesting to study why otherwise law-abiding people are willing to even consider making copies of copyrighted material, that is a topic for another column.

Many people think the new technologies of the information age require more than technical skills on the part of their users—they require some thought about the ethical consequences of these technologies, both from a personal and from a societal perspective. Someday we might see the following headlines in our daily papers:

"Berserk Robot Kills Six at Auto Plant"

"Computer Failure at Hospital Threatens Safety of Hundreds"

If these disasters happened, the affected community would be outraged. But once the headlines died down, the long, drawn-out process of assessing responsibility would begin. Who was at fault? What could be done to keep this from happening again?

The Impact Of Technology

As we develop new information and automation technologies that our children will use as freely as we use paper and pencils, we should give some thought to preparing them for the complexities that arise—not just from the technology itself, but from the impact this technology can have on the people who make it, and especially on those who use it.

With this thought in mind, I was pleased to come across a book entitled *Computer Ethics* by Thomas Kemnitz and Philip Vincent ($9.95 from Trillium Press, Box 921, Madison Square Station, New York, NY 10159). It's not a book that "teaches" ethical behavior; instead, it explores the complexities of the topic for youngsters in grades seven and up.

The book consists of numerous hypothetical cases, each of which raises an interesting question for which the answer is not at all clear. Instead of presenting a point of view, the book presents a balanced view of both sides of the issue. Then it asks questions that stimulate readers to formulate their own opinions on the case and to present these opinions in a well-thought-out manner. Here's an example:

> In this day and age, one often hears talk of "human rights." People talk of certain individual's rights being violated. Some individuals maintain rights are guaranteed because of a government's "constitution." Others maintain that all human beings are, or should be guaranteed, certain rights simply because they are human beings. A common error is committed when one speaks of rights without examining the philosophical background that constitutes or guarantees these rights. Should rights be guaranteed to people? Animals? Machines?...
>
> If cognitive abilities are the criteria for granting or having rights, then humans obviously have rights...Should computers have rights? Are not computers capable of reasoning, analyzing and processing information? Are computers capable of enlightening us or other computers if they are so requested? As computer technology grows, many feel computers will be able to duplicate and exceed the thinking capabilities now dominated by man...
>
> What should be the basis for rights?

If The Headlines Happen

The activities that follow this case explore the issues that were raised in some depth, without expressing a particular position. For example: How do you distinguish between rights and privileges?

In addition to raising interesting questions about the social consequences of technology, *Computer Ethics* stimulates critical thinking skills. Given the complexity of the world into which our children are growing, this skill is one that should be nurtured and developed from an early age.

I hope we never see the kinds of headlines that would result if some of the hypothetical cases in *Computer Ethics* became real. But if we do, I hope even more that we as a society will be prepared to engage in the kind of debate that can not only resolve the issue at hand, but that can help make our world a safer and happier place in which to live.

Dr. Thornburg's most recent product is Calliope, *a nonlinear idea processor for the Apple IIe, IIc, and Macintosh computers. He welcomes letters from readers and can be reached in care of this magazine.* ©

The Beginners Page

Tom R. Halfhill, Editor

String Comparisons

As we've pointed out more than once in the past few columns, computers really know nothing about our written language of alphabetic characters, punctuation marks, and symbols—they are capable of dealing only with numbers. Although this means computers have to spend a lot of time translating things for our convenience (and vice versa), it also means that computers can perform "arithmetic" on character strings.

This concept seems a little strange at first, because we're used to thinking of the written word and mathematics as two different, incompatible languages. After all, a phrase such as "The quick brown fox jumped over the lazy dogs" is just as meaningless in mathematics as the phrase "X=(Y+2)*(Z/4)" is in English. But since a computer sees "The quick brown fox..." as merely a string of numbers (character codes), we can write programs that perform a kind of arithmetic on what appears to *us* as strings of characters. Here's an example:

```
IF "A"<"B" THEN PRINT "IT WORKS!"
```

When you press RETURN, the result is the message IT WORKS!.

Notice the subtle yet vital difference between this line and the statement IF A<B THEN PRINT "IT WORKS!". Although both statements are comparing two values with an arithmetic operator (<, the less-than sign), the first statement isn't comparing two *numeric* values; it's comparing two *character* values.

At least, that's how it looks on the surface. From the computer's point of view, two numbers—character codes—are still being compared. The character A is "less than" the character B because the character code for A is a smaller number than the character code for B. You can confirm this by typing PRINT ASC("A") and PRINT ASC("B")—the character codes are 65 and 66, respectively. (See the February 1986 "Beginner's Page" for more details on ASCII character codes.) It's easy to remember that the letter A is less than the letter B, because A precedes B in the alphabet. But keep in mind that it's really the character codes, *not the alphabetical positions*, that count. Consider this example:

```
IF "A">"a" THEN PRINT "IT WORKS!"
```

From the computer's point of view, two numbers—character codes—are being compared. The character A is "less than" the character B because the character code for A is a smaller number than the character code for B.

When you enter this statement, you might expect to see the message IT WORKS!. Alphabetically, the uppercase letter *A* should take precedence over the lowercase letter *a*. But it doesn't work that way on most computers. Instead, the IF-THEN test fails; *A* is not greater than *a*. Why? Because the character codes for uppercase letters are numbered from 65 to 90, and the codes for lowercase letters are numbered from 96 to 122. (Yes, it's odd.) Therefore, *A* (65) is less than *a* (96). The statement above is really the equivalent of this:

```
IF ASC("A")>ASC("a") THEN PRINT
  "IT WORKS!"
```

which, in turn, is the equivalent of this:

```
IF 65>96 THEN PRINT "IT WORKS!"
```

As long as the computer can figure out that 65 isn't greater than 96, it doesn't have to know anything about alphabets.

Incidentally, you'll get different results if you try some of these examples on Commodore computers (except the Amiga). Commodore machines assign character codes a bit differently than other computers do. Normally, the Commodore 64, 128, and VIC-20 don't display upper/lowercase characters—you have to press the SHIFT-Commodore keys to switch to this mode. This renumbers the lowercase character set from 65 to 90 and the uppercase set from 193 to 218. So on a Commodore, the uppercase letters are indeed "greater than" the lowercase letters.

Other types of comparisons are possible with strings, too. Try these:

```
IF "OK"="OK" THEN PRINT "OK"

IF "DIAGNOSTIC TEST"<>"DIAG-
  NOSTIC TEST" THEN PRINT
  "YOU'VE GOT A HARDWARE
  PROBLEM"

IF "DOG">"CAT" THEN PRINT "TOLD
  YA SO"
```

All of the examples we've seen so far compare *string literals*. Of course, you can also compare characters stored in string variables:

```
10 DIM A$(5),B$(5):REM This line for
   Atari only
20 A$="<"
30 B$=">"
40 IF A$<B$ THEN PRINT "< IS LESS
   THAN >"
```

String arithmetic isn't limited to comparisons. Next month, we'll see how you can *add* two strings together in various versions of BASIC, and cover some remaining string functions as well. ©

Bill Wilkinson

Avoiding Disk Errors

I know many of you will find this hard to believe, but I've never encountered a disk error on the Atari which I couldn't explain. Further, I have had very few DOS errors, ever. (The reasons for the few errors I have encountered, by the way, were always related to random access files—a common problem with Atari DOS 2.0 and its derivatives.) Yet after a few hundred phone calls and letters, I know that many of you have experienced the frustration of wiped-out disk files. Why? Well, I can't know each and every reason, and I can't repair damage that's already been done, but maybe I can give you some helpful hints for the future.

Hands Off That Disk

Hint 1: Never, never, never take a disk out of a drive unless the program you're using tells you to. (This goes beyond even the good advice about never removing a disk when the drive is still spinning.) In particular, never swap disks until prompted to do so. Why? Well, because the Atari disk drive has no way to tell the computer that the disk has been removed or changed.

Consider: How does any DOS know what disk sectors to allocate to a new file? Generally, a DOS keeps a list of unused disk sectors. The next time it needs to find a sector (for example, to extend a file), it takes one from this list. The list (called a *Volume Table Of Contents* or VTOC in Atari parlance) is usually kept on disk until a file is opened, when it is read into memory. It is rewritten to the disk when a file is closed.

Okay, now open a file for output, write some information, swap disks, and write more data. What happens? The list of sectors was correct for the first disk, but it's extremely unlikely that it bears any reasonable relation to what exists on the second disk. Most probably, DOS will allocate several sectors which were already part of other files on the second disk. Kablooey!

If you're using an application program, then, follow the prompts and don't swap disks unless told to. If you're programming and working with disk files, make sure you close all open files before swapping disks (END automatically closes all open files in BASIC). If you're using DOS, you should be safe as long as you change disks only at the DOS prompt. Of course, when duplicating files or disks, you must swap disks when DOS tells you to.

Beware Of RESET

Hint 2: Never hit the SYSTEM RESET button during a disk operation. For example, if you hit RESET in the middle of a SAVE, it's possible to end up with a completely blown program. In fact, if you then SAVE the program to disk again, you could end up with a blown disk file.

This results from a really subtle bug in DOS 2.0. When DOS enters what is known as *burst I/O* mode (to speed up input/output), it "copies" the memory to disk. But DOS 2.0's file organization requires that the last three bytes of each sector contain a link to the next sector in the file. How can it do this when it is writing directly from memory? Answer: By "swapping" three bytes of memory long enough to write a sector, and then restoring the bytes.

Now suppose you happen to hit RESET when those three bytes are swapped out. Oops...say goodbye to your program.

There are two ways to fix this problem. First, since DOS gets control after a RESET, it could check to see if a disk write was interrupted. If so, it could restore the three bytes. Or, second, DOS could always copy bytes to be written into a buffer, thus never disturbing the program (or data) in memory. The second approach is successfully used by DOS 2.5.

Missing Sectors

Hint 3: Avoid hitting RESET during disk operations even if you're using DOS 2.5, because you may still mess up the disk a bit. Here's one way: Open a file for write (OPEN #5,8,0,"D:FILE" in BASIC, for example), write some data, OPEN another file for write, write data to both files, CLOSE the first file, write some more data to the second file, and then hit RESET. What happens?

The VTOC says the sectors in the second file which were written before the CLOSE are now in use (and that was true when the CLOSE took place). If you add the number of free sectors remaining on the disk to the number of sectors used in all files, the total is no longer 707 in single density or 1010 in enhanced density, as it should be. You just lost some of your disk space.

Hint 4: Everything I just mentioned about RESET also applies to turning off the power. For example, if you have a power failure in the middle of a SAVE from BASIC or while there are some data files open in a business program, be prepared for some problems.

Fortunately, DOS 2.5 comes with a program called DISKFIX.COM which does a pretty good job of fixing up a "damaged" disk (either DOS 2.0 or 2.5). It allows you to undelete files as long as you haven't written any new files since the deletion. At your choice it will either try to recover or permanently remove a file which was left open for output. And, most importantly, it checks each file on the disk to make sure it is OK, and then reconstructs the VTOC to ensure that all 707 or 1010 sectors are accounted for. ©

C. Regena

Animation In TI BASIC

The theme for this issue of COMPUTE! is graphics and animation, so we'll discuss some ways you can animate in TI BASIC. TI Extended BASIC adds really fun animation with the sprite features, but even in regular console BASIC you can make characters move. I'm going to suggest four ways you can animate your graphics.

Perhaps the simplest way to move something on the screen upward is to use the PRINT statement. The short program below draws a rocket at the bottom of the screen. Lines 140–160 print blank lines which move the rocket toward the top of the screen. (You may also use PRINT with colons.) Of course, any other graphics you might have on the screen also move upward as you print. This method works best with larger objects that need to be moved upward because you don't need to redraw the graphics.

```
110 CALL CLEAR
120 CALL CHAR(130,"1038383E
    38387C44")
130 CALL HCHAR(24,15,130)
140 FOR P=1 TO 21
150 PRINT
160 NEXT P
170 END
```

The next short program illustrates a way to move an object across the screen horizontally. This method involves erasing the object and then redrawing it—all the way across the screen. Unlike the previous method, this won't affect other graphics on the screen. Although it works with several characters, objects move more quickly and more smoothly if you use only one character.

The program redefines character number 130 as an arrow. In a FOR-NEXT loop that changes the column number, first a space (character number 32) is placed in the previous column to erase the existing arrow, then the new arrow is drawn in the next column. This repeatedly erases and redraws the arrow one column to the right. Run the program to see how fast the arrow moves across the screen.

```
110 CALL CLEAR
120 CALL CHAR(130,"080C0EFF
    0E0C08")
130 FOR C=3 TO 28
140 CALL HCHAR(8,C-1,32)
150 CALL HCHAR(8,C,130)
160 NEXT C
170 END
```

This method is probably the most common way to move a character. You can move it in any direction by erasing the character in the present position, then changing the row and column and redrawing it in another position. In this short example, we've erased the character with a blank space. But if the character is moving over other graphics, you might need to erase it with the appropriate graphics characters to restore the background. Otherwise, the moving character would leave behind a trail of spaces. This method of animation is rather jerky if your object consists of several characters that need to be moved, but it can be fairly quick with just one character.

CALL COLOR Motion

The next example program illustrates a different way to move an object made up of several characters. Rather than moving one character at a time, we'll use CALL COLOR to make all the characters in the set invisible at once, then another CALL COLOR to make the object in the next position visible.

This sample draws an eight-character horse. The horse is actually drawn eight times on the screen using eight different character sets. Lines 130–200 define strings for eight graphic character definitions. The loop in lines 210–250 defines the graphic characters. In each of the sets from number 9 to 16, the characters are defined using the strings A$.

Lines 260–380 are another loop. Line 270 makes the characters invisible. Lines 280–290 determine a character number and a row number depending on the set number. Lines 300–370 draw the horse. This loop draws eight horses on the screen vertically, but they are all invisible.

Lines 390–470 are the loops that create the movement. The CALL COLOR statement with a 14 defines the horse as color 14 for a particular color set. The horse moves up and down as the color set number varies and one set is made invisible and the next set made visible. All you need to do is add the rest of the carousel and the music!

This example has only one horse moving up and down. You could draw more horses on the screen—for example, with the set number 9 horse at the bottom of the screen and the set 16 horse at the top. No matter how many horses are on the screen, the CALL COLOR statement changes all the horses in a particular set. You can have several objects moving at the same time by using the CALL COLOR loops in lines 390–470.

```
110 CALL CLEAR
120 CALL SCREEN(16)
130 A$(1)="2E3F3F7F7FFFE7E7
    "
140 A$(2)="008080C0C0E0E0E"
150 A$(3)="07070707071F7FFF
    "
160 A$(4)="F1FFFFFFFFFFFF8"
170 A$(5)="FFFDFCFCFCFCF8F8
    "
180 A$(6)="C0C0E0E0E0602"
190 A$(7)="C060301A0E"
200 A$(8)="F8783C1830606"
210 FOR C=9 TO 16
220 FOR J=1 TO 8
230 CALL CHAR(C*8+23+J,A$(J
    ))
240 NEXT J
250 NEXT C
260 FOR C=9 TO 16
270 CALL COLOR(C,1,1)
280 CH=C*8+23
290 ROW=(C-8)*3-1
300 CALL HCHAR(ROW-1,14,CH+
    1)
```

```
310 CALL HCHAR(ROW-1,15,CH+
    2)
320 CALL HCHAR(ROW,14,CH+3)
330 CALL HCHAR(ROW,15,CH+4)
340 CALL HCHAR(ROW,16,CH+5)
350 CALL HCHAR(ROW,17,CH+6)
360 CALL HCHAR(ROW+1,14,CH+
    7)
370 CALL HCHAR(ROW+1,16,CH+
    8)
380 NEXT C
390 FOR C=9 TO 16
400 CALL COLOR(C-1,1,1)
410 CALL COLOR(C,14,1)
420 NEXT C
430 FOR C=16 TO 9 STEP -1
440 CALL COLOR(C,1,1)
450 CALL COLOR(C-1,14,1)
460 NEXT C
470 GOTO 390
480 END
```

CALL CHAR Animation

The last method of animation I'm going to discuss this month is using CALL CHAR. Just as CALL COLOR instantly changes the color of all characters on the screen in that color set, CALL CHAR redefines a graphic character definition of all characters of that number on the screen. For example, if you have something on the screen and execute CALL CHAR(32,"FF"), all of the characters with number 32 (all the spaces) instantly change to the new character definition, in this case a horizontal line.

The following program illustrates this technique. Lines 110–180 clear the screen and draw a simple face using keyboard symbols. You can draw a much fancier face, but this is just a sample. To type the eyes, use the function key along with the C key to get the ` mark. This is character 96. Line 190 redefines character 96 for an open eye. Lines 200–210 create a delay loop while the eye is open, then line 220 redefines character 96 as a closed eye. Lines 230–240 create another delay loop. Line 250 branches back to line 190 to open the eye.

```
110 CALL CLEAR
120 PRINT TAB(6);"@@@@@@@@@
    @"
130 PRINT TAB(6);"@
    @"
140 PRINT TAB(6);"@   `   `
    @"
150 PRINT TAB(6);"!     ^
    !"
160 PRINT TAB(6);"!     ~
    !"
170 PRINT TAB(6);"\
    /"
180 PRINT TAB(7);"\______/"
    ::::
190 CALL CHAR(96,"18247A7A7
    A7E81")
200 FOR DELAY=1 TO 500
210 NEXT DELAY
220 CALL CHAR(96,"000000008
    37D2548")
230 FOR DELAY=1 TO 100
240 NEXT DELAY
250 GOTO 190
260 END
```

Latest TI News

Now a few comments on the TI-99/4A world. I enjoyed a recent visit to Las Vegas to the Southern Nevada Users Group (SNUG, P.O. Box 26301) and also met several people from the Los Angeles and San Diego areas. Terri Masters, president of the L.A. 99er Computer Group (P.O. Box 3547, Gardena, CA 90247), was busy preparing for their Fest-West expo to be held March 1–2. It will be over by the time you read this, but you can plan on attending next year. Chicago holds an annual fest in October, and other groups have expos as well, so you can see the TI-99/4A is not dead.

I also met Craig Miller of Millers Graphics (1475 W. Cypress Avenue, San Dimas, CA 91773), who demonstrated his GRAM Kracker, which will open up all sorts of possibilities for TI owners. This device can save a module (cartridge) program onto a disk or cassette. It also allows you to change or customize a module program—for example, change the title screen or default colors. Miller was also distributing his new book, *The Orphan Chronicles*, by Ron Albright. This book tells the history of the TI and includes a current list of TI dealers, manufacturers, and user groups.

Les Merryman (Lancaster, California), a distributor for Myarc, was also at the SNUG meeting and showed several new Myarc products, including disk controllers, a hard disk drive, and their new Extended BASIC module.

Please don't write to me about hardware products—write directly to the manufacturers and distributors. There are still companies making peripherals for the TI, and there are people who have as many as four disk drives hooked up to their machines. Even though Texas Instruments quit selling the TI-99/4A more than two and a half years ago, user groups are still going strong, and it's amazing what people are doing with their TIs. ©

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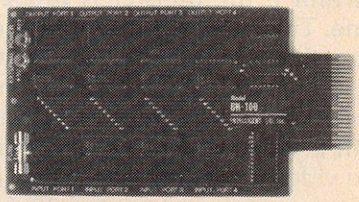

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The PC/VCR Connection

Remember those 8 mm home movies you took back in the 1960s and 70s...the ones stored away in a shoebox on the top shelf of a closet...the ones you haven't seen in years because it's too much trouble to set up the projector and screen? Now, if you have a videocassette recorder (VCR), you can show them on your TV set.

The first step is to transfer the film to tape. There are commercial firms in most major cities that specialize in this service. Ask your video dealer to recommend one or call the tape editor at your local TV station for suggestions. The cost is quite reasonable—usually just $2 to $3 for 50 feet of film, plus about $6 for the cost of a two-hour tape. Most firms give substantial price breaks for 200- and 400-foot reels.

The picture quality of the tape can actually exceed that of the original film if the transfer is properly done. This means you should avoid firms that transfer the film to tape by projecting your movies on a screen and recording the image with a video camera. Because film and video have different speeds (18 frames per second versus 30 fps), taping from a movie screen can result in horizontal interference lines and flickering. Professional transfer firms have special equipment to overcome this problem.

Once the film is copied on tape, you can add music and narration if your VCR has dubbing features. If not, consider renting a VCR with those features and, while you have the second machine available, make copies of the tape for friends or relatives. As your tapes begin to take on a professional-looking quality, you'll want to add titles, too. Here's where your IBM PC or PCjr really shines.

Simple Patchwork

All you need to make titles with your computer is a cable to connect the composite video output to the VCR. You'll need a shielded cable with a male RCA-type plug on both ends. (Electronics stores such as Radio Shack have them in different lengths for about $5. Or you can borrow one from a stereo system.) Plug one end of the cable into the video input jack on the back of the VCR. If your VCR is an older model with nothing but an antenna connection, you should rent or borrow a newer machine for best results. The other end of the cable plugs into the jack labeled V on the back of the PCjr, or into the jack on the PC's color/graphics adapter board. (If your PC only has the monochrome adapter, you lack the necessary hardware.)

Once the connection is made, you can record virtually anything that appears on your computer screen, although some color combinations that look good on an RGB monitor don't record well.

If your computer's display is a composite monitor, you'll have to disconnect it to plug the patch cable into the composite video output. That means you'll need to figure out some method for previewing the titles—the computer output. The easiest way is to connect a TV set to the VCR as usual. Then, whatever your computer is "playing" will be displayed on the TV and can be recorded by the VCR—just as though the PC were a TV station or cable system. Alternatively, you can view the computer output on an RGB monitor or TV connected directly to the PC or PCjr.

Creating Your Own Titles

The next step is to produce the titles. Things like: *Christmas 1975, Eric's 4th Birthday, Vacation in Hawaii.* You can use any program that produces text on the computer screen, preferably in a large size and in color. You'll want something that doesn't leave a menu line or blinking cursor on the screen.

For really professional results (at a professional price—$250), it's difficult to beat IBM's *PC Story Board* software. This program is designed for making animated graphics presentations. Besides having different sizes and styles of type—shadowed, outlined, and slanted in either direction—*Story Board* allows you to dissolve, wipe, explode, push, and weave from one screen to another. A whole series of titles can be stored on disk and played back automatically in a timed sequence.

Story Board is designed for corporate presentations, and although the results are spectacular, most of us can't justify spending $250 to title home videos. Fortunately, there's an economical alternative.

You can produce colorful, attractive titles with a very simple BASIC program—even if you're not a programmer. The program below produces three-line titles in colors; consult the COLOR statement (for text) in your BASIC manual to equate a color with a number (e.g., 1=blue, 2=green, etc.). Background colors must be in the range of 0 through 7; foreground (text) must be in the range of 0 through 15. Insert spaces ahead of the text to center the lines on the screen.

The INKEY$ statement in line 200 keeps the OK prompt off the bottom of the screen. On the PCjr, you can generate even larger characters by changing the number 40 in line 100 to 20. This displays 20 characters per line instead of 40.

IBM PC/PCjr Video Titler

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
EH 10 REM The 3 title lines foll
      ow
JA 20 LINE1$="                CHRIS
      TMAS"
GE 30 LINE2$="                    19
      80"
```

```
LK 40 LINE3$="                at Gra
    ndma's"
LD 50 REM The colors for each of
    the three lines follow
HA 60 COLR1=4          'This is re
    d for line 1
OH 70 COLR2=7          'This is wh
    ite for line 2
IM 80 COLR3=1          'This is bl
    ue for line 3
AE 90 BACKGROUND=0     'This is bl
    ack. Change 0 to 1 for blu
    e, etc.
CI 100 WIDTH 40:CLS:KEY OFF:LOCA
    TE 1,1,0
IC 110 PRINT
EH 120 COLOR COLR1,BACKGROUND
FB 130 PRINT LINE1$
BE 140 PRINT:PRINT:PRINT
GN 150 COLOR COLR2
GG 160 PRINT LINE2$
CK 170 PRINT:PRINT:PRINT
HC 180 COLOR COLR3
IL 190 PRINT LINE3$
KO 200 A$=INKEY$:IF A$="" THEN 2
    00
GB 210 WIDTH 80:COLOR 7,0
LP 220 END                    ©
```

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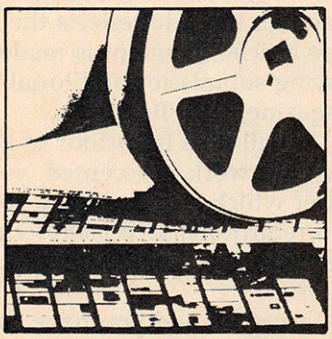

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MLX Mixup

If you've tried to enter the "Screen Genie" program from the April issue, you may have discovered that the version of "MLX" published in that issue (p. 123) cannot be used. The MLX program in the April issue is an accidental resurrection of the old version, which has not been used since November 1985. Screen Genie must be entered with the new version of MLX, which appeared in the December, January, and February issues.

Switchbox

The Atari version (Program 3) of this game from the March issue (p. 34) has two typos. In line 130, the AR$(1.3) should be AR$(1,3). The proper Proofreader checksum for the corrected line is NH. More significantly, in line 460 the character shown as {=} should actually be SHIFT-=, the vertical line character.

In the Apple version (Program 4), the following line should be added to ensure that no extraneous characters appear on the game screen:

```
20 1035 FOR I = 36096 TO 36103:
      POKE I,0: NEXT
```

In the Atari ST version (Program 7), a set of quotation marks is missing in line 20. The first variable definition in the line should be:

sp$(0)="\ _":.

Commodore Program Profiler

In this utility program from the February 1986 issue, two of the DATA lines contain spurious question marks and are missing characters. Lines 170 and 370 should read as follows:

```
170 DATA 160,192,32,30,171,32,
    207,255,201,13      :rem 99
370 DATA 126,192,141,127,192,1
    65,157,208,106,169 :rem 75
```

IBM PrtSc Protector & Screen Clock

These two programs—"PrtSc Protector" from the February issue (p. 81) and "Screen Clock" from the April issue (p. 107)—both have the same problem. Due to a quirk in the program we use to generate listings, the "Automatic Proofreader" checksums for the DATA lines are incorrect. That is, the programs are correct as published, but, if you attempt to type them in using our Automatic Proofreader utility, the checksums you'll get for the DATA lines will be different from those shown in the magazine. As a result, we recommend that these programs be entered directly, without using the Proofreader.

ST Doodler

A bracket character is missing in this Logo graphics program for the Atari ST in the February 1986 issue (p. 78). In the procedure BCORF at the bottom of the middle column, there should be a left bracket, [, before SETPOS. ©

Attention Programmers

COMPUTE! magazine is currently looking for quality articles on Commodore, Atari, Apple, and IBM computers (including the Commodore Amiga and Atari ST). If you have an interesting home application, educational program, programming utility, or game, submit it to COMPUTE!, P.O. Box 5406, Greensboro, NC 27403. Or write for a copy of our "Writer's Guidelines."

COMPUTE's Author Guide

Most of the following suggestions serve to improve the speed and accuracy of publication. COMPUTE! is primarily interested in new and timely articles on the Commodore 64/128, Atari, Apple, IBM PC/PCjr, Amiga, and Atari ST. We are much more concerned with the content of an article than with its style, but articles should be clear and well-explained.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* If your article was written with a word processor, we also appreciate a copy of the text file on the tape or disk. Please use high-quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Atari tapes should specify whether they are to be LOADed or ENTERed. We prefer to receive Apple programs on disk rather than tape. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length—from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5×7 black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

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16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing, "Revision" on the envelope and the article.

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COMPUTE!'s Guide To Typing In Programs

Computers are precise—type the program *exactly* as listed, including necessary punctuation and symbols, except for special characters noted below. We have provided a special listing convention as well as a program to check your typing—"The Automatic Proofreader."

Programs for the IBM, TI-99/4A, and Atari ST models should be typed exactly as listed; no special characters are used. Programs for Commodore, Apple, and Atari 400/800/XL/XE computers may contain some hard-to-read special characters, so we have a listing system that indicates these control characters. You will find these Commodore and Atari characters in curly braces; *do not type the braces.* For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A complete list of these symbols is shown in the tables below. For Commodore, Apple, and Atari, a single symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. This will produce a reverse video character on the Commodore (in quote mode), a graphics character on the Atari, and an invisible control character on the Apple.

Graphics characters entered with the Commodore logo key are enclosed in a special bracket: [<A>]. In this case, you would hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S. One exception is {SHIFT-SPACE}. When you see this, hold down SHIFT and press the space bar. If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (white on black) should be entered with the inverse video

Atari 400/800/XL/XE

When you see	Type	See	
{CLEAR}	ESC SHIFT <		Clear Screen
{UP}	ESC CTRL -		Cursor Up
{DOWN}	ESC CTRL =		Cursor Down
{LEFT}	ESC CTRL +		Cursor Left
{RIGHT}	ESC CTRL *		Cursor Right
{BACK S}	ESC DELETE		Backspace
{DELETE}	ESC CTRL DELETE		Delete character
{INSERT}	ESC CTRL INSERT		Insert character
{DEL LINE}	ESC SHIFT DELETE		Delete line
{INS LINE}	ESC SHIFT INSERT		Insert line
{TAB}	ESC TAB		TAB key
{CLR TAB}	ESC CTRL TAB		Clear tab
{SET TAB}	ESC SHIFT TAB		Set tab stop
{BELL}	ESC CTRL 2		Ring buzzer
{ESC}	ESC ESC		ESCape key

Commodore PET/CBM/VIC/64/128/16/+4

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL 9	
{OFF}	CTRL 0	
{BLK}	CTRL 1	
{WHT}	CTRL 2	
{RED}	CTRL 3	
{CYN}	CTRL 4	
{PUR}	CTRL 5	
{GRN}	CTRL 6	
{BLU}	CTRL 7	
{YEL}	CTRL 8	

When You Read:	Press:	See:
[<1>]	COMMODORE 1	
[<2>]	COMMODORE 2	
[<3>]	COMMODORE 3	
[<4>]	COMMODORE 4	
[<5>]	COMMODORE 5	
[<6>]	COMMODORE 6	
[<7>]	COMMODORE 7	
[<8>]	COMMODORE 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	
←	←	

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key (Atari logo key on 400/800 models).

Whenever more than two spaces appear in a row, they are listed in a special format. For example, {6 SPACES} means press the space bar six times. Our Commodore listings never leave a single space at the end of a line, instead moving it to the next printed line as {SPACE}.

Amiga program listings contain only one special character, the left arrow (←) symbol. This character marks the end of each program line. Wherever you see a left arrow, press RETURN or move the cursor off the line to enter that line into memory. Don't try to type in the left arrow symbol; it's there only as a marker to indicate where each program line ends.

The Automatic Proofreader

Type in the appropriate program listed below, then save it for future use. The Commodore Proofreader works on the Commodore 128, 64, Plus/4, 16, and VIC-20. Don't omit any lines, even if they contain unfamiliar commands or you think they don't apply to your computer. When you run the program, it installs a machine language program in memory and erases its BASIC portion automatically (so be sure to save several copies before running the program for the first time). If you're using a Commodore 128, Plus/4 or 16, do *not* use any GRAPHIC commands while the Proofreader is active. You should disable the Commodore Proofreader before running any other program. To do this, either turn the computer off and on or enter SYS 64738 (for the 64), SYS 65341 (128), SYS 64802 (VIC-20), or SYS 65526 (Plus/4 or 16). To reenable the Proofreader, reload the program and run it as usual. Unlike the original VIC/64 Proofreader, this version works the same with disk or tape.

On the Atari, run the Proofreader to activate it (the Proofreader remains active in memory as a machine language program); you must then enter NEW to erase the BASIC loader. Pressing SYSTEM RESET deactivates the Atari Proofreader; enter PRINT USR(1536) to reenable it.

The Apple Proofreader erases the BASIC portion of itself after you run it, leaving only the machine language portion in memory. It works with either DOS 3.3 or ProDOS. Disable the Apple Proofreader by pressing CTRL-RESET before running another BASIC program.

The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor, letting you enter, edit, list, save, and load programs that you type. Type RUN to activate. Be sure to leave Caps Lock on, except when typing lowercase characters.

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a hexadecimal number (on the Apple) or a pair of letters (on the Commodore, Atari, or IBM) appears. The number or pair of letters is called a *checksum*.

Compare the value displayed on the screen by the Proofreader with the checksum printed in the program listing in the magazine. The checksum is given to the left of each line number. Just type in the program a line at a time (without the printed checksum), press RETURN or Enter, and compare the checksums. If they match, go on to the next line. If not, check your typing; you've made a mistake. Because of the checksum method used, do not type abbreviations, such as ? for PRINT. On the Atari and Apple Proofreaders, spaces are not counted as part of the checksum, so be sure you type the right number of spaces between quote marks. The Atari Proofreader does not check to see that you've typed the characters in the right order, so if characters are transposed, the checksum still matches the listing. The Commodore Proofreader catches transposition errors and ignores spaces unless they're enclosed in quotation marks. The IBM Proofreader detects errors in spacing and transposition.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader prompts you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program as usual (this replaces the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert an existing BASIC program to Proofreader format, save it to disk with SAVE *"filename"*,A.

Program 1: Atari Proofreader

By Charles Brannon, Program Editor

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:REA
    D A:POKE I,A:CK=CK+A:N
    EXT I
120 IF CK<>19072 THEN ? "E
    rror in DATA Statement
    s.  Check Typing.":END

130 A=USR(1536)
140 ? :? "Automatic Proofr
    eader Now Activated."
150 END
160 DATA 104,160,0,185,26,
    3,201,69,240,7
170 DATA 200,200,192,34,20
    8,243,96,200,169,74
180 DATA 153,26,3,200,169,
    6,153,26,3,162
190 DATA 0,189,0,228,157,7
    4,6,232,224,16
200 DATA 208,245,169,93,14
    1,78,6,169,6,141
210 DATA 79,6,24,173,4,228
    ,105,1,141,95
220 DATA 6,173,5,228,105,0
    ,141,96,6,169
230 DATA 0,133,203,96,247,
    238,125,241,93,6
240 DATA 244,241,115,241,1
    24,241,76,205,238
250 DATA 0,0,0,0,0,32,62,2
    46,8,201
260 DATA 155,240,13,201,32
    ,240,7,72,24,101
270 DATA 203,133,203,104,4
    0,96,72,152,72,138
280 DATA 72,160,0,169,128,
    145,88,200,192,40
290 DATA 208,249,165,203,7
    4,74,74,74,24,105
300 DATA 161,160,3,145,88,
    165,203,41,15,24
310 DATA 105,161,200,145,8
    8,169,0,133,203,104
320 DATA 170,104,168,104,4
    0,96
```

Program 2: IBM Proofreader

By Charles Brannon, Program Editor

```
10 'Automatic Proofreader Vers
   ion 3.0 (Lines 205,206 adde
   d/190 deleted/470,490 chang
   ed from V2.0)
100 DIM L$(500),LNUM(500):COLO
    R 0,7,7:KEY OFF:CLS:MAX=0:
    LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,C
    HR$(4)+CHR$(70):ON KEY(15)
     GOSUB 640:KEY (15) ON:GOT
    O 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PR
    INT"Proofreader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT
    (LEN(L$)/W)-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POK
    E 1052,34:POKE 1054,0:POKE
     1055,79:POKE 1056,13:POKE
     1057,28:LINE INPUT L$:DEF
     SEG:IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$
    =MID$(L$,2):GOTO 170
```

```
180 IF VAL(LEFT$(L$,2))=0 AND
    MID$(L$,3,1)=" " THEN L$=M
    ID$(L$,4)
200 IF ASC(L$)>57 THEN 260 'no
     line number, therefore co
    mmand
205 BL=INSTR(L$," "):IF BL=0 T
    HEN BL$=L$:GOTO 206 ELSE B
    L$=LEFT$(L$,BL-1)
206 LNUM=VAL(BL$):TEXT$=MID$(L
    $,LEN(STR$(LNUM))+1)
210 IF TEXT$="" THEN GOSUB 540
    :IF LNUM=LNUM(P) THEN GOSU
    B 560:GOTO 150 ELSE 150
220 CKSUM=0:FOR I=1 TO LEN(L$)
    :CKSUM=(CKSUM+ASC(MID$(L$,
    I))*I) AND 255:NEXT:LOCATE
     Y,1:PRINT CHR$(65+CKSUM/1
    6)+CHR$(65+(CKSUM AND 15))
    +" "+L$
230 GOSUB 540:IF LNUM(P)=LNUM
    THEN L$(P)=TEXT$:GOTO 150
    'replace line
240 GOSUB 580:GOTO 150 'insert
     the line
260 TEXT$="":FOR I=1 TO LEN(L$
    ):A=ASC(MID$(L$,I)):TEXT$=
    TEXT$+CHR$(A+32*(A>96 AND
    A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," ")
    :COMMAND$=TEXT$:ARG$="":IF
     DELIMITER THEN COMMAND$=L
    EFT$(TEXT$,DELIMITER-1):AR
    G$=MID$(TEXT$,DELIMITER+1)
     ELSE DELIMITER=INSTR(TEXT
    $,CHR$(34)):IF DELIMITER T
    HEN COMMAND$=LEFT$(TEXT$,D
    ELIMITER-1):ARG$=MID$(TEXT
    $,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 4
    10
290 OPEN "scrn:" FOR OUTPUT AS
     #1
300 IF ARG$="" THEN FIRST=0:P=
    MAX-1:GOTO 340
310 DELIMITER=INSTR(ARG$,"-"):
    IF DELIMITER=0 THEN LNUM=V
    AL(ARG$):GOSUB 540:FIRST=P
    :GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIM
    ITER)):LAST=VAL(MID$(ARG$,
    DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST
    =P:LNUM=LAST:GOSUB 540:IF
    P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(S
    TR$(LNUM(X)),2)+" "
350 IF CKFLAG=0 THEN A$="":GOT
    O 370
360 CKSUM=0:A$=N$+L$(X):FOR I=
    1 TO LEN(A$):CKSUM=(CKSUM+
    ASC(MID$(A$,I))*I) AND 255
    :NEXT:A$=CHR$(65+CKSUM/16)
    +CHR$(65+(CKSUM AND 15))+"
    "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN O
    PEN "lpt1:" FOR OUTPUT AS
    #1:GOTO 300
420 IF COMMAND$="CHECK" THEN C
    KFLAG=1:GOTO 290
430 IF COMMAND$<>"SAVE" THEN 4
    50
440 GOSUB 600:OPEN ARG$ FOR OU
    TPUT AS #1:ARG$="":GOTO 30
    0
450 IF COMMAND$<>"LOAD" THEN 4
    90
460 GOSUB 600:OPEN ARG$ FOR IN
    PUT AS #1:MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPU
    T #1,L$:BL=INSTR(L$," "):B
    L$=LEFT$(L$,BL-1):LNUM(P)=
    VAL(BL$):L$(P)=MID$(L$,LEN
    (STR$(VAL(BL$)))+1):P=P+1:
    WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INP
    UT "Erase program - Are yo
    u sure";L$:IF LEFT$(L$,1)=
    "y" OR LEFT$(L$,1)="Y" THE
    N MAX=0:LNUM(0)=65536!:GOT
    O 130:ELSE 130
500 IF COMMAND$="BASIC" THEN C
    OLOR 7,0,0:ON ERROR GOTO 0
    :CLS:END
510 IF COMMAND$<>"FILES" THEN
    520
515 IF ARG$="" THEN ARG$="A:"
    ELSE SEL=1:GOSUB 600
517 FILES ARG$:GOTO 130
520 PRINT"Syntax error":GOTO 1
    30
540 P=0:WHILE LNUM>LNUM(P) AND
     P<MAX:P=P+1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:L
    NUM(X)=LNUM(X+1):L$(X)=L$(
    X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1
     STEP -1:LNUM(X)=LNUM(X-1)
    :L$(X)=L$(X-1):NEXT:L$(P)=
    TEXT$:LNUM(P)=LNUM:RETURN
600 IF LEFT$(ARG$,1)<>CHR$(34)
     THEN 520 ELSE ARG$=MID$(A
    RG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34)
     THEN ARG$=LEFT$(ARG$,LEN(
    ARG$)-1)
620 IF SEL=0 AND INSTR(ARG$,".
    ")=0 THEN ARG$=ARG$+".BAS"
630 SEL=0:RETURN
640 CLOSE #1:CKFLAG=0:PRINT"St
    opped.":RETURN 150
650 PRINT "Error #";ERR:RESUME
     150
```

Program 3: Commodore Proofreader

By Philip Nelson, Assistant Editor

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
    ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

Program 4: Apple Proofreader

By Tim Victor, Editorial Programmer

```
10 C = 0: FOR I = 768 TO 768 +
   68: READ A:C = C + A: POKE I
   ,A: NEXT
20 IF C < > 7258 THEN PRINT "ER
   ROR IN PROOFREADER DATA STAT
   EMENTS": END
30 IF PEEK (190 * 256) < > 76 T
   HEN POKE 56,0: POKE 57,3: CA
   LL 1002: GOTO 50
40 PRINT CHR$ (4);"IN#A$300"
50 POKE 34,0: HOME : POKE 34,1:
    VTAB 2: PRINT "PROOFREADER
   INSTALLED"
60 NEW
100 DATA 216,32,27,253,201,141
110 DATA 208,60,138,72,169,0
120 DATA 72,189,255,1,201,160
130 DATA 240,8,104,10,125,255
140 DATA 1,105,0,72,202,208
150 DATA 238,104,170,41,15,9
160 DATA 48,201,58,144,2,233
170 DATA 57,141,1,4,138,74
180 DATA 74,74,74,41,15,9
190 DATA 48,201,58,144,2,233
200 DATA 57,141,0,4,104,170
210 DATA 169,141,96
```

©

Managing Files From Atari ST BASIC

William Sanders

This excerpt from COMPUTE! Books' new title The Elementary Atari ST *demonstrates how to work with the disk system and how to create sequential text files and random access files. A simple program for keeping and updating an address book illustrates various file-handling techniques.*

While programming, you will often find that subroutines which you wrote for one application can be used in subsequent programs with no modifications or with minor changes. ST BASIC provides the MERGE command so that you can transfer these subroutines between programs without retyping them. You have to make sure your subroutines do not contain the same line numbers as other routines with which they will be MERGEd, but, otherwise, MERGE is a simple procedure. For example, enter and save this program:

```
10 CLEARW 2 : FULLW 2
20 FOR X = 1 TO 110 STEP 10
30 NA$ = "NAME# " + STR$(X)
40 GOSUB 200
50 NEXT
60 END
```

Now enter:

```
SAVE "PART1"
```

After you have done that, enter NEW and do the next program.

```
200 REM ****************
210 REM CENTERING ROUTINE
220 REM ****************
230 L = 40 -INT( LEN(NA$)/2 )
240 PRINT TAB(L)NA$
250 RETURN
```

Next enter:

```
SAVE "PART2"
```

You now have two programs saved as files. Neither program will work by itself. If you tried to load them with the LOAD or OLD command, as soon as you loaded the second one, the first one would be wiped out. However, with the MERGE command, you can load them separately. Once they are both loaded, you can run the combined program, and, if you want, you can even save it as a BAS file. Key in this sequence:

```
MERGE "PART1"
MERGE "PART2"
RUN
```

At this point everything should work just fine. Now enter:

```
SAVE "COMBINE"
```

You now have a BASIC file made up of the two combined files. As you collect useful subroutines, you can keep a record of their line number ranges, and it will be possible to write a program simply by MERGEing several subroutines.

Sequential Text Files

Of the two kinds of text files we will discuss, sequential files are simpler to work with. Random access files are a little trickier, but can be accessed faster than sequential files. Using sequential and random access files, it is possible to enter data from a program and store it as a text file. You can add to it, change it, and retrieve data from the file.

Creating sequential files. The first step is to write a *formatting program* which will create a sequential file. To create a file:

```
OPEN "O",File#,"FILENAME"
PRINT# or PRINT# USING or WRITE#
CLOSE
```

These statements take care of ev-

erything we need in a sequential file.

Now let's begin writing our address book program, which will store the names of a known number of people who sent us Christmas cards. (Then next Christmas we can check the file to see to whom we should send cards.)

```
10 FULLW 2 : CLEARW 2
20 GOTOXY 1,10 : INPUT "HOW MANY
   ENTRIES";N%
30 DIM NA$(N%) : CLEARW 2
40 FOR X=1 TO N%
50 GOTOXY 1,10 : PRINT "NAME#
   ";X;SPACE$(40)
60 GOTOXY 9,10 : INPUT NA$(X)
70 NEXT X
100 REM ******************************
110 REM PUT DATA INTO SEQUEN-
    TIAL FILE
120 REM ******************************
130 OPEN "O",#1,"XMAS.DAT"
140 FOR X=1 TO N%
150 PRINT#1,NA$(X)
160 NEXT X
170 CLOSE
```

After you enter the program, run it, and remember the number of names you entered. Save the program under the name MAKEFILE; we will come back to it later. Enter *FILES* from BASIC to make sure there is a file called XMAS.DAT that was created by our MAKEFILE program.

The next step is to read our files, using:

```
OPEN "I","FILENAME"
INPUT# or LINE INPUT#
EOF check
CLOSE
```

The next program will OPEN XMAS, INPUT the file, check EOF (end-of-file), CLOSE the file, and then PRINT out the contents to the screen. Notice the similarities and differences between it and our previous program for writing files:

```
10 FULLW 2 : CLEARW 2
20 REM ************************
30 REM READ FROM SEQUENTIAL
   FILE
40 REM ************************
50 OPEN "I",#1,"XMAS.DAT"
60 WHILE NOT EOF(1)
70 INPUT#1,NA$
80 PRINT NA$
90 WEND
100 CLOSE
```

After you run the program, save it under the filename READFILE. Using the EOF function, you do not have to know the number of files you entered. If there are more files, EOF(1) (with 1 being the file number), then the value of NOT EOF(1) will equal 0. If the value of NOT EOF(1) is equal to −1, then the program has found the end-of-file.

Using the WHILE–WEND statement, we check for the case where EOF is *not* true. When this condition is met, the program exits the loop. Notice that as soon as we INPUT# the data from the XMAS file, we printed it to the screen using the normal PRINT statement.

Appending sequential files. So far, so good. We have a program that outputs a list of names into a data file and one that inputs those names back to us. What happens, though, if we want to add some names to our file? Some versions of BASIC have an Append statement along with Open and Input. However, while ST BASIC does not have such a statement, it is a simple matter to append a sequential file. It involves two steps:

1. Count the number of elements in a file and put them into an array.
2. Enter the new elements at the end of the array, and overwrite the old file with the combined data in the array.

```
10 FULLW 2 : CLEARW 2
20 REM ************************
30 REM READ FROM SEQUENTIAL
   FILE
40 REM ************************
50 INPUT "HOW MANY NEW NAMES
   TO ADD";NN
60 OPEN "I",#1,"XMAS.DAT"
70 WHILE NOT EOF(1)
80 INPUT#1,NA$
90 N=N+1
100 WEND
110 CLOSE
200 REM ********************
210 REM LOAD DATA INTO ARRAY
220 REM ********************
230 OPEN "I",#1,"XMAS.DAT"
240 DIM NA$(N+NN)
250 FOR X=1 TO N
260 INPUT#1,NA$(X)
270 NEXT
280 CLOSE
300 REM ************
310 REM ADD NEW DATA
320 REM ************
330 FOR X=1 TO NN
340 INPUT "NAME PLEASE";NA$(X+N)
350 NEXT
400 REM ********************
410 REM COMBINE OLD AND NEW
420 REM ********************
430 N%=N+NN
440 OPEN "O",#1,"XMAS.DAT"
450 FOR X=1 TO N%
460 PRINT#1,NA$(X)
470 NEXT
480 CLOSE
```

You can use this method of appending files for simple record keeping. If you're really ambitious, it is not too difficult to edit the array while it is in memory and change the data. However, we will soon be discussing random access files, and the random files are probably better suited for creating files that will require a good deal of manipulation.

Now we've seen how to output and input elements of a single file. However, since filenames are essentially nothing but strings, we could use variables to do much of the work automatically. This next example, "File Manager," will create, append, and read any text file you want. It handles only a single string element, but you can change that if you want. Save the program under the name FILEMAN.

A shortcut. FILEMAN is relatively long, but certain parts of it are very similar to earlier routines we have written. Rather than retyping everything, we will use the MERGE, EDIT, and RENUM functions. First, enter lines 10–120 from FILEMAN below, the MENU block, and save these lines as FILEMAN. Load MAKEFILE, your program to create sequential files. Then enter:

```
RENUM 130,10
```

and then enter:

```
MERGE FILEMAN
```

Compare the listings of previous programs we have written to each block in the following listing. When you find a match, follow the procedure described above to merge the routines into their proper places in FILEMAN as you build your File Manager program.

File Manager

```
10 REM ****
20 REM MENU
30 REM ****
40 FULLW 2 : CLEARW 2 : RESTORE :
   CLEAR
50 FOR X=1 TO 4 : READ CHOICE$
60 GOTOXY 5,X*3 : PRINT X;".
   ";CHOICE$
70 NEXT X
80 GOTOXY 3,17 : PRINT "CHOOSE BY
   NUMBER";
90 A$=INPUT$(1) : A=VAL(A$)
100 ON A GOSUB CREATE,APPEND,
    VIEW, EXIT
```

```
110 DATA CREATE NEW FILE,ADD TO
    FILE,READ FILE,QUIT
120 GOTO 40
130 REM ***************
140 REM CREATE NEW FILE
150 REM ***************
160 CREATE:
170 FULLW 2 : CLEARW 2
180 INPUT "NAME OF FILE";NF$
190 GOTOXY 1,10 : INPUT "HOW
    MANY ENTRIES";N%
200 DIM NA$(N%) : CLEARW 2
210 FOR X=1 TO N%
220 GOTOXY 1,10 : PRINT "NAME#
    ";X;SPACE$(40)
230 GOTOXY 9,10 : INPUT NA$(X)
240 NEXT X
250 REM ****************************
260 REM PUT DATA INTO SEQUEN-
    TIAL FILE
270 REM ****************************
280 OPEN "O",#1,NF$
290 FOR X=1 TO N%
300 PRINT#1,NA$(X)
310 NEXT X
320 CLOSE
330 RETURN
340 REM ********************
350 REM ADD TO EXISTING FILE
360 REM ********************
370 APPEND:
380 FULLW 2 : CLEARW 2
390 REM ***********************
400 REM READ FROM EXISTING FILE
410 REM ***********************
420 INPUT "NAME OF FILE TO
    APPEND";NF$
430 INPUT "HOW MANY NEW NAMES
    TO ADD";NN
440 OPEN "I",#1,NF$
450 WHILE NOT EOF(1)
460 INPUT#1,NA$
470 N=N+1
480 WEND
490 CLOSE
500 REM ********************
510 REM LOAD DATA INTO ARRAY
520 REM ********************
530 OPEN "I",#1,NF$
540 DIM NA$(N+NN)
550 FOR X=1 TO N
560 INPUT#1,NA$(X)
570 NEXT
580 CLOSE
590 REM ************
600 REM ADD NEW DATA
610 REM ************
620 FOR X=1 TO NN
630 INPUT "NAME PLEASE";NA$(X+N)
640 NEXT
650 REM ********************
660 REM COMBINE OLD AND NEW
670 REM ********************
680 N%=N+NN
690 OPEN "O",#1,NF$
700 FOR X=1 TO N%
710 PRINT#1,NA$(X)
720 NEXT
730 CLOSE
740 RETURN
750 REM ************************
760 REM READ FROM SEQUENTIAL
    FILE
770 REM ************************
780 VIEW:
790 FULLW 2 : CLEARW 2
800 INPUT "FILE TO READ";NF$
810 OPEN "I",#1,NF$
820 WHILE NOT EOF(1)
830 INPUT#1,NA$
840 PRINT NA$
850 WEND
860 CLOSE
870 PRINT :PRINT "HIT ANY KEY TO
    RETURN TO MENU"
880 W$=INPUT$(1)
890 RETURN
900 REM ************
910 REM QUIT PROGRAM
920 REM ************
930 EXIT:
940 END
```

Hand Me A Line

LINE INPUT and LINE INPUT # can be very handy commands for reading and writing sequential files. For example, let's say you want to enter a name, address, and phone number into an array, store the array on disk, and later read it back. With LINE INPUT, it is possible to use a single string or string array variable to put all that information in at once. Likewise, when retrieving information from the disk, you can get a whole line by using LINE INPUT #.

This is especially useful when you are reading a file with an unknown format. For example, let's say that you want to read the contents of a disk, but don't know whether it is composed of strings or numeric values, and you don't know their order. By using LINE INPUT # and a string variable, you can read the file line by line rather than variable by variable.

To see how LINE INPUT works, enter the following program. When you run it, be sure to include commas between the name, address, and phone number. Unlike the INPUT statement, commas entered from the keyboard when using LINE INPUT will not result in an error message.

```
10 REM **********
20 REM LINE INPUT
30 REM **********
40 FULLW 2 : CLEARW 2
50 GOTOXY 5,5 : INPUT "HOW MANY
    ENTRIES";N%
60 DIM NAP$(N%)
70 CLEARW 2
80 FOR X = 1 TO N%
90 LINE INPUT "Name, Address, Phone
    ";NAP$(X)
100 NEXT X
200 REM ***********************
210 REM PRINT RESULTS TO SCREEN
220 REM ***********************
230 CLEARW 2
240 FOR X = 1 TO N%
250 PRINT NAP$(X)
260 NEXT
```

The program does not do anything with files, but it would be a simple matter to have it PRINT # to the disk instead of to the screen. Change the block beginning at line 200 to write the file to disk. The name, address, and phone are in one string with the delimiters preserved.

Now, we're going to write information to disk using several variables, and then, using LINE INPUT #, we are going to read the disk with a single string variable. This will show you how to read a line of variables that were stored either as separate variables or as a single LINE INPUTed variable.

```
10 FULLW 2 : CLEARW 2
20 GOTOXY 5,5 : INPUT "HOW MAN
    Y ENTRIES";N%
30 GOTOXY 5,5 : PRINT SPACE$(40): DI
    M NA$(N%),AD$(N%),PH$(N%)
40 FOR X=1 TO N%
50 INPUT "NAME";NA$(X)
60 INPUT "ADDRESS";AD$(X)
70 INPUT "PHONE";PH$(X)
80 NEXT X
100 REM **************
110 REM OUTPUT TO DISK
120 REM **************
130 OPEN "O",#1,"NAMEAD"
140 FOR X=1 TO N%
150 PRINT#1,NA$(X);",";AD$(X);",";PH$(
    X)
160 NEXT X
170 CLOSE
200 REM ********************
210 REM READ WITH LINE INPUT#
220 REM ********************
230 CLEARW 2 : GOTOXY 5,5 : PRINT "Hi
    t any key to continue";
240 AN$=INPUT$(1) : CLEARW 2
250 OPEN "I",#1,"NAMEAD"
260 ON ERROR GOTO 300
270 LINE INPUT#1,NAP$
280 PRINT NAP$
290 GOTO 270
300 CLOSE
310 LOOK$=INPUT$(1)
320 END
```

As you saw when the program executed, the variables, along with their printed format established in line 150, were read and displayed with a single string variable. This is where LINE INPUT # can save time and guessing. Of course, it would have been even simpler to use LINE INPUT when we entered the information originally, but the program was designed to show you how LINE INPUT # works when reading files created with several variables.

We also introduced another way to determine the end of a file. While the EOF statement is the preferred method, you can also use ON ERROR GOTO to jump out of

an error. When the *end-of-file* error occurs, the program jumps to the line that CLOSEs the file. Be careful in using ON ERROR GOTO, because there will be times when some bug in your program will cause an error rather than the error condition you intended to trap for.

PRINT # USING And Files

A final way to store information on disks is with PRINT # USING, which sends data to the disk much like the PRINT USING statement outputs to the screen. The format is slightly different, but the statement works essentially the same way. PRINT # USING is very handy in programs which process formatted numeric data:

```
10 REM ******************
20 REM ENTER NUMERIC DATA
30 REM ******************
40 FULLW 2 : CLEARW 2
50 GOTOXY 5,5 : INPUT "HOW MAN
   Y ENTRIES";N%
60 GOTOXY 5,5 : PRINT SPACE$(20) : DI
   M AMOUNT(N%)
70 FOR X=1 TO N%
80 GOTOXY 10,5 : PRINT SPACE$(2
   0) : GOTOXY 5,5 :INPUT "HOW MUC
   H";AMOUNT(X)
90 NEXT X
100 REM ******************************
    ***
110 REM WRITE TO DISK WITH PRIN
    T #, USING
120 REM ******************************
    ***
130 GOTOXY 5,5 : PRINT SPACE$(20)
140 OPEN "O",#1,"EXPENSES"
150 FOR X=1 TO N%
160 TOTAL=TOTAL+AMOUNT(X)
170 PRINT #1, USING "####.##";AM
    OUNT(X),TOTAL
180 NEXT X
190 CLOSE
200 PRINT "Hit any key" : LOOK$=INP
    UT$(1)
```

When you read your file, all of the data will be formatted for you. Instead of using the variables you originally employed, use LINE INPUT #. Thus, the following program will read and display your information as you wrote it to disk:

```
300 OPEN "I",#1,"EXPENSES"
310 ON ERROR GOTO 350
320 LINE INPUT#1,EXPENSE$
330 PRINT EXPENSE$
340 GOTO 320
350 CLOSE
360 PRINT "Hit any key" : LOOK$=
    INPUT$(1)
```

Random Access Files

Random access files are like containers of equal size into which you store data. You first decide how big a container you will need, based on the maximum size of the material you will be putting in the box. Each character in a string takes one byte. Therefore, if your maximum length for a given string is ten, it will be necessary to allocate a total of ten bytes. With numbers, storage is different. Here's a chart for quick reference on how much memory space to allocate for the different kinds of data:

Type	Allocation
String	1 byte per character
Integer	2 bytes per number
Single-precision	4 bytes per number
Double-precision	8 bytes per number

All entries into a random access file must be in string format, including numbers; we will examine the functions for doing that later. For now, we will concentrate on entering data as normal strings.

For the most part, the process of creating and reading random access files looks very much like sequential files, but there are important differences. For instance, when you OPEN a random access file, you must include the length of the file. First, as we did with sequential files, we OPEN the file and place the filename in quotes. However, instead of writing the mode, we indicate the file number and the length of our file. Here is the format:

```
OPEN "R",#1,"NAMEFI",128
```

With this statement we can either write to the disk file or read from it. Unlike with sequential files, we do not indicate whether the mode is output or input when we OPEN a random access file.

Random access files can be undivided or divided. Undivided files use the same length for every entry. For the most part, it is pointless to use undivided files unless you are entering a single field, such as a list of names with no other information, or when you put all the information into a single string as we did with LINE INPUT #. It is more useful to divide random access files into sections called *fields*, with each field having a maximum length. The FIELD statement expects a file number, width, and string variable:

```
FIELD #1, 20 AS A$, 10 AS B$, 2 AS C$
```

The above statement sets the width of A$ to 20, B$ to 10, and C$ to 2. When the file is OPENed, the LENgth value (the last value entered in the OPEN statement) must equal the sum of the FIELD values. In the above example, the length must be 20 + 10 + 2 = 32. When OPENing the R file (R is used for both input and output), the last value would be 32.

```
OPEN "R",#1,"FILENAME",32
```

To illustrate using random access files, let's modify our address book program. We will call the file we create HOMETOWN, using three strings. Before we can enter the data into a random access file, we have to use the LSET statement to store our records in their respective fields. Moreover, the variable names we LSET cannot be the same ones we INPUT. Therefore, we have two sets of variables, one for INPUT and one for LSET. The nice thing about LSET is that it automatically pads the strings with sufficient spaces to fit the field exactly, or it truncates the string if it is too long.

Here is a list of our variable names:

NA$ for a person's name	LSET = N$
CT$ for the city's name	LSET = C$
SC$ for the state's mailing code	LSET = S$

Since we'll be dealing with the names of people and cities and thus the fields will be of differing lengths, we'll have to decide on a maximum-size name. Longer names will be truncated to this specified size. This process is extremely important in working with random access files since we are limited to the number of bytes specified when we OPEN a file. Without the truncate feature, entries over the maximum length would spill over into the next record. Therefore, we will limit the length of a name to 20, a city to 10, and states to the two-character abbreviations employed by the post office:

N$	= 20
C$	= 10
S$	= 2
Total	= 32

Using these values, we can now write a program to enter a

single record into a random access file:

```
10 CLEARW 2 : NR%=1
20 GOTOXY 1,4 : INPUT "NAME";NA$
30 GOTOXY 1,6 : INPUT "CITY";CT$
40 GOTOXY 1,8 : INPUT "STATE
   CODE";SC$
100 REM *****************
110 REM WRITE SINGLE RECORD
120 REM *****************
130 OPEN "R",#1,"HOMETOWN",32
140 FIELD #1, 20 AS N$,10 AS C$,2 AS
    S$
150 LSET N$=NA$
160 LSET C$=CT$
170 LSET S$=SC$
180 PUT #1,NR%
190 CLOSE
200 END
```

That was a lot of work to enter one simple record, but be patient and we will do more. Now, we will GET# a record from a random access file. As in writing to random access files, we must OPEN the file with a specified length and read it in terms of a specified record. The following program will read record 1 in the HOMETOWN file:

```
10 CLEARW 2 : NR%=1
20 REM *****************
30 REM READ SINGLE RECORD
40 REM *****************
50 OPEN "R",#1,"HOMETOWN",32
60 FIELD #1, 20 AS N$,10 AS C$,2 AS S$
70 GET #1,NR%
80 PRINT N$:PRINT C$;",";S$
90 CLOSE
100 END
```

We had to write quite a lot just to write and read a single record, but this illustrates how random access files operate. Now we can deal with multiple records with our HOMETOWN example.

Our next task is to create a *sequential* file to keep track of our pointers in the random access file. Basically, a pointer routine will check the sequential file and tell us which record number was the last one we wrote, and then it will move the pointer to the next record number. For instance, if there are ten records in a random access file, we want the pointer 10 to be stored somewhere we can easily get it. When we want to add to a random access file, we can then find the value 10, add 1 to it, and begin writing our record at position 11. We will call this file HOMEPOINT.

```
10 CLEARW 2: GOTOXY 1,1
20 INPUT "How many new entries";NE%
30 FOR X=1 TO NE%
40 GOTOXY 4,4 : PRINT SPACE$(25) : GO
   TOXY 1,4 : INPUT "NAME";NA$
50 GOTOXY 4,6 : PRINT SPACE$(25) : GO
   TOXY 1,6 : INPUT "CITY";CT$
60 GOTOXY 7,8 : PRINT SPACE$(25) : GO
   TOXY 1,8 : INPUT "STATE CODE";S
   C$
70 IF X=1 THEN GOSUB 100 ELSE GOS
   UB 200
80 NEXT X
90 GOTO 400
100 REM *****************
110 REM FIND LAST POINTER
120 REM *****************
130 OPEN "I",#1,"POINT"
140 INPUT #1,POINTER%
150 CLOSE
200 REM *****************
210 REM WRITE RANDOM FILE
220 REM *****************
230 POINTER%=POINTER%+1
240 OPEN "R",#2,"HOMETOWN",32
250 FIELD #2, 20 AS N$,10 AS C$,2 A
    S S$
260 LSET N$=NA$
270 LSET C$=CT$
280 LSET S$=SC$
290 PUT #2,POINTER%
300 CLOSE
310 RETURN
400 REM **************
410 REM UPDATE POINTER
420 REM **************
430 OPEN "O",#1,"POINT"
440 PRINT#1,POINTER%
450 CLOSE
460 END
```

The first time you run this program, you must *initialize* the POINT file. To do this, enter GOTO 400 the first time you run the program.

Now that we have several records in our file, we will need a way to get them out again. Here's where our counter variable POINTER comes in handy. First, we will read POINTER to see how many records there are and then loop through the records to GET# them all. Notice that in line 60, we first INPUT#1 POINTER and after INPUTing it into memory, it is used in the FOR-NEXT loop in line 150 to pull all the records out.

```
10 FULLW 2 : CLEARW 2
20 REM *****************
30 REM FIND LAST POINTER
40 REM *****************
50 OPEN "I",#1,"POINT"
60 INPUT #1,POINTER%
70 CLOSE
100 REM *****************
110 REM READ RANDOM FILE
120 REM *****************
130 OPEN "R",#2,"HOMETOWN",32
140 FIELD #2, 20 AS N$,10 AS C$,2 AS
    S$
150 FOR X=1 TO POINTER%
160 GET #2,X
170 PRINT N$:PRINT C$;",";S$:PRINT
180 NEXT
190 CLOSE
200 LOOK$=INPUT$(1)
```

By adding a few lines and calculating a few more bytes, you can expand our example program into a very useful, customized address list. The program already enters names, cities, and states. All you have to add are addresses and zip codes, and there you have it. By attaching a subroutine to send it to your printer, you could generate your own mailing list program.

More File-Handling Commands

Most file applications deal with strings, but there are many applications which require the use of numbers instead. Instead of using STR$ to convert numbers into strings, we can use MKI$, MKS$, and MKD$. The *I*, *S*, and *D* in the commands stand for Integer, Single-precision, and Double-precision number conversions. Unfortunately, these conversions translate your numbers into ASCII code, so you have to convert them back to numbers using CVI, CVS, and CVD before you use them in arithmetic operations.

Let's see how they are used with files. First, create a numeric variable TOTAL. For a single-precision number, TOTAL would take four bytes, or two for integers and eight for double precision. We will call our string SUM$, so we would define our FIELD as:

```
FIELD #2, 4 AS SUM$
```

Then with LSET, we would put:

```
LSET SUM$ = MKS$(TOTAL)
```

Finally, once we read SUM$ from our file, if we want to reconvert it to a numeric variable, we would enter:

```
TOTAL = CVS(SUM$)
```

By making the conversions to and from string and numeric variables, we can store strings in random access files, yet use numeric variables in programs where the values are used as real numbers. This applies only to random access files, for we saw how we could store and update numeric variables in sequential files with no conversions.

There is a great deal more you can do with files; this introductory look at them just scratches the surface. It is possible to make database systems that search for individual records, change individual records, sort records, and more. ©

BASIC Equivalents In C

Harley M. Templeton

One of the hottest programming topics these days is the C language. C is the language of choice for many professional programmers because it's easy to write and produces compact, efficient machine language code. Another plus is that C programs are easy to transport from one computer to another. For those who may be new to C, here's an article that describes similarities between BASIC and C. It's excerpted from a chapter in From BASIC To C, *currently available from COMPUTE! Books.*

From a beginner's viewpoint, one of the reassuring aspects of the C language is that it has many things in common with BASIC. You can write a large part of your C program using statements that are just like or very similar to BASIC statements. Of course, they have no line numbers, are written with lowercase letters, and end with a semicolon. But they use the same keywords as BASIC statements, and perform the same or nearly the same operations. These are the C language statements that are equivalent to BASIC statements:

1. Assignment statement
2. if statement
3. for loop
4. while loop
5. goto statement

Assignment Statement

The *assignment statement* assigns a value to a variable. The value may be that of a constant, another variable, an expression, or a function. An assignment statement in BASIC is:

```
100 ITEM = 4875
```

The C equivalent is:

```
item = 4875;
```

Same thing ... almost. BASIC is very secretive about the *type* of a variable. ITEM is automatically assigned single-precision type, and the constant 4875 is assigned integer type. The integer is converted to single precision and stored as a single-precision variable.

C does not assign a type to a variable automatically. The example shown would result in an error message unless it had been preceded by a *declarator*. This particular declarator assigns type **float** to variable *item*:

```
float item;
```

C's **float** variable is identical to the single-precision variable in BASIC. It is a real number providing six to seven digits of precision. The constant is assigned integer type in C also. It's converted to **float** type and stored as the value of *item*.

The statements are the same in both languages. The difference is that C requires you to declare variables, which shows you at a glance which variables you're using and what type they are. Automatic assignment of types in BASIC sometimes provides strange answers; specific declaration of variables in C puts you in the driver's seat.

C, like some versions of BASIC, includes a type of assignment statement that assigns the same value to more than one variable:

```
sum1 = sum2 = sum3 = 0;
```

This statement assigns the value of 0 to variable *sum3* first. Then it assigns the value of *sum3* to variable *sum2*. Last of all, it assigns the value of *sum2* to variable *sum1*. You can use any variable or expression to the right of the rightmost equal sign (instead of the 0).

Here's another example in BASIC:

```
380 AVE = (VAL1 + VAL2 + VAL3) / 3
```

The C language statement is:

```
ave = (val1 + val2 + val3) / 3;
```

The BASIC statement adds three single-precision values, converts the integer 3 to single precision, and performs single-precision division. The result is stored as a single-precision variable.

Assuming that *val1*, *val2*, *val3*, and *ave* have been declared as **float** type, the C statement provides the same result, but in a different way. A C program performs no **float** type computations. Instead, the program that contains this statement converts *val1*, *val2*, *val3*, and integer 3 to type **double**, and performs the computations. Type **double** is a real-number type that provides 16 to 17 digits of precision. When it's converted and stored, the result is more accurate (potentially, at least) than if the result had been type **float**.

If *val1*, *val2*, and *val3* are declared as integers, you should use a **float** type constant:

```
ave = (val1 + val2 + val3) / 3.0;
```

The program adds the integers, converts the sum and constant to type **double**, performs the computations, and converts the result to **float**. Using 3 instead of 3.0 would have caused all the numbers to be treated as integers, and an integer result would have been converted to **float** and stored. This would probably not be accurate enough.

Here's a more complex BASIC statement that includes a function:

```
500 SIDE1 = SIN(A) * HYP
```

The C equivalent is:

```
side1 = sin(a) * hyp;
```

The BASIC example calls the SIN function. Some versions of the interpreter return a double-precision result, but most return a single-precision result. The result is a single-precision value in variable SIDE1.

In C, the result is the same, but the computations are **double** type. The function, however, is in one of the libraries that came with your C compiler. The statement causes the compiler to ask the link program to get the function from the library and include it in your program. The

advantage is that you don't have to use the C compiler or libraries each time you run the program. The library function becomes as much a part of your program as the functions you write and compile.

C assignment statements are very much like BASIC assignment statements. All you need to do is omit the line number, change the letters to lowercase, and add a semicolon.

if Statement

The C **if** statement never needs a "then" and cannot transfer control to another part of the program. It uses parentheses around the relational or logical expression. Otherwise, it is the BASIC IF in lowercase letters and ending with a semicolon. Here's an example in BASIC:

```
450 IF YEAR MOD 4 THEN FEB = 28
    ELSE FEB = 29
```

In C, you'll need four statements:

```
if (year % 4)
   feb = 28;
else
   feb = 29;
```

Both versions use modulo division to identify leap years. The percent sign (%) is the modulo division operator in C. When the result is not zero, the variable *feb* is set to 28. When the result is zero, *feb* is set to 29. Like BASIC, C considers a zero value as false and a nonzero value as true. C replaces the BASIC THEN by using parentheses. Whatever comes after the closing parentheses is considered to be the statement to be executed if the expression is true. Now for the bad news. C has no equivalent for this BASIC statement:

```
500 IF YEAR < 1984 THEN 600 ELSE 650
```

But the news is really not that bad, because C has a better way to do the same thing. In BASIC, line 600 and lines following are statements to be executed for years prior to 1984. Lines 650 and following are statements that apply to subsequent years. In C, you can put those statements right in the **if** statement:

```
if (year < 1984) {
   rate = .25;
   base = 2500;
   surcharge = .50;
   }
else {
   rate = .26;
   base = 2000;
   surcharge = .52;
   }
```

Whatever it is, it went up in 1984. The important thing to notice is the left brace following the parenthesis. This brace is the beginning of a *compound statement*, or *block*, that is executed for years prior to 1984. The right brace ends the block. All the statements you need for years prior to 1984 go right here instead of somewhere else in your program. Similarly, a block following **else** contains the statements for years 1984 and later—all right here together, where you can't miss them.

In BASIC, you can leave off the ELSE when you don't need it:

```
400 IF YEAR > 1983 THEN RATE =
    RATE + .01:BASE
  = BASE - 500: SURCHARGE =
    SURCHARGE + .02
```

You can in C, too:

```
if (year > 1983) {
   rate = rate + .01;
   base = base - 500;
   surcharge = surcharge + .02;
   }
```

You would have to set *rate*, *base*, and *surcharge* to the values that apply before 1984, or this statement would not give you the same answer. If you set the variables to the 1983 values (with assignment statements), this statement is more efficient in either language. In either version, the statement does nothing if the year is 1983 or earlier.

C's **if** statement works like BASIC's IF statement, and it can make your program more readable by including blocks of statements that otherwise would be in some other part of the program.

for Loop

C's **for** loop is much more versatile than BASIC's FOR-NEXT loop.

The BASIC loop starts with a FOR statement and ends with a NEXT:

```
800 SQ = 1: ODD = 1
810 FOR R = 1 TO 15
820 PRINT SQ, R
830 ODD = ODD + 2
840 SQ = SQ + ODD
850 NEXT R
```

The C loop has no need for NEXT:

```
sq = odd = 1;
for (r = 1; r <= 15; r = r + 1) {
   printf("%d     %d\n",sq, r);
   odd = odd + 2;
   sq = sq + odd;
   }
```

Notice that the C statement consists of keyword **for** followed by three expressions enclosed in parentheses and separated by semicolons. The first expression initializes *r*; it corresponds to the FOR R = 1 portion of the BASIC statement. The next expression is evaluated before each repetition of the statements in the loop. This corresponds to the TO 15 portion of the BASIC statement. The third expression is executed for each repetition of the loop, after the last statement. This expression corresponds to the STEP 1 option implied in the BASIC statement.

The loop itself is a block, described in the section on the **if** statement. The loop could consist of a single statement. The statements in this block print 15 perfect squares and their roots without multiplying or calling a square root function. How about that?

Whether the loop consists of a single statement or a compound statement (block), no NEXT statement is needed. Either the semicolon that ends the statement or the brace that encloses the block tells the compiler what belongs in the loop.

The **for** statement of C does not look like the FOR statement of BASIC, but **for** statements like the one shown in this section work exactly like BASIC FOR-NEXT loops.

while Loop

The C **while** loop is similar to the WHILE–WEND loop of BASIC. The C version doesn't need the WEND statement for the same reason that the **for** loop does not need a NEXT. Here's an example from BASIC:

```
250 WHILE N <> 21
260 INPUT N
270 N = N + 5
280 WEND
```

The C version is:

```
while (n != 21) {
   scanf("%d",n);
   n = n + 5;
   }
```

The **while** keyword is followed by an expression within parentheses. In the example, the expression is a relational one, having a true value (1) or a false value (0). Notice that != means not equal

to. The expression could be a numeric expression; in that case, it is considered true when its value is not equal to zero. A zero value is considered false. In either case, the loop is executed as long as the expression is true.

In the C version, the statements of the loop are enclosed in braces and include the **scanf( )** function to accept a decimal number that you type in. These statements are executed until the user types 21; then the loop terminates. In either language, it could happen that typing 21 would not get you out of the loop. This would happen if variable *n* were a real number type and the automatic type conversions introduced a fractional result (21.00001, for example). Declare *n* as an integer to avoid this problem.

Notice the contrast between **for** and **while** loops. The **for** loop initializes, tests, and increments. The **while** loop only tests. The loop must include some way for the variable to acquire the value required for the test. Otherwise, the loop is repeated until you get tired of it and turn off your computer. Here's the **while** loop version of the **for** loop example:

```
r = sq = odd = 1;
while (r <= 15) {
   printf("%d    %d\n",sq, r);
   odd = odd + 2;
   sq = sq + odd;
   r = r + 1;
   }
```

The initialization expression moved to the statement preceding the loop, the incrementing expression moved into the loop, and the keyword changed. Otherwise, the examples are identical.

goto Statement

BASIC's GOTO statement allows you to write unmanageable programs, yet it is unavoidable in many BASIC programs. C's **goto** statement is seldom required. You should avoid using the **goto** statement to keep your programs understandable.

Here's the culprit in BASIC:

```
400 GOTO 450
```

In C:

```
goto there;
```

Since C has no line numbers, the **goto** statement has to be different, but it works the same. However, the program must include a statement with "there" as its label:

```
there:year = year + 1; /* You may
   label any statement */
```

Leave the **goto** statement for use only in dire emergencies.

A Program Example

You can program solutions for many problems using only these statements along with input/output functions. Program 1 demonstrates this with a very simple checkbook balancer.

Notice the first line of the program. It is a *compiler control line*, required for the input/output statements in the example. The number sign (#) of a compiler control line must be in column 1 of the line, the leftmost character position.

The input/output functions required are **printf( )**, which displays prompting messages on the screen, **scanf( )**, which accepts the numbers you type in, and **getche( )**, which accepts a single character from the keyboard and displays it on the screen. The other executable statements, except **return**, are all like BASIC statements. The **return** statement just returns control to the operating system.

The program first asks for the balance and stores it after you type it in. Then it asks if there are any outstanding deposits. Using the familiar **if** statement and the character input function, the program accepts the first character you type and requests a deposit amount if you have typed Y. After displaying the prompting message, the program stores the deposit value and enters a **while** loop. Until you type 0 for the deposit amount, the loop is repeated, adding the deposit to the balance and getting another deposit value.

When you type any letter other than Y (and that includes y), the program skips to process the checks, subtracting each check from the previous balance. When you type 0 (for no more checks), the program displays the balance.

The program is not very user-friendly, because it skips the processing of deposits if you type any letter but Y. It should at least recognize y. It could reject all letters but Y, y, N, and n, telling you to try again.

This program shows that it's possible to program solutions to common problems using only the statements described in this article. But you can do a lot more with C: things that are done differently from BASIC and things you cannot do in BASIC.

Program 1: Checkbook in C

```
#include <stdio.h>
main ( ) /* Balance your checkbook? */
{
double bal, chk, dep;
char in[12];
int c;

printf("Type in statement balance:"); /* Display function */
scanf("%lf", &bal); /* Formatted input function */
printf("Any outstanding deposits? (Y or N) ");
if ((c = getche()) == 'Y') { /* Character input function */
   printf("\nType outstanding deposit: $");
   scanf("%lf", &dep);
   while (dep > 0) {
      bal = bal + dep;
      printf("Type outstanding deposit: $");
      scanf("%lf", &dep);
      }
   }
printf("\nType outstanding check: $");
scanf("%lf", &chk);
while (chk > 0) {
   bal = bal - chk;
   printf("Type outstanding check: $");
   scanf("%lf", &chk);
   }
printf("Your checkbook balance should be $%.2lf",bal);
return;
}
```

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News & Products

Hard Disk For Atari ST

Hard disks for the Atari 520ST and 1040ST in 10-, 20-, 30, and 60-megabyte configurations have been introduced by Supra Corporation. The SupraDrive system connects to the computer's high-speed DMA port and can significantly improve disk transfer speeds. The drive is compatible with TOS and will work with other standard DMA bus peripherals. The ST can be booted directly from the hard disk.

The SupraDrive system, which ranges in price from $799 for the 10 mb system to $1,995 for the 60 mb unit includes format, backup, and partition utilities that allow the user to created up to four separate logical drives for file storage.

Supra Corporation, 1133 Commercial Way, Albany, OR 97321.

Circle Reader Service Number 218.

Supra's hard disk for the Atari ST is available in four sizes.

New Tools For Amiga

Brown-Wagh Publishing has released three new productivity tools for the Amiga, designed by Micro-Systems Software Inc. of Florida.

Analyze! is a spreadsheet program that can be used for financial analysis and planning, bookkeeping, home budgets, check registers, and professional-sized spreadsheets.

Using *OnLine!*, a telecommunications program, you can link up with commercial information services, send Telex messages and electronic mail, and exchange data with other computers. This program comes equipped with user-defined macrokeys to transmit frequently used commands and script files for automated operation.

The electronic bulletin board system, *BBS-PC*, interfaces to a hard disk and a 2400 bps modem. It enables other users to call your Amiga and read messages, leave you messages, send you a file, or take a file you have left for them. *BBS-PC* works in the background so the Amiga can answer the phone while other users are working on their projects.

Analyze! and *BBS-PC* retail for $99.95, and *OnLine!* retails for $69.95.

Brown-Wagh Publishing, 100 Verona Ct., Los Gatos, CA 95030.

Circle Reader Service Number 219.

ST Graphic Arts

Progressive Computer Applications, Inc., has announced *The Graphic Artist*, a graphic arts package for the Atari ST. This software package combines computer-aided design, typesetting, spreadsheet, and word processing capabilities for use with the color graphics features of the ST.

The Graphic Artist Language FiGGAL is an auxiliary package which allows the user to create complex custom applications for *The Graphic Artist*. It offers if-then logic, branching, looping, and variables.

Suggested retail price for *The Graphic Artist* is $495.00, and $245.00 for *The Graphic Artist Language*.

Progressive Computer Applications, Inc., 2002 McAuliffe Dr., Rockville, MD 20851.

Circle Reader Service Number 220.

Adventure Game New For The Mac, ST

Search Transylvania for Princess Sabrina with Penguin Software's graphic adventure game *Transylvania* in a new Macintosh version. You must look through the forest and castle, encounter creatures, and put the clues together in order to find and rescue the princess.

Transylvania now uses the new *Comprehend* advanced parser—the portion of the adventure that analyzes your commands—as well as colorful graphics. It is also available for the Atari ST, Apple II (64K required), and Commodore 64.

The Macintosh version retails for $39.95.

Penquin Software, 830 Fourth Ave., P.O. Box 311, Geneva, IL 60134.

Circle Reader Service Number 221.

Educational Software

Learning Technologies has released ten educational software packages for pre-kindergarten through grade six. All software is compatible with the Apple II-series and Commodore 64 and 128.

For preschool through grade two:

Animal Hotel develops specific recall, visual memory, visual discrimination, and analysis of the whole.

Bike Hike develops specific recall and visual memory, number recognition, and counting and visual discrimination.

Lion's Workshop also develops skills in visual discrimination as well as pattern recognition and analysis of part-whole relationships.

Visual discrimination, matching, observation, and deductive reasoning skills are developed in *Same or Different.*

Both *Shutterbug's Pictures* and *Shutterbug's Patterns* develop skills in visual discrimination and analysis of part-whole relationships, while *Patterns* adds pattern recognition.

For ages eight and above:

Number Please develops specific recall and sequential memory.

Thinking skills such as observing details, comparing and contrasting, classifying, defining a problem, determining a solution, and evaluating outcomes are developed in *Gremlin Hunt.*

Pipeline teaches such thinking skills as defining a problem, experimenting with possible solutions, evaluating outcomes, recognizing patterns, and determining part-whole relationships.

For math instruction for preschool through sixth grade:

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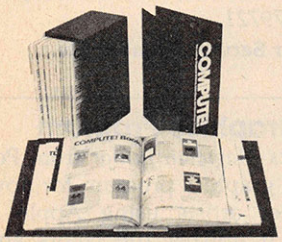

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Each program retails for $19.95 and includes a redemption card for a free *Learning Kit*. The *Learning Kit* includes a color poster, a custom lesson plan, worksheets, a progress chart, and award certificates.

Learning Technologies, 4255 LBJ, Suite 265, Dallas, TX 75244.

Circle Reader Service Number 222.

In Pursuit Of Computer Trivia

King Chip, from XYLYX Computer Entertainment Limited, is a board game designed to test your knowledge in many areas of the computer industry. Similar to *Trivial Pursuit* in format, it contains more than 4,000 questions in six categories: data communications, history and current events, hardware, jargon, and acronyms, potpourri, and software. Questions in each category can be selected from five levels of difficulty, and vary in format among multiple choice, fill-in-the blank, true or false, and one- or two-word answers.

The object of the game is to answer enough questions correctly so that you can attain the throne of King Chip. Once there, you'll have to keep answering correctly to maintain it.

What sets *King Chip* apart from many other trivia-type games is its depth of responses. The back of each question card contains not only each correct answer but, where appropriate, an explanation of the answer. So it's a bit of a tutorial as well as just a game.

King Chip retails for $39.95.

XYLYX Computer Entertainment Limited, 20 Torbay Rd., Markham, Ontario, Canada L3R 1G6.

Circle Reader Service Number 223.

Apple II, Commodore, IBM Telecommunications Package

The Information Connection, from Grolier Electronic Publishing, combines a telecommunications program, text editor, and tutorial software on one disk for the Apple II-series, IBM PC or PCjr, and Commodore 64 or 128 in 64 mode. This package for beginners teaches the fundamentals of telecommunications and features a simulated on-line practice session. There is also an alarm and automatic shut-off to help control telecommunications costs.

Apple and IBM versions retail for $59.95 and the Commodore 64 version costs $39.95.

Grolier Electronic Publishing, Inc., 95 Madison Ave., New York, NY 10016.

Circle Reader Service Number 224.

World Series Baseball

Manage your own baseball team and play the team of your choice with *The World's Greatest Baseball Game* from Epyx, an upgraded version of the popular original. This strategy game features over 75 teams, complete rosters for the 1984 and 1985 seasons, statistics from actual All Star and World Series teams, the ability to trade players, and a scoreboard that asks baseball trivia questions.

Users can custom-design their own teams by picking lineups from actual major league baseball rosters, and then challenge the team of their choice in a championship game.

For the Commodore 64/128, Apple II-series, and IBM at prices ranging from $24.95 to $34.95.

Epyx Computer Software, Inc., Sunnyvale, CA 94089.

Circle Reader Service Number 225.

Two New Teaching Aids

Gamco Industries, Inc. has released two new software packages to help teachers explain calendars and simple geometry. Both packages hold up to 200 student files which automatically record each student's records.

Calendar helps students learn the days and months; seasons, special days, and holidays; and how to use a calendar.

Perimeter, Area, & Volume offers simple geometry formulas and practice in using them. There are several levels in each lesson.

In either package, when the student achieves a certain score, he or she may play an arcade-style game as a reward.

Calendar and *Perimeter, Area, & Volume* are available for $39.95 each for the Apple II-series and the Commodore 64.

Gamco Industries, Inc., Box 1911, Big Spring, TX 79721.

Circle Reader Service Number 226.

Simple Graphics Program

The Graphics Magician Junior from Polarware is a graphics program for novice computer artists using Apple II computers. It utilizes 108 colors and patterns with a wide variety of computer "brushes." Pictures can then be saved to disk or printed out.

Polarware is a division of Penguin software.

Retail price is $34.95.

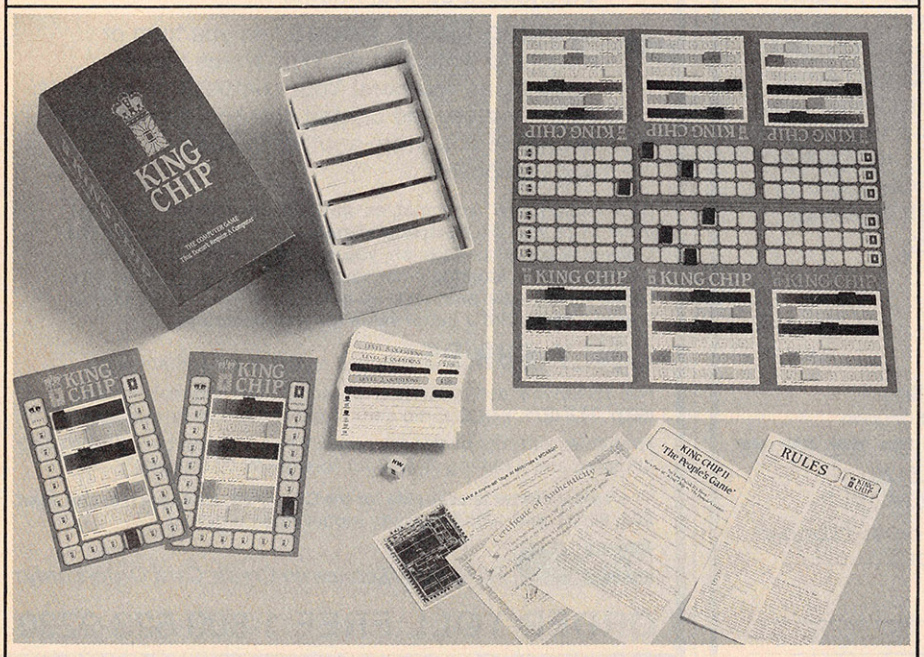
Polarware, 2600 Keslinger Rd., P.O. Box 311, Geneva, IL 60134.

Circle Reader Service Number 227.

Apple Graphics Utilities

Dark Star Systems has designed two printing utilities for Apple II computers.

MousePrintz lets *MousePrint* users print their pictures directly to an Epson or other non-Apple dot-matrix printer, plus offers a menu of screen-editing features, including full-screen viewing, inversion, mirror image, and cropping; rotation, shading, chart recording, and



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automatic centering and adjustment of margins. For the 128K Apple IIe and Apple IIc.

The *ScreenSnapper* is designed for use with *Applesoft* and machine code programs running on the Apple II+, IIe, and IIc. This program lets you print to the screen in a variety of ways, including enlargement, rotation, inversion, and shading. It shows you what a printout will look like before printing. *ScreenSnapper* will not work with copy-protected software.

Suggested retail price for *MousePrintz* is $35.00, and $40.00 for *ScreenSnapper.*

Available from *Greengate Productions, Inc., 204l Pioneer Ct. #15, San Mateo, CA 94403.*

Circle Reader Service Number 228.

256K RAM For The Amiga

A 256K display RAM card for the Amiga installs behind the front panel and expands available memory for programs and graphics to 512K. The card comes with a one year warranty, manual, and schematics. It's designed for compatibility with software and hardware.

Suggested retail price is $120.00

Starpoint Software, 122 South Broadway, Yreka, CA 96097-2902.

Circle Reader Service Number 229.

CompuServe And MCI Interconnect

CompuServe Inc. and MCI Communications Corporation have interconnected their electronic mail services. Subscribers to either of the two systems can instantaneously communicate with each other using the same methods and commands as before. CompuServe's InfoPlex and EasyPlex are both included.

Circle Reader Service Number 230.

High-Level Language For Amiga

Designed by Professor Niklaus Wirth, the creator of Pascal, *Modula-2* is a high-level language which encourages the user to write programs in modules. This method of programming makes it easy to design, write, and maintain software. Programmers familiar with Pascal should be able to learn the language in a few hours.

Modula-2 for the Amiga features full interface to the ROM Kernel, *Intuition,* and AmigaDOS; 32-bit native code implementation; separate compilation of modules with version control; a CODE statement for in-line assembly code; and the ability to quickly locate and identify errors in source code. It also supports transcendental functions and real numbers.

Modula-2, published by TDI Software, is not copy-protected. Suggested retail price for the regular version is $89.95; the developer's version is $149.95. Both come with a 300-page manual.

TDI Software, Inc., 10410 Markison Rd., Dallas, TX 75238.

Circle Reader Service Number 231.

Commemorative Version Of *Mac Challenger*

Profits from the sale of the commemorative version of Aegis Development's *Mac Challenger* flight simulator for the Macintosh will go to the Challenger space shuttle's Children's Fund and Rebuild the Space Shuttle Fund. The commemorative version has a sticker on the front of the package and is dedicated to the seven-member crew of the Challenger space shuttle.

Suggested retail price is $49.95.

Aegis Development Inc., 2210 Wilshire Blvd., #277, Santa Monica, CA 90403.

Circle Reader Service Number 232.

Home Accounting Package For Apple II

Schmidt Enterprises has introduced a sophisticated, easy-to-use accounting package appropriate for use in the home or small business. *The Accountant* can access an unlimited number of transactions, with no limit to the number of accounts and categories used. The user can instantly retrieve, print, or delete any transaction or group of transactions. The Printed Transaction Summary feature allows the user to print and total a selected group of transactions. A profit/loss statement can be created by subtracting debits from credits.

The Accountant comes with a manual containing sample disk files and a tutorial. An on-screen help menu is available at all times. No command phrases are used, as all functions can be activated by a single keypress. The program accesses the disk only for loading the program and saving data, which makes search and retrieval functions execute in seconds.

The Accountant retails for $120.

Schmidt Enterprises, 7448 Newcastle Ave., Reseda, CA 91335.

Circle Reader Service Number 233.

Telecommunications Package For Mac

Software Ventures Corporation has begun shipping *MicroPhone,* a telecommunication program for the Macintosh designed for both novice and experienced computer users.

MicroPhone automates the telecommunications process, allowing the user to do things like access stock quotes hourly or send and receive electronic mail without striking a single key, freeing him or her to do other work simultaneously. The program can record complete telecommunications sessions, remembering any series of keyboard commands and system prompts. The entire sequence can be called up at any later time with a single keystroke.

MicroPhone retails for $74.95, and carries a 30-day unconditional money-back guarantee.

Software Ventures Corporation, 2907 Claremont Ave., Suite 220, Berkeley, CA 94705.

Circle Reader Service Number 234.

Penmanship Practice On Your Computer Screen

Beginning writers quickly get the "feel" of correct letter formation with *Touch 'n Write,* a new penmanship program that lets students practice handwriting directly on the computer screen. A complete 23-lesson curriculum based on the Palmer Method of manuscript writing, the program operates with the Touch Window, a portable touch screen easily attached to the screen.

Using their fingers or the pen included with Touch Window, youngsters first learn to duplicate basic letter strokes. Next, they trace and then "fingerpaint" letters in colors chosen from their own on-screen paint set. As students move from one section of a lesson to the next, they get rest and reward through short animations based on the theme of their choice -- nature, fantasy, or the circus. When a letter or number lesson is completed, they can "touch 'n color" in an electronic picture book related to one of the three themes. And after a lesson is completed, a reward certificate can be printed out.

Touch 'n Write, available for 64K Apple II computers, costs $69 (software only; the Touch Window is additional).

Sunburst Communications, Inc., 39 Washington Ave., Pleasantville, NY 10570.

Circle Reader Service Number 235.

Cross Assembler Program For Atari ST

Lamar Micro has developed a 65C02 cross assembler program for the Atari 520 ST. The *C02 Cross Assembler* allows the ST to serve as a software development system for Apple, Atari, or Commodore computers that use the 6502 or the 65C02 microprocessor.

Suggested retail price is $89.95.
Lamar Micro, 2107 Artesia Blvd., Redondo Beach, CA 90278.

Circle Reader Service Number 236.

Nutrition Analysis Program

Micromedx has announced availability of *Macnutriplan*, a nutrition analysis program for the Apple Macintosh.

The program asks the user to type in the type and amount of food that he or she has had for each meal. It keeps a running tally of the meal's caloric content plus the user's choice of any two other elements, like cholesterol, saturated fat, vitamin B-6, or potassium. In addition, maximum values for any of these tallies can be set, causing an audible/visual alarm to go off when exceeded. If the user requests further analysis, the program will ask for the user's name and age, and calculate what percentage of his or her recommended daily allowance of key nutrients the meal will supply.

The program comes with a built-in directory of caloric and nutritional content of more than 400 common foods; up to 200 more can be added.

Macnutriplan requires 150K memory in a 512K Macintosh, one disk drive, and Microsoft BASIC 2.0. Suggested retail price is $75.

Micromedx, 187 Gardiners Ave., Levittown, NY 11756.

Circle Reader Service Number 237.

Stock Update Package For *Managing Your Money*

The Micro Education Corporation of America has expanded its offerings by introducing *Managing The Market*, a stock price update package for the IBM-PC that automatically accesses Dow Jones News/Retrieval Service.

Managing The Market is a cost-effective communications program that allows you to update securities automatically via modem. The program can be used in conjunction with Andrew Tobias' financial package *Managing Your Money*, or by itself with spreadsheets like *Lotus 1-2-3*. An onscreen stopwatch helps keep track of time spent online. Once connected to the service, all data is stored in a file so the user can log off quickly (reducing phone charges) and review the information at his or her leisure. Users can also create customized "hot lists" of up to 225 securities to check key prices at a glance, saving the time and expense of running through their entire list of securities.

Managing The Market runs on the IBM-PC and PCjr (with 256K), and requires DOS 2.0 or any later version.

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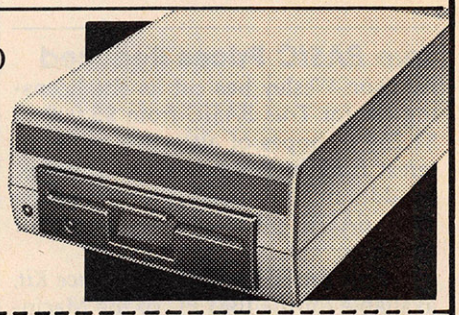

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Suggested retail price is $149.95, which includes a free password for Dow Jones News/Retrieval Service (a $75 value) and an hour's free connect time.

Micro Education Corporation of America, 285 Riverside Ave., Westport, CT 06880.

Circle Reader Service Number 238.

Chess Tutorial And Game For Apple And Commodore

Enlightenment, Inc., has announced the availability of *Paul Whitehead Teaches Chess*, a combination chess tutorial/opponenent for IBM, Apple II, and Commodore 64 computers.

The tutorial is designed to take the user from not knowing anything at all about chess to the point where he or she can beat a middle-level chess player. It is driven by a database that contains a tree-like structure where the user's choices guide the branching of the presentation. This allows the user to skip over information that he or she already knows. Each branch contains both moves and comments integrated together. The commentary appears and disappears every half move, so you can see an anylisis of your game while the players are on the screen.

Once the user is ready to take on an opponent, the *Coffeehouse Chess Monster* is a formidable one. The Apple and Commodore versions of this game portion of the program were written by international master Julio Kaplan. The IBM version is a customization of the SPOC program from Cypress Software. All three versions retail for $49.95.

Enlightenment, Inc., 1240 Sanchez St., San Francisco, CA 94114.

Circle Reader Service Number 239.

True BASIC Prices Reduced

Addison-Wesley has cut its site licensing fee for *True BASIC* from $5,000 to $1,250 in hopes of attracting more interest from high schools and colleges. In addition, the publisher is introducing *True BASIC* packages designed for students.

True BASIC Student's Reference Kit, available for the IBM PC or the Macintosh, includes full-function software and a reference manual for $49.95. *True BASIC Student's User Kit*, being sold for $41.95, includes the software and user manual.

True BASIC, a product of John Kemeny and Thomas Kurtz, the original creators of BASIC, features increased speed, multi-line functions, named subroutines, windows, and portability between the Macintosh and IBM PC.

A student calculus program, *Calculus Student's Toolkit*, for the Apple II and IBM PC also is available. The $19.95 program assists students in mastering topics such as limits, differentiation, and integration.

Addison-Wesley Publishing Company, Educational Media Systems Division, Reading, MA 01867.

Circle Reader Service Number 240.

Submarine Simulation

Overt Strategic Simulations has announced *OPERATION: keystone*, a submarine simulation for IBM PCs and compatibles with at least 200K RAM.

The program, which sells for $69, features randomly generated mission assignments and stresses strategic planning over quick reflexes.

Overt Strategic Simulations, P.O. Box 66424, Los Angeles, CA 90066.

Circle Reader Service Number 241.

Software Catalog On Disk

Electronic Courseware Systems, Inc. has made available a disk version of its software catalog. The disks, available now for Apple and Commodore 64 with an IBM version expected, catalog the company's instructional software offerings, including music, MIDI, math, science, language arts, and utility programs.

The disk is available for $2.99, which is refundable if software is purchased from the catalog. Paper versions of the catalog are available at no charge.

Electronic Courseware Systems, Inc, 1210 Lancaster Dr., Champaign, IL 61821.

Circle Reader Service Number 242.

Computerized Classic

A computer version of *Treasure Island* has been indroduced by Classics on Computer. The game, designed for students in grades 5–9, is intended to help students rediscover the joys of reading. A player's progress in the game depends on reading comprehension and vocabulary-building skills.

This adaptation of the Robert Louis Stevenson novel is available for Apple II series computers for $39.95.

Classics on Computer, 5150 Wilshire Blvd., Suite 502, Los Angeles, CA 90036.

Circle Reader Service Number 243.

Gato For 64

Spectrum Holobyte, Inc., has introduced a Commodore 64 version of the popular World War II submarine simulation game, *Gato*, previously available for the Apple and IBM computers.

Gato puts you in the captain's seat of a World War II "Gato" class submarine, as you play against the computer to decide who controls the seas. The 64 version includes eight missions, five difficulty levels, and three ships. And the Commodore version uses the 64's sound capabilities to add realism, including a digitized voice to receive mission assignments from SUBCOM.

Suggested retail price is $29.95.

Spectrum HoloByte, Inc., 1050 Walnut, Suite 325, Boulder, CO 80302.

Circle Reader Service Number 244.

128 Program Generator

OMNISoft & Associates has introduced *OMNICodeI*, a program that generates source code in writing BASIC programs and subroutines to handle screen formatting, input, and compiled output. The code generated is modular, RE-Marked, and compiler-compatible.

OMNICodeI has a user interface designed so that even a novice will be comfortable in the operating environment. For the experienced programmer, the package can save hours of work.

The Commodore 128 version requires at least one 1541 or 1571 disk drive and an 80-column display (either color or monochrome). It writes Commodore BASIC 7.0, and is compatible with the BLITZ!-128 BASIC Compiler from Skyles Electric Works. Retailing for $89.95, the package includes *OMNI Merge-128*, which allows the user to merge tokenized BASIC programs and subroutines.

OMNISoft & Associates, P.O. Box 280, Rogers, AZ 72756.

Circle Reader Service Number 245.

Geopolitical Simulation For IBM

Mindscape has announced that its highly-acclaimed *Balance of Power*, previously available only for the Macintosh, will be available in IBM format this June.

Written by noted software designer Chris Crawford, this one- or two-player strategy game allows players to assume the role of either the President of the United States or the General Secretary of the Soviet Union for a fictional eight-year period. Each leader must work to enhance his or her country's prestige, yet avoid nuclear war. They can support friendly governments, move against unfriendly governments, and try to foil the same efforts of the opposing superpower.

Balance of Power's vast database of information on the 62 nations represented in the game helps players make their strategic decisions. Players can learn about a country's political stability, GNP, literacy rate, and financial assistance to and from other nations. As

players develop strategies, all data must be considered in light of international events presented as news items. The scenario is constantly changing.

With Microsoft Windows as the user interface, the IBM version creates a gameplay environment virtually identical to that of the Macintosh computer.

The IBM version of *Balance of Power* is $49.95.

Mindscape, Inc., 3444 Dundee Rd., Northbrook, IL 60062.

Circle Reader Service Number 246.

Commodore I/O Controller Card

The BH100 General Purpose I/O Card is an intelligent input-output device from Intelligent I/O, Inc., for the VIC-20, Commodore 64, and 128. The card provides a total of eight 8-bit parallel ports (32 separate input and 32 separate output lines). Since the ports are memory mapped, data is sent or retrieved by a single POKE or PEEK command.

The card can be used in a home control application, controlling lights, appliances, relays, motors, heating/cooling systems, and other electrical devices. It can also be used for more sophisticated applications, like laboratory data acquisition, automated testing/experimentation, and security systems, and can be connected to analog-to-digital and digital-to-analog converters.

Suggested retail price is $129.

Intelligent I/O, Inc., 30 Lawrence Ave., Potsdam, NY 13676.

Circle Reader Service Number 247.

Programming Utility For Amiga

Gimpel Software has announced the availability of *Amiga-Lint*, a diagnostic facility for the C programming language running on the Commodore Amiga. It's similar to the *Lint* that runs on the Unix operating system.

Amiga-Lint will analyze C programs and report on bugs, glitches, and inconsistencies. It helps develop reliable programs and port programs over from other machines and operating systems.

Some of the types of errors reported by *Amiga-Lint* include parameter-argument mismatches, library usage irregularities, variables declared but not used, and suspicious use of operators and unreachable code. The program's features include full K & R support, fast one-pass operation, no fixed-size tables to overflow, and special *Lint*-style comments to suppress errors. *Amiga-Lint* runs under the Amiga's CLI interface.

Suggested retail price is $98.

Gimpel Software, 3207 Hogarth Ln., Collegeville, PA 19426.

Circle Reader Service Number 248.

Apple, IBM Math Tutorials

Mindplay has introduced two programs that help children learn about math while they're having fun.

In *Campaign Math*, players practice their math skills as they research issues, raise funds, and choose the advertising media that will help them win an election. This helps them hone not only their math skills, but their knowledge of political science elements like platform issues, surveying techniques, population size, and fundraising. In *RoboMath*, arcade action inspires robomathematicians to practice multiplication and division as they close down trashbot factories. Players choose a quick-answer method or use the screen to work out more difficult problems with a unique step-by-step process that prompts development of long division or multiplication skills.

Both programs are available for IBM PC and Apple II computers, and retail for $39.95 each.

Mindplay Software, Methods & Solutions, Inc., 82 Montvale Ave., Stoneham, MA 02180.

Circle Reader Service Number 249. ©

HOTWARE: Software Best Sellers

This Month	Last Month	Title	Publisher	Remarks	Systems: Apple	Atari	Commodore	IBM	Macintosh
Entertainment									
1.	3.	*Ultima IV*	Origin Systems	Fantasy game	•	•	•		
2.	5.	*F-15 Strike Eagle*	MicroProse	Air combat simulation	•	•	•	•	
3.	1.	*Jet*	SubLogic	Jet simulation			•		
4.	4.	*Karateka*	Brøderbund	Action karate game	•	•	•		
5.	2.	*Silent Service*	MicroProse	Submarine simulation	•	•	•	•	
Education									
1.	1.	*Typing Tutor III*	Simon & Schuster	Typing instruction program	•		•	•	•
2.	2.	*Math Blaster!*	Davidson	Introductory math program, ages 6-12	•	•	•	•	
3.	4.	*Music Construction Set*	Electronic Arts	Music composition program	•	•	•		
4.	3.	*New Improved MasterType*	Scarborough	Typing instruction program	•	•	•	•	•
5.	5.	*I Am The C-64*	Creative/ Activision	Introduction to the C-64			•		
Home Management									
1.	1.	*Print Shop*	Brøderbund	Do-it-yourself print shop	•	•	•		
2.	2.	*The Newsroom*	Springboard	Do-it-yourself newspaper	•		•	•	
3.	3.	*Bank Street Writer*	Brøderbund	Word processor	•	•	•	•	
4.	5.	*Print Shop Graphics Library*	Brøderbund	100 additional graphics	•	•	•		
5.		*Swiftax*	Timeworks	Tax preparation program	•		•	•	

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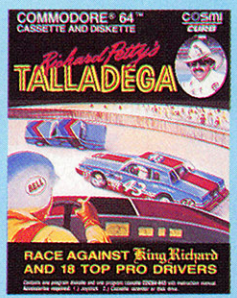

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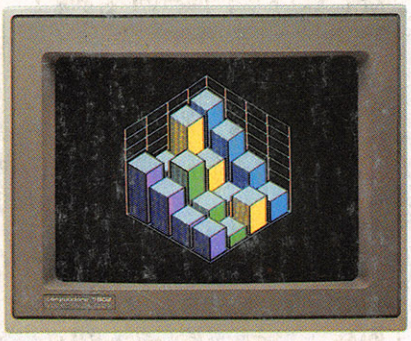

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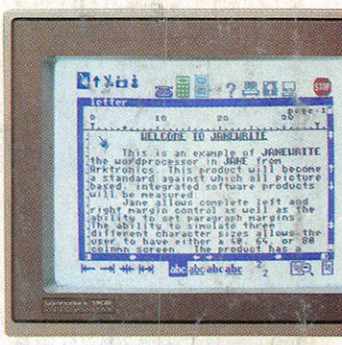

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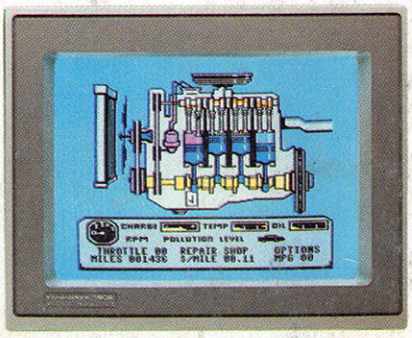

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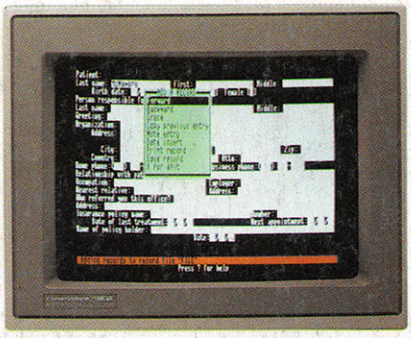
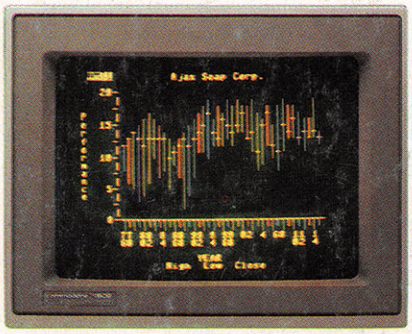
o your banking

learn to fly

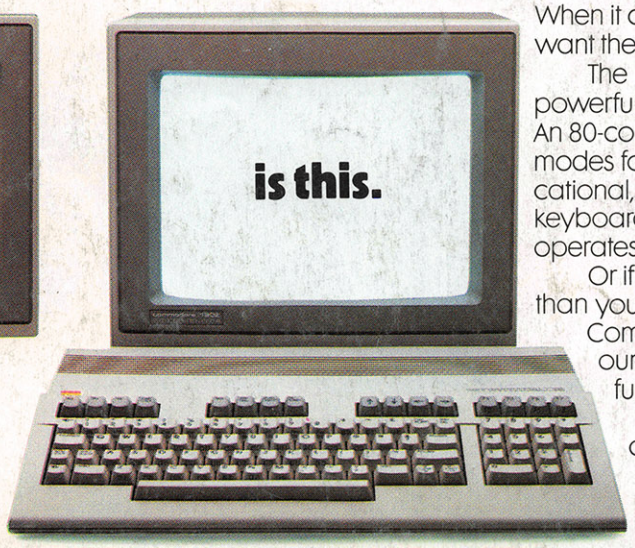


organize a data base

tell a stor



forecast sales



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