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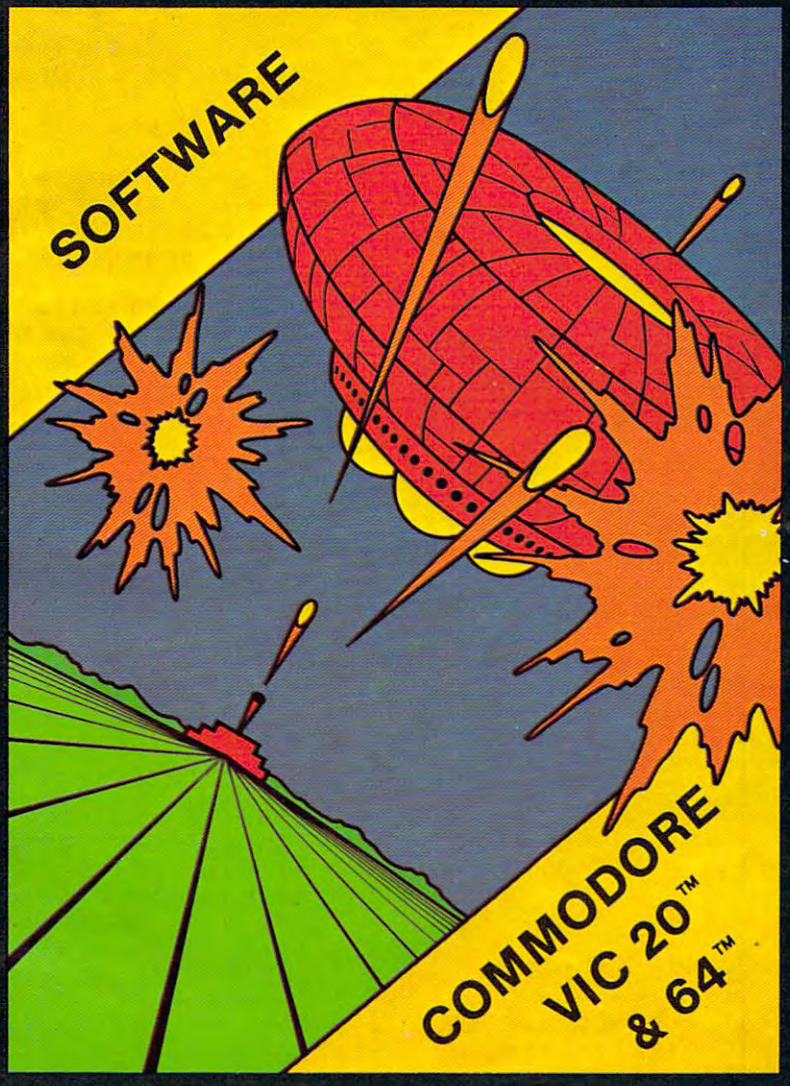

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```
820 IF STRIG(0)=0 THEN 820
830 GOSUB 880:GOSUB 860:GOSUB 870
840 POKE 18,T1:POKE 19,T2:POKE 20,T3
    :GOTO 410
850 END
860 FOR I=0 TO 3:POSITION 2,I+4:PRIN
    T #6;PUZZLE$(I*4+1,I*4+4):NEXT I
    :RETURN
870 FOR I=0 TO 3:POSITION 14,I+4:PRI
    NT #6;GOAL$(I*4+1,I*4+4):NEXT I:
    RETURN
880 GRAPHICS 2+16:SETCOLOR 0,1,4:SET
    COLOR 1,5,4:SETCOLOR 2,8,8:SETCO
    LOR 3,10,6:SETCOLOR 4,0,0
890 POKE 756,CHBASE/256:POSITION 5,2
    :PRINT #6;"hex puzzle"
900 POSITION 2,3:PRINT #6;"____":POS
    ITION 14,3:PRINT #6;"____"
910 FOR I=4 TO 7:POSITION 1,I:PRINT
    #6;"\{4 SPACES}]":POSITION 13,I:
    PRINT #6;"\{4 SPACES}]":NEXT I
920 POSITION 2,8:PRINT #6;"^^^^":POS
    ITION 14,8:PRINT #6;"^^^^"
930 POSITION 1,9:PRINT #6;"PUZZLE":P
    OSITION 14,9:PRINT #6;"GOAL":RET
    URN
```

"Mosaic Puzzle," Atari version.

Program 4: Mosaic Puzzle — TI Version

by Rick Rothstein

```
190 CALL MAGNIFY(4):: RANDOMIZE ::
    DIM TILE(16),TEMP(16):: TEMP(16
    )=16 :: FR=153
200 CALL CLEAR :: CALL SCREEN(11)::
     CALL CHARSET :: CALL CHAR(35,"
    0",71,RPT$("0",12)&"FF0000FF")
210 DISPLAY AT(1,9):RPT$("G",12)::
    DISPLAY AT(2,9):"OPTION##MENU"
220 DISPLAY AT(3,9):RPT$("H",12)::
    DISPLAY AT(10,4):"PRESS####FOR"
     :: DISPLAY AT(11,4):"HHHHH####
    HHH"
230 DISPLAY AT(13,6):"1#######NUMBER
    #PUZZLE" :: DISPLAY AT(16,6)BEE
    P:"2#######LETTER#PUZZLE"
240 WASTE=RND :: CALL KEY(0,K,ST)::
     IF ST=0 THEN 240
250 IF K=49 THEN I=0 ELSE IF K=50 T
    HEN I=1 ELSE IF K=7 THEN 700 EL
    SE CALL SOUND(150,110,0):: GOTO
     240
260 CALL CLEAR :: CALL SCREEN(4)::
    IF I=0 THEN RESTORE 710 ELSE RE
    STORE 790
270 FOR I=80 TO 136 STEP 4 :: READ
    A$,B$ :: CALL CHAR(I,"FFFF"&A$&
    "FFFFFFFF"&B$&"FFFF"):: NEXT I
    :: CALL CHAR(140,RPT$("0",64))
280 CALL CHAR(71,"0000000000000003
    0303030303030300000FFFF")
290 CALL CHAR(74,"00003F3F303030300
    000FCFC0C0C0C0C303030303F3F0000
    0C0C0C0CFCFC",78,RPT$("0C",8)&"0
    0000000FFFF")
300 RESTORE 870 :: FOR I=38 TO 47 :
    : READ A$ :: CALL CHAR(I,A$)::
    NEXT I
310 CALL COLOR(5,15,2,6,15,2):: CAL
    L HCHAR(2,7,71,20):: DISPLAY AT
    (3,5):"GJ"&RPT$("I",16)&"KG"
320 FOR I=4 TO 16 STEP 4 :: DISPLAY
     AT(I,1):RPT$("####GH"&RPT$("G"
    ,16)&"NG####",4):: NEXT I

330 DISPLAY AT(20,5):"GL"&RPT$("O",
    16)&"MG" :: CALL HCHAR(21,7,71,
    20)
340 GOSUB 890 :: FOR I=1 TO 15 :: T
    ILE(I)=I :: NEXT I
350 FOR J=1 TO 15 :: R=1+INT(RND*(1
    6-J)):: TEMP(J)=TILE(R):: TILE(
    R)=TILE(16-J):: NEXT J
360 N=0 :: FOR I=1 TO 14 :: FOR J=1
     TO 15-I :: IF TEMP(I)>TEMP(I+J
    )THEN N=N+1
370 NEXT J :: NEXT I :: IF N/2<>INT
    (N/2)THEN TEMP(16)=TEMP(15):: T
    EMP(15)=TEMP(14):: TEMP(14)=TEMP
    (16):: TEMP(16)=16

380 FOR I=1 TO 16 :: TILE(I)=TEMP(I
    ):: NEXT I :: N=0 :: SP=16
390 FOR I=22 TO 124 STEP 34 :: FOR
    J=62 TO 164 STEP 34 :: N=N+1 ::
     CALL LOCATE(#TILE(N),I,J):: NE
    XT J :: NEXT I
400 MOVE$="" :: TOTAL=0 :: DISPLAY
    AT(24,1):CHR$(32+6*DIR)&"######(
    )*+#,-(.+/:#0#########"&CHR$(39-7
    *NO):: CALL SOUND(150,666,0)::
    GOTO 430
410 CALL SOUND(150,110,0)
420 WASTE=RND :: IF K=73 OR K=78 OR
     K=105 OR K=110 THEN 450
430 CALL KEY(1,KK,ST):: IF KK=18 TH
    EN 670 ELSE CALL JOYST(1,X,Y)::
     IF ABS(X)+ABS(Y)=8 OR X+Y=0 TH
    EN 450
440 IF X/4=(-1)^(1-DIR)THEN 510 ELS
    E IF X/4=(-1)^(2-DIR)THEN 550 E
    LSE IF Y/4=(-1)^(2-DIR)THEN 630
     ELSE IF Y/4=(-1)^(1-DIR)THEN 5
    90
450 CALL KEY(0,K,ST):: IF ST=0 THEN
     430 ELSE IF K=45 THEN 670 ELSE
     IF K=83-HORZ OR K=115-HORZ THE
    N 510
460 IF K=68+HORZ OR K=100+HORZ THEN
     550 ELSE IF K=88-VERT OR K=120
```


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TI-99/4A Notes

Rick Rothstein

The TI/99-4A version of "Mosaic Puzzle" requires Extended BASIC. In this version, you have the option of requesting either letters (A-O) or numbers (1-15) within a 4-by-4 frame. When you have entered your choice, the game board with its lettered or numbered blocks appears in a scrambled order. The object of the game is to slide the blocks about, one at a time, to bring them to one of several preselected patterns. Some patterns that you can try to duplicate are given in the table.

Move the lettered or numbered blocks around the game board with a joystick or the keyboard (E, S, D, and X keys). You actually have a choice of moving either the free space (hole) or the labeled blocks. The game is initially set to move the free space, but by pressing I (note the appearance of the left-right arrow symbol in the lower-left corner of the screen), you can move the labeled blocks.

Each move that you make is tallied, and the total number of moves is given at the bottom of the screen. Moves are normally accompanied by a sliding noise (notice the note symbol at the lower-right corner of the screen). If this noise becomes annoying, press N and the noise will cease (the note will also disappear).

At certain times during the game, you may wish to retrace your previous moves. Press - (minus sign) or hit the fire button to step back through each preceding move. With this option, a maximum of 250 moves can be recalled.

Once you've achieved the desired preselected pattern from its scrambled beginnings, you can restore the original game board pattern by pressing FCTN (REDO) and challenge yourself or others to beat your tally.

Other options available to you during the game are:

Keystroke	Description
FCTN (BACK)	Returns to the letter or number option menu
FCTN (BEGIN)	Starts a new game
FCTN (ERASE)	Ends the program

Possible Patterns For Puzzle, TI Version

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	1 5 9 13 2 6 10 14 3 7 11 15 4 8 12	7 8 9 10 6 1 2 11 5 4 3 12 15 14 13
Horizontal	Vertical	Spiral
1 2 3 4 12 13 14 5 11 15 6 10 9 8 7	12 2 1 15 7 9 10 4 11 5 6 8 14 13 3	A B C D E F G H I J K L M N O
Peripheral	Adds To Thirty	Horizontal
A E I M B F J N C G K O D H L	G H I J F A B K E D C L O N M	A B C D L M N E K O F J I H G
Vertical	Spiral	Peripheral
F O G B I N D H E L M J A C K	E L F J A M B D O C K N I G H	
Words(1)	Words(2)	

```
    -VERT THEN 590 ELSE IF K=69+VER
    T OR K=101+VERT THEN 630
470 IF K=6 THEN CALL HCHAR(24,4,32,
    26):: GOSUB 890 :: GOTO 380 ELS
    E IF K=7 THEN 700
480 IF K=15 THEN CALL DELSPRITE(ALL
    ):: GOTO 200 ELSE IF K=14 THEN
    CALL HCHAR(24,4,32,26):: GOTO 34
    0 ELSE IF ST=-1 THEN 420
490 IF K=78 OR K=110 THEN NO=1-NO :
    : FR=153+NO*30000 :: CALL HCHAR
    (24,30,39-7*NO):: GOTO 420
500 IF K=73 OR K=105 THEN HORZ=15-H
    ORZ :: VERT=19-VERT :: DIR=1-DI
    R :: CALL HCHAR(24,3,32+6*DIR):
    : GOTO 420 ELSE 410
510 IF SP=1 OR SP=5 OR SP=9 OR SP=1
    3 THEN 410 ELSE SP=SP-1 :: CALL
     POSITION(#TILE(SP),ROW,COL)::
    CALL SOUND(4000,FR,14*NO)
520 IF MINUS=0 THEN MOVE$="L"&MOVE$
     ELSE MINUS=0
530 FOR I=COL TO COL+34 STEP 2 :: C
    ALL LOCATE(#TILE(SP),ROW,I):: N
    EXT I
540 TILE(SP+1)=TILE(SP):: TILE(SP)=
    16 :: CALL SOUND(-1,FR,30):: GO
    TO 690
550 IF SP=4 OR SP=8 OR SP=12 OR SP=
    16 THEN 410 ELSE SP=SP+1 :: CAL
    L POSITION(#TILE(SP),ROW,COL)::
     CALL SOUND(4000,FR,14*NO)
560 IF MINUS=0 THEN MOVE$="R"&MOVE$
     ELSE MINUS=0
570 FOR I=COL TO COL-34 STEP -2 ::
    CALL LOCATE(#TILE(SP),ROW,I)::
    NEXT I
580 TILE(SP-1)=TILE(SP):: TILE(SP)=
    16 :: CALL SOUND(-1,FR,30):: GO
    TO 690
590 IF SP>12 THEN 410 ELSE SP=SP+4
    :: CALL POSITION(#TILE(SP),ROW,
    COL):: CALL SOUND(4000,FR,14*NO
    )
```


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DESIGNED BY GREG YOUNG. FOR ALL ATARI COMPUTERS AND THE COMMODORE 64.

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```
600 IF MINUS=0 THEN MOVE$="D"&MOVE$
    ELSE MINUS=0
610 FOR I=ROW TO ROW-34 STEP -2 ::
    CALL LOCATE(#TILE(SP),I,COL)::
    NEXT I
620 TILE(SP-4)=TILE(SP):: TILE(SP)=
    16 :: CALL SOUND(-1,FR,30):: GO
    TO 690
630 IF SP<5 THEN 410 ELSE SP=SP-4 :
    : CALL POSITION(#TILE(SP),ROW,C
    OL):: CALL SOUND(4000,FR,14*NO)
640 IF MINUS=0 THEN MOVE$="U"&MOVE$
    ELSE MINUS=0
650 FOR I=ROW TO ROW+34 STEP 2 :: C
    ALL LOCATE(#TILE(SP),I,COL):: N
    EXT I
660 TILE(SP+4)=TILE(SP):: TILE(SP)=
    16 :: CALL SOUND(-1,FR,30):: GO
    TO 690
670 IF MOVE$="" THEN 410 ELSE MINUS
    =1 :: K=ASC(MOVE$):: MOVE$=SEG$
    (MOVE$,2,250):: TOTAL=TOTAL-2
680 IF K=82 THEN 510 ELSE IF K=76 T
    HEN 550 ELSE IF K=85 THEN 590 E
    LSE IF K=68 THEN 630
690 TOTAL=TOTAL+1 :: DISPLAY AT(24,
    19)SIZE(4)BEEP:TOTAL :: MOVE$=S
    EG$(MOVE$,1,250):: GOTO 420
700 CALL DELSPRITE(ALL):: CALL CLEA
    R :: END
710 DATA FEFEFEFEFEFEFEFEFEFEFEFE,7
    F7F7F7F7F7F7F7F7F7F7F7F7F,F8F0F3F
    FFFFFFEFCF8F1F0F0,1F0FCFCF8F1F3
    F7FFFFF0F0F
720 DATA F8F0F3FFFFFEFEFFFFF3F0F8,1
    F0FCFCF8F1F1F8FCFCF0F1F,FFFFFEF
    CF8F1F0F0FFFFFFFF,8F0F0F4FCFCF0
    F0FCFCFCFCF
730 DATA F0F0F3F3F0F0FFFFFFF3F0F8,1
    F1FFFFF3F1F8FCFCF8F1F3F,FCF8F1F
    3F0F0F1F3F3F1F8FC,1F1FFFFF3F1F8F
    CFCF8F1F3F
740 DATA F0F0F3FFFFFFFFFEFEFEFEFE,0
    F0FCF8F9F1F3F3F7F7F7F7F,FCF8F9F
    9FCF8F1F3F3F1F
8FC,3F1F9F9F3F1F8FCFCF8F1F3F
750 DATA FCF8F1F3F3F1F8FCFFFFF8F8,3
    F1F8FCFCF8F0F0FCF8F1F3F,CFCECCC
    CCCCCCCCCCCCCECF,0F0763F3F3F3F
    3F3F363070F
760 DATA F3F3F3F3F3F3F3F3F3F3F3,C
    FCFCFCFCFCFCFCFCFCFCFCF,CECCCCC
    FCFCFCFCFCECCCCCC,0703F3F3E3C78
    F1F3F7F0303
770 DATA CECCCCCFCFCFCFCFCFCCCCCE,0
    703F3F3E38787E3F3F30307,CFCFCFC
    FCECCCCCCCFCFCFCF,E3C3831333730
    303F3F3F3F3
780 DATA CCCCCCCCCCCCCFCFCFCCCCCE,0
    707FFFF0F07E3F3F3E3070F
790 DATA FEFCF8F1E3E7E0E0E7E7E7E7,7
    F3F1F8FC7E70707E7E7E7E7,E0E0E7E
    7E7E0E0E7E7E7E0E0,1F0FC7E7C70F0F
    C7E7C70F1F
800 DATA F8F0E3E7E7E7E7E7E7E3F0F8,0
    F07E7FFFFFFFFFFFE7070F,E0E0E7E
    7E7E7E7E7E7E7E0E0,3F1F8FC7E7E7E
    7E7C78F1F3F
810 DATA E0E0E7E7E7E0E0E7E7E7E0E0,0
    707FFFFFF1F1FFFFFFF0707,E0E0E7E
    7E7E0E0E7E7E7E7E7,0707FFFFFF1F1
    FFFFFFFFFF
820 DATA F8F0E3E7E7E7E7E7E7E3F0F8,0
    F07E7FFFFF8787E7E70707,E7E7E7E
    7E7E0E0E7E7E7E7E7,E7E7E7E7E70707
    E7E7E7E7E7
830 DATA F8F8FEFEFEFEFEFEFEFEF8F8,1
    F1F7F7F7F7F7F7F7F1F1F,FFFFFFF
    FFFFFFFFFE7E3F0F8,E7E7E7E7E7E7E7
    E7E7C70F1F
840 DATA E7E7E7E6E4E0E0E0E6E7E7E7,C
    78F1F3F7FFFFF7F3F1F8FC7,E7E7E7E
    7E7E7E7E7E7E0E0,FFFFFFFFFFFFFF
    FFFFF0707
850 DATA E7E3E1E0E4E6E7E7E7E7E7E7,E
    7C787072767E7E7E7E7E7E7,E7E3E1E
    0E4E6E6E7E7E7E7E7,E7E7E7E7E76767
    270787C7E7
860 DATA F8F0E3E7E7E7E7E7E7E3F0F8,1
    F0FC7E7E7E7E7E7E7C70F1F
870 DATA 3060FF0000FF060C,0E0908086
    8F8F86,00446C54444444,007C44444
    4447C,0044444444281,007C40784040
    7C
880 DATA 00446454544C44,0044444444
    438,0078447844447 8,0078444478484
    44
890 FOR I=1 TO 16 STEP 2 :: CALL SP
    RITE(#I,76+4*I,16,193,1,#I+1,80
    +4*I,11,193,1):: NEXT I :: RETU
    RN
```

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Questions Beginners Ask

Tom R. Halfhill, Features Editor

Are you thinking about buying a computer for the first time, but don't know anything about computers? Or maybe you just purchased a computer and are still a bit baffled. Each month in this column, COMPUTE! will answer some questions commonly asked by beginners.

Q I'm looking around for my first personal computer, and am wondering if I should get an 8-bit or 16-bit computer. I don't really understand the difference, except I was told by a salesman that 16-bit computers are faster, have more memory, and will eventually replace 8-bit computers. Is this true? Are 8-bit computers becoming obsolete? Would I be better off with a 16-bit computer? What is the real difference, anyway?

A These questions come up fairly often, so let's deal with them in some detail.

First, it's not true that 8-bit computers are becoming obsolete. Most of the computers being sold today are 8-bit computers, especially the under-$1000 home computers. Although it is true that 16-bit computers will likely become increasingly common, 8-bit machines (especially in the low price range) will be around for a good while.

Nor is it true that 16-bit computers are necessarily faster or contain more memory.

The difference between 8- and 16-bit computers lies in their *Central Processing Units*. The CPU is the central "brain" of a computer. It fetches instructions written by programmers, performs arithmetic to execute the instructions, and stores the results of its calculations in memory. The CPU controls or oversees all the operations performed by the computer. Without a CPU, a computer would be a brainless collection of memory chips, support chips, and wires.

In very large *mainframe* computers, the CPU might be a unit the size of a refrigerator, made up of dozens of circuit boards. Microcomputers (including personal computers) have a *microprocessor* CPU – a CPU that fits on a single silicon chip smaller than a penny. Microprocessors work strictly with binary numbers (1's and 0's). All instructions and numbers required for calculations must first be converted to groups of binary numbers before the microprocessor CPU can handle them.

Some microprocessors are designed to handle groups of binary numbers only four digits long. That is, all numbers and instructions must be broken up into groups of four 1's and 0's, such as 1101 or 1011. This would be called a *4-bit* microprocessor (a bit is a binary digit – a 1 or a 0). Portable calculators use these 4-bit chips.

Other microprocessors are more powerful and can handle numbers and instructions in groups of eight 1's and 0's. These are *8-bit* microprocessors. A 16-bit microprocessor handles 16 bits at a time, a 32-bit microprocessor handles 32 bits, and so on.

Generally speaking, the larger these groupings (called *word size*), the more powerful the computer. Computers which handle numbers internally in larger chunks of bits can work faster and more efficiently. Also, they generally have more memory because they are designed to run larger programs and therefore need more memory.

But keep in mind that these are general rules, and, as always, there are exceptions. Several other factors also determine the speed of a computer and the amount of memory it contains.

For instance, the only 16-bit home computer now on the market is the Texas Instruments TI-99/4A. Its maximum memory expansion is 48K, which is no more (and in some cases less) than the maximum memory available in such 8-bit computers as the Commodore 64, Apple II/IIe, Atari, Radio Shack TRS-80, Timex/Sinclair, etc. Also, most of these 8-bit computers can run BASIC programs somewhat faster than the TI-99/4A.

In one benchmark test we heard about, a small 8-bit Timex/Sinclair 1000 actually outran a larger and much more expensive 16-bit IBM Personal Computer. Yet, a business person who needs the powerful features of an IBM PC would not want to choose the T/S 1000 on the basis of speed alone.

That's why you shouldn't base a buying decision solely on the question of 8-bit versus 16-bit. Too many other factors are important. Instead, carefully evaluate your own needs, and then shop for a computer and software combination that serves them well. ©

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* Popular Computing, November, 1982
† Apple Softalk, April, 1982

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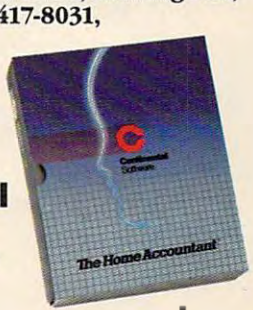

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On The Road With Fred D'Ignazio

There's A Robot In My Room

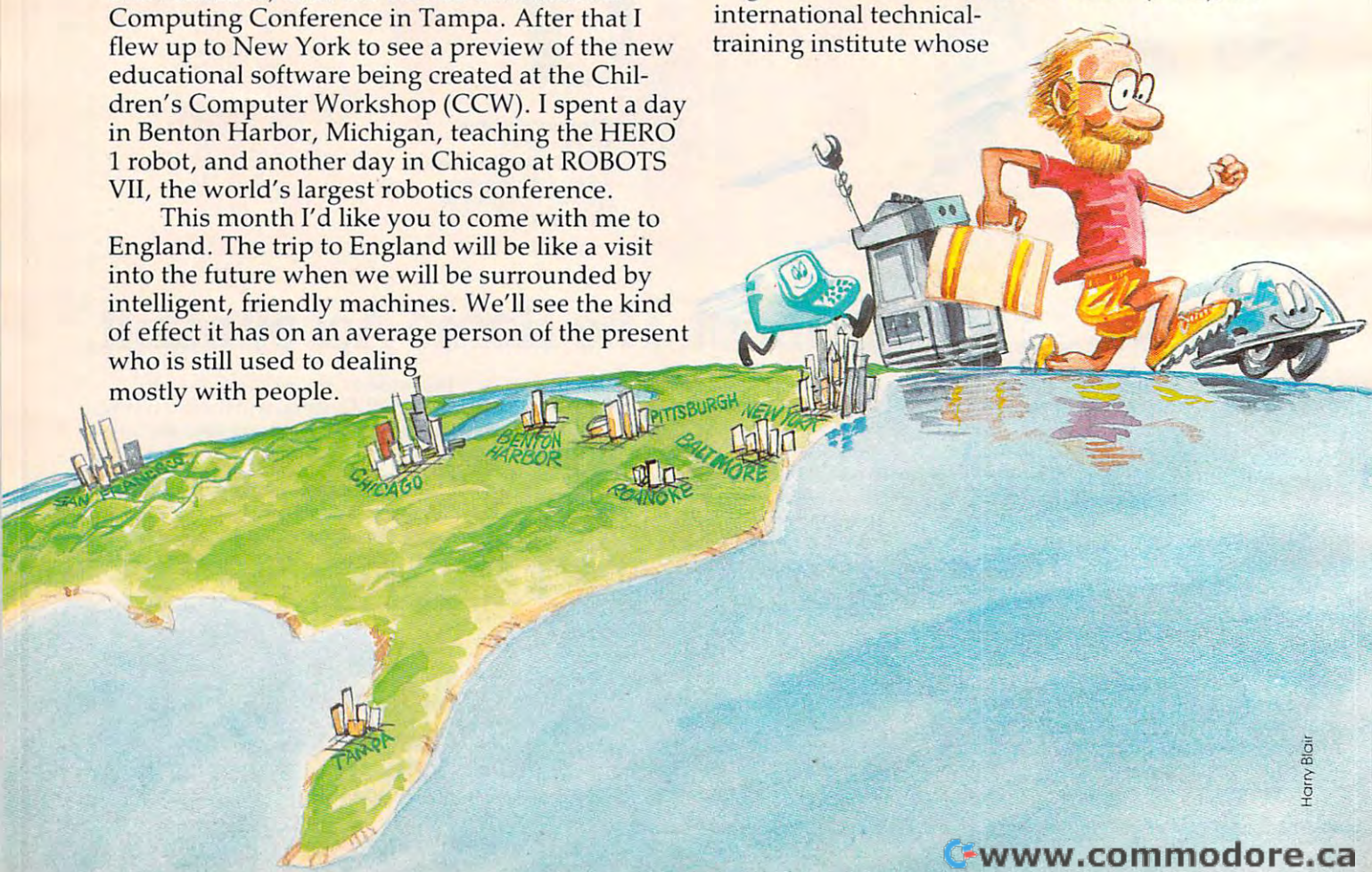
If It's Tuesday, I Must Be In Benton Harbor

Last month I asked you to lace up your racing shoes and sprint with me on my whirlwind tour of computer and robot centers around the United States. I visited the West Coast Computer Faire in San Francisco, then the Florida Instructional Computing Conference in Tampa. After that I flew up to New York to see a preview of the new educational software being created at the Children's Computer Workshop (CCW). I spent a day in Benton Harbor, Michigan, teaching the HERO 1 robot, and another day in Chicago at ROBOTS VII, the world's largest robotics conference.

This month I'd like you to come with me to England. The trip to England will be like a visit into the future when we will be surrounded by intelligent, friendly machines. We'll see the kind of effect it has on an average person of the present who is still used to dealing mostly with people.

A Scene Out Of Dr. Who

After returning from Chicago, I spent a couple of days at home in Roanoke, Virginia. Then I climbed aboard a TWA jet and flew across the Atlantic to London, England. I went to London to teach a three-week course on "Robotics Literacy" at the Organization Reconstruction Travail (ORT), an international technical-training institute whose



Harry Blair

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world headquarters is in London. I also helped with the course materials by arranging to have a HERO robot flown over from the United States and I carried a Tasman Turtle robot with me on the airplane.

There were 15 students in the Robotics Literacy course. The students came from countries all over the world, including India, France, Israel, the United States, Italy, and the United Kingdom. The students were all adults. They were directors of university engineering schools, vocational schools, and teacher training schools. They had come to London to learn how to set up a robotics course in their own countries. They returned to their countries with a ten-pound notebook full of course materials, another 50 pounds of books, brochures, and manuals, a computer, a robot arm, and lots of "hands-on" experience.

How High The Tech

I anticipated that a course on robotics would be "high tech," but I did not dream how high the tech would be. The classroom was like a scene out of science fiction's *Dr. Who* program. We had twenty BBC (Model B) computers networked together on the Econet Network. The computers sat on polished mahogany tables lining the walls of the classroom. Next to each computer was a Smart Arm robot. The robots were plugged into the computers and could be programmed using the Arm Controller keypads.

At one point the course manager had all the arms going at the same time. The arms waved, swooped, picked up pencils and half-empty coffee cups.

Also next to the tables was a robotics interface kit. The kit came in a box that looked like a steel briefcase. When you opened the box, you saw an array of wires and metal parts. The kit was developed by the Moshinsky Institute in Israel. It contained sensors and motors that could be connected to the computers and to the Smart Arm robots. It was like a robotic Erector set. With the kit, you could take the Smart Arm, give it eyes and ears, and incorporate it into a miniature factory workstation. Two Smart Arms could work together, sensing each other's movements via infrared, electrical, and optical sensors.

The kit sounds sophisticated, but it was assembled by students at the institute out of spare parts scavenged from the institute's supply room.

At the front of the room was an enormous television set and a BBC computer as the network controller. The teacher could conduct an experiment or give a demonstration simultaneously on the master computer and on the 20 student computers and robots.

Also, whenever a student wanted to ask a question or show off something he was proud of, the instructor could copy the student's computer screen onto any other student's screen or onto the big TV screen at the front of the class.

At the back of the room was a huge multi-projector slide system mounted on a six-foot platform. During the course, we got to see several videotapes and slide shows on different robot applications.

Also at the back was a hulking, hydraulically powered robot arm. The robot was used in major demonstrations and became a star when TV and newspaper reporters arrived.

Running around the floor were lots of little robots, like robot gremlins. A robot "buggy" zipped across the floor, following a twisting, turning piece of white tape with its photoelectric sensor.

The robot turtle was on the floor, talking, beeping, blinking its little LED "eyes," and trying to find its way out of a maze made of cardboard walls.

And HERO was there too, waving his arm, and rolling over the cables and wires that criss-crossed the floor.

An English HERO

When I first arrived in England, I hoped to receive a HERO robot shipped directly from Benton Harbor, the world headquarters of Heath Company, the robot's manufacturer. Unfortunately, Heath was swamped by orders for the HERO and was way behind meeting shipments. A spare robot couldn't be found.

Luckily for me and my students, we found a HERO robot in England. Zenith Data Systems, a Heath-affiliated company located in Gloucester, England, near the west coast, offered to loan us their machine in return for some training on the HERO.

I journeyed to Gloucester by train on my second day in England. I met the English HERO and found that he had been

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fitted with an English power supply and a deeper voice than the HERO I'd met in Benton Harbor.

I returned to London. Two days later HERO arrived in a box big enough to encase a circus gorilla. His wrist was bent, his head was on crooked, and his photoelectric sensor that monitored the number of times his wheel turned around was disconnected. But these were minor problems. After a little sprucing up, he worked perfectly.

The Master Of Ceremonies

HERO got to be our course's Master of Ceremonies. It was his job to say a few words to inspire the students and get the course started.

The only hitch was that to turn HERO into a congenial Master of Ceremonies, I had to program him. And I had never programmed a HERO before. (The mucking around I did in Benton Harbor was definitely not programming. Take a look at last month's "On the Road" column to see what happened the first time HERO and I were alone together.)

Without proper programming, all HERO was capable of was a few robot calisthenics. Of course, HERO could also say "Ready" (it sounded more like "RED-DY!"). But that meant HERO was ready to be programmed, not ready to do tricks.

I spent the entire weekend before the opening ceremonies programming HERO. I had to enter my entire program as two-digit hexadecimal commands typed into the keyboard on HERO's head. To make HERO's motors move, I had to tell HERO's computer which of six motors to turn on, what motor position to start from, and how far the motor should turn.

In order to get HERO to talk, I had to think up HERO's speech then break it into hundreds of *phonemes* – the sounds that are the building blocks of spoken words. Then I had to code the phonemes into HERO's "Robot Language" and enter more two-digit codes into HERO's onboard memory.

After all the hours of work, I didn't want to lose anything, so I hitched HERO to a tape recorder, and I saved this program on eight tape cassettes.

Then, late Sunday night, I turned HERO's power off. As a result, he forgot everything I had taught him. This was okay, I thought, since I had copies of the program on the eight tapes.

HERO Sat There

On Monday morning, right before HERO made his grand entrance into the classroom, I popped a cassette into the recorder and tried to load the speech program back into his onboard memory.

HERO said "RED-DY!" to signal me that the program was finished loading. I tried to run the program, but HERO just sat there. I looked at the locations in HERO's memory to make sure the program was there.

They weren't there! I was horrified to learn that the front-end of the program had, overnight, turned into computer mush.

I tried a new tape. More mush.

Another tape. And another. And another.

All eight tapes had incomplete copies of my program. I consulted the time on HERO's clock. HERO was to make his grand entrance in just fifteen minutes.

Luckily I had copied down all my commands on a scrap of paper. I found the paper and retyped the missing commands into HERO's head.

"RED-DY!" HERO said. I grinned. This time he was really ready.

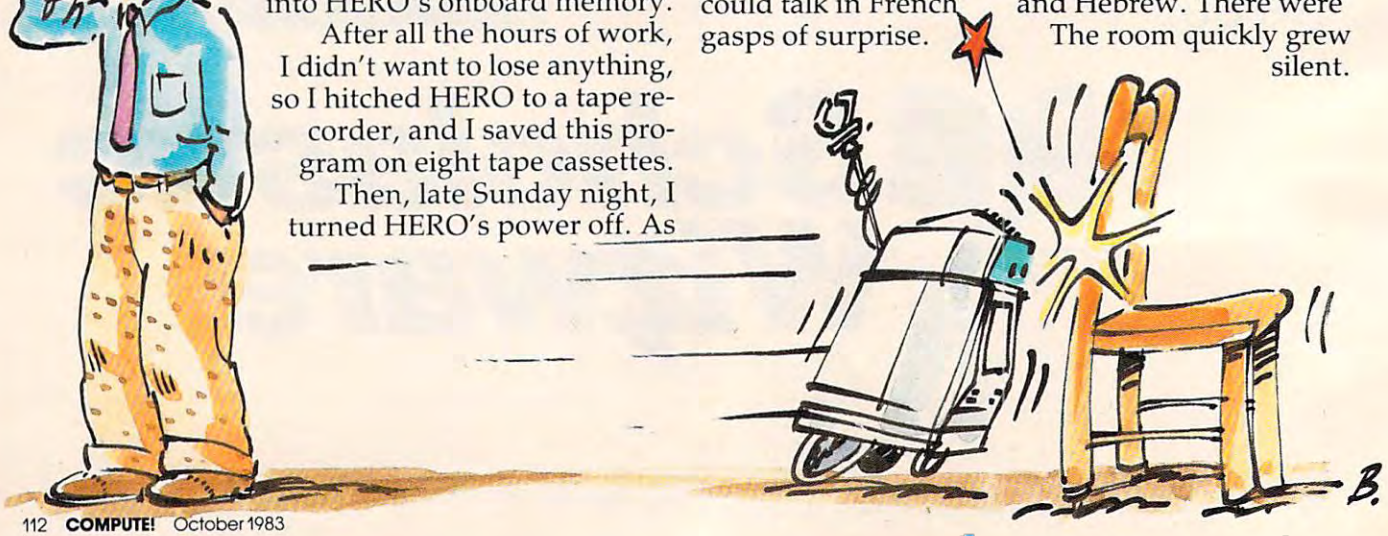
I picked HERO up and carried him to the classroom door. I peeked into the room. Everyone was assembled. The director of the course was on the speaker's platform at the front of the room.

The director nodded his head. It was time. I pressed HERO's A button, his DO button, and keyed in the four-digit starting address of the program.

HERO took off. He marched into the classroom, spun around three times, and waved the WELCOME!! sign he held in his gripper "hand."

HERO stopped spinning. "Attention," he said. ("Attention, please" in French.) "Shekket." ("Be quiet" in Hebrew.)

Everyone was amazed that an American robot could talk in French and Hebrew. There were gasps of surprise. The room quickly grew silent.



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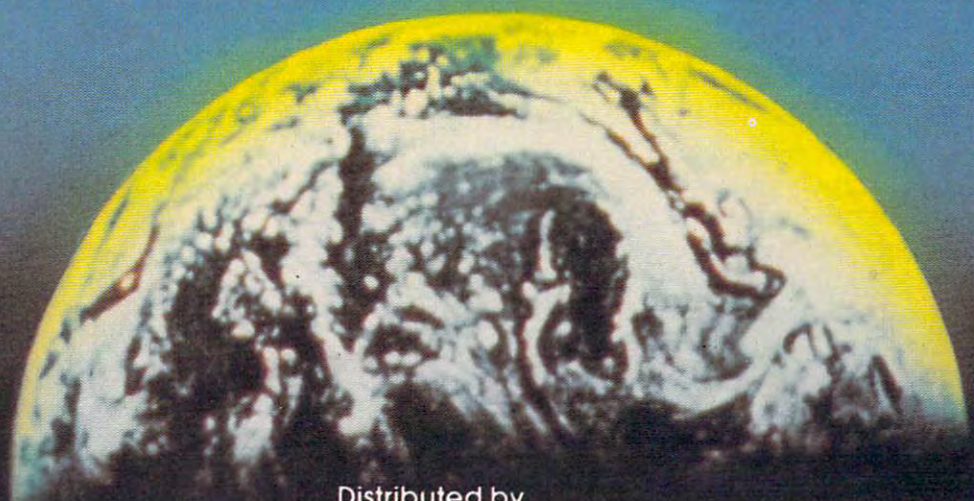

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"Welcome to the ORT Robotics Literacy Course," HERO said. "I am HERO, the robot from America. I hope you have fun. Ha! Ha! Ha! Bye, bye."

HERO spun around once more, waved his sign, then marched toward the door. The audience began clapping.

But HERO was not destined to make a triumphant exit from the classroom. In fact, he never even made it to the door. On his way, he crashed headfirst into a chair.

Poor HERO didn't know he hadn't made it through the door. He thought he was out in the hallway. His "Master of Ceremonies" program finished executing. "RED-DY!" he said.

"Listen," said one of the instructors. "The robot knows its master's name. It's saying *'Freddie.'* "

Everyone began laughing.

I picked HERO up. I felt like an embarrassed parent. "It wasn't his fault," I stammered. "It was my programming...."

I lurched out of the room with HERO in my arms.

"RED-DY!" said HERO.

A Briefcase And A Sewing Machine

I brought two computers from the United States to help me teach the Robotics Literacy course. I had a briefcase-sized Epson HX-20 computer with me to record business expenses and to do course and calendar planning and memos. I brought along a sewing machine-sized Compaq computer to write up my course lectures and to create several graphs, figures, tables, and small data bases from the research material I had gathered for the course.

I used the computers to create lectures on the history of robots, the future of robots, the automated factory, artificial intelligence, the Tasman Turtle, the HERO robot, robots in the home, exotic (outer space, undersea, and legged) robots, CAD/CAM (Computer-Aided Design/Computer-Aided Manufacturing), industrial robots, robot anatomy, and the impact of robots on jobs, work, and people.

I also brought two robots, as I mentioned – HERO the robot and the Tasman Turtle. The turtle ran on an Apple computer loaned to me by Apple Computer/U.K.

The turtle, HERO, and the Compaq computer had to be converted to British current and voltage (a stepdown from 220 volts to 110, and a change in the current from 60 to 50 Hz). The little Epson computer was okay since it ran on rechargeable batteries. If I'd had to recharge it, I would have had a problem, but during my entire three-week course, the batteries never ran down.

There's A Robot In My Bedroom

I was the only full-time guest instructor for the course so I was always extremely busy. Often I would teach and work 12 hours a day.

I had to work constantly, and I needed my computers and robots near me to do my work. It would have been a great inconvenience to lug them back and forth from ORT to a hotel room every day. But I would need them during the day at ORT and in the evening back at the hotel. I felt almost like a bionic man. I had to have my computers and robots around me, or I couldn't function.

The director of the Robotics Literacy course came up with a solution: I could live and work at ORT in one of the two upstairs suites, down the hall from the course classroom. My office would be my bedroom, and vice versa.

Hey! That's great! I thought. I'm always talking about how people should get intimate with their computers and robots. Now here was the chance for me to see how intimate my machines and I could get.

I was looking forward to this arrangement. I would be all alone at night in the ORT building, but my robots and computers would keep me company. When I went to bed at night, my computers and robots would surround me like tiny sentinels. In the morning I could leap out of bed, turn on the computers and robots, and get to work immediately. I wouldn't have to waste time on nonessentials like getting dressed, brushing my teeth, or taking a shower. (I couldn't take a shower anyway since the ORT shower was broken.)

But I still had one problem: who would wake me up each morning at dawn so I could get right to work? I didn't have a travel clock with me, and I couldn't get a wake-up call from the hotel desk. In fact, I had no phone at all. I was isolated from the world. To make outgoing calls I had to throw on some clothes and run across the street to the Finchley Road tube (subway) station. I made all my business and personal calls at the station in a doorless booth, with dozens of people streaming by and trains rumbling by underneath sounding like earthquakes.

The Robot Alarm Clock

How was I to wake up each morning on time?

Then I remembered that HERO had a built-in realtime clock. I wrote a program using this clock and HERO's light sensor. The light sensor, a photoelectrical cell, can sense up to 256 levels of luminance, or brightness. I made a stab at how bright it would be at 5:30 in the morning, and I created a little wake-up speech for HERO to launch into.

That night I turned HERO on, plugged him into the wall current so his battery would not run

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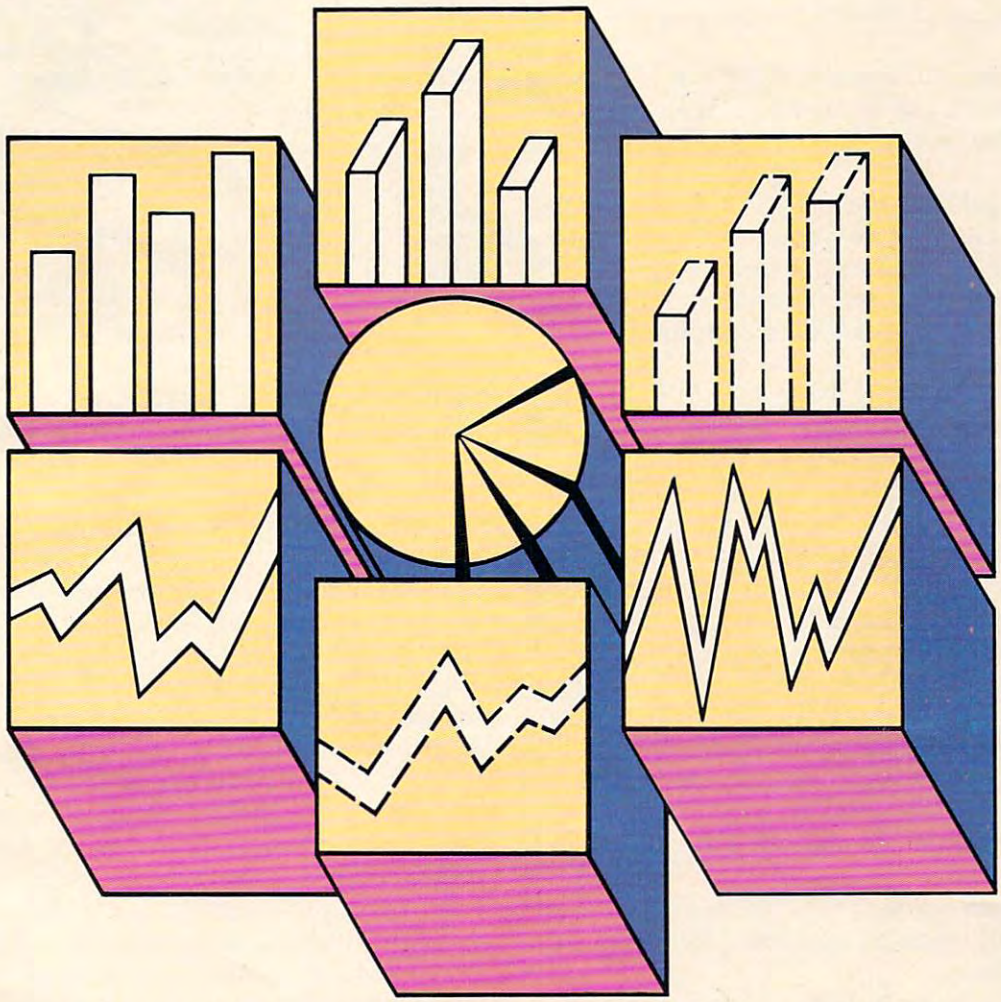

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down during the night, and started his "wake-up" program running.

I tiptoed toward my bed.

Behind me, HERO came immediately to life and startled the heck out of me.

"Good morning, Fred!" he said cheerfully. "Time to wake up! Get out of bed, you sleepyhead. It's 11 p.m."

I spun around angrily. What was HERO doing delivering his wake-up message at eleven o'clock at night? Was he crazy? Was my program full of bugs?

Then I realized that HERO hadn't malfunctioned and that my program was working correctly. I had erred by starting the program running while the room was still lit. HERO had mistaken my bedside reading light for the early morning sun.

I turned out the bedside lamp. Phooey! I thought. If I want to read in bed, I'll have to do it under the covers with a flashlight.

When the lamp went out, the room became as black as the bottom of a well at midnight. I stumbled my way past two computers and a turtle robot to get to HERO on the far side of the room. I felt the keyboard carefully and pressed the keys to restart HERO's wake-up program. Then I made my way back to bed, trying carefully not to step on any of my mechanical friends in my bare feet. (Both computers were on the floor, along with the turtle. I like programming on the floor where I can spread out my work.)

I hopped into bed and fell immediately to sleep.

"Good morning, Fred!" HERO called. I sat up, shocked. It wasn't morning. The room was still pitch black.

"Time to wake up! Get out of bed, you sleepyhead," HERO continued. "It's 11:45 p.m."

What set him off this time? I wondered. Just then a car went by on the street beneath my window. The car headlights shone into my room. Then I realized what had happened. Headlights from a passing car had triggered HERO's wake-up message. I had to decrease his sensitivity to light.

I was beginning to get slightly paranoid (from lack of sleep). I was worried that HERO would wake me up if a tiny firefly flew into my bedroom. This kind of alarm clock I could do without.

I finished retuning HERO's program, turned out the lights, started the program running, and climbed back into bed. For a while I lay in bed gritting my teeth, just waiting for the starlight or some distant neon sign to set HERO off and give me that infernal, cheerful "Good Morning, Fred." But nothing happened, and I finally fell asleep.

Only A Supernova

The next morning I was awakened by someone

hammering on my door. "Fred, are you in there? It's Steve. Are we going to breakfast, or not?"

It was my friend Steve Lubin.

"What time is it?" I asked.

"Eight thirty," Steve replied. "You ought to be up now."

Eight thirty! I had overslept!

I looked over at HERO. He hadn't been stolen. He was still there, looking peaceful, contented, and robotic. His red "power" light was on. I checked his display. The program was still working.

Then why hadn't he awakened me?

As I pulled on my pants, slipped into a shirt, and tied my shoes, it came to me. This time HERO's light sensor was set too *low*. The morning sun was not enough. HERO probably wouldn't wake me until the sun went supernova.

I finished getting dressed and went out to breakfast with Steve. As I ate a mushy egg on a bagel, I thought about my experiment to turn a robot into an alarm clock.

My experiment hadn't been too successful, but I resolved to keep trying.

The next night, HERO woke me up at 1 a.m. (a truck headlight) and at 4:30 a.m. (dawn came sooner than I realized).

But the next night after that, I finally got all the bugs out. HERO woke me up at 5:19. That was close enough to 5:30. I was satisfied. My robot alarm clock was working.

You Can't Tickle A Robot's Back

My experiment in turning a robot into an alarm clock was ultimately a success. But my experiment in robot and computer intimacy was a dismal failure.

Each night after my human colleagues at ORT abandoned me to return to their homes, I became desperately lonely. I was surrounded by friendly computers and robots, but I was still

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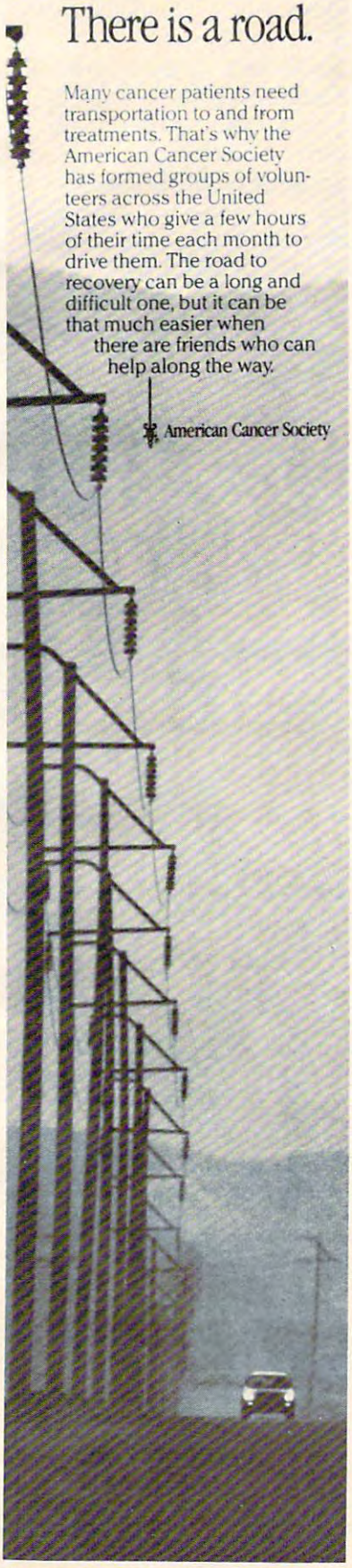

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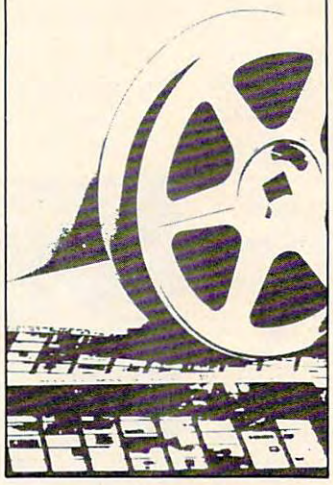

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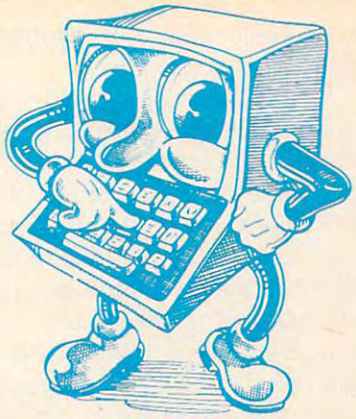

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lonely. I missed my wife and family, and I craved human companionship.

At first I tried to get the robots to simulate human companionship. I programmed the turtle to count to ten and say things like "Stop ... Go ... Left ... Right." And I taught HERO to say things like "That's a cute pair of pajamas you have on, Fred." But this wasn't the same as giving my son a piggyback ride to bed, or tickling my daughter's back, or reading the Sunday comics with my wife. Machines, even intelligent, friendly machines, could supplement human companionship, but they couldn't replace it. At least not in my life.

Pub Crawling, Crystal Balls, And Croissants

The Robotics Literacy course was a wild success. I learned more about robots than I had ever cared to learn. I learned about pneumatics, hydraulics, infrared sensors, flexible manufacturing systems, robot vision systems, stepper motors, servo motors, the whole bit.

And I taught my students all the things I knew. I told them about the giant industrial robots I had seen in Chicago, and the advanced thinking, feeling, sensing robots I had met at the Robotics Institute at Carnegie-Mellon University, in Pittsburgh. On the last day of the course, I gave my final lecture. I gazed into the crystal ball and talked about the future of robot-human relations. I talked about what sort of shape robots might take in the future, and the kind of impact they might have on our lives.

Then my wife came over to England, and I bailed out of the course. I had spent three weeks of almost nonstop work, surrounded by machines, and I'd had enough.

Before my wife arrived, in the evenings as a substitute for human companionship, I used to feast on chocolate éclairs and croissants at local patisseries (bakeries), then do a tour of the London bars and wash away my sorrows with warm, dark English beer. They call this sort of behavior "pub crawling," and it's a very apt phrase. By the end of an evening of videogames, whipped cream, and beer, I would totter back to my bedroom office, crawl into my bed, and dream strange dreams. In one dream, for example, I was pursued by my robots. HERO was chasing me, holding a buttery croissant in his gripper, and the turtle raced after me with a mug of beer sloshing around on his dome.

By the time Janet arrived in London, I'd had enough beer, enough sweets, and enough robots.

Robot In A Garbage Bag

But there was still one remaining chore. I had to return HERO to his home in Gloucester and teach the Zenith people in Gloucester some of the robot's finer points.

To get HERO back to Gloucester, Janet and I rented a little Ford Escort. We slipped a green garbage bag over HERO's head (so nobody would recognize him) and let him ride in the back seat with a seatbelt around his waist.

After only five minutes of practice to get used to driving on the right side of the car and on the left side of the road, we merged into mad, congested London traffic, and we were off.

Driving 60 miles an hour on the left-hand side of the road was scary. The trip to Gloucester left Janet and me shaken. But I didn't get a single complaint from HERO. In fact, he tolerated my driving beautifully. I banged his head against the car roof several times. And I jostled him against the front seat and bounced him off the back seat. He never complained. Instead, all I ever heard (from underneath the garbage bag) was an occasional, muffled "RED-DY."

You can find out more about HERO by writing:

Douglas Bonham
Heath Company
Benton Harbor, Michigan 49022
(Or call: 616/982-3200)

On the road with Fred D'Ignazio and his friends at the ORT Robotics Literacy Course in London, England.

HERO the robot came from America. The Tasman Turtle came from Australia.

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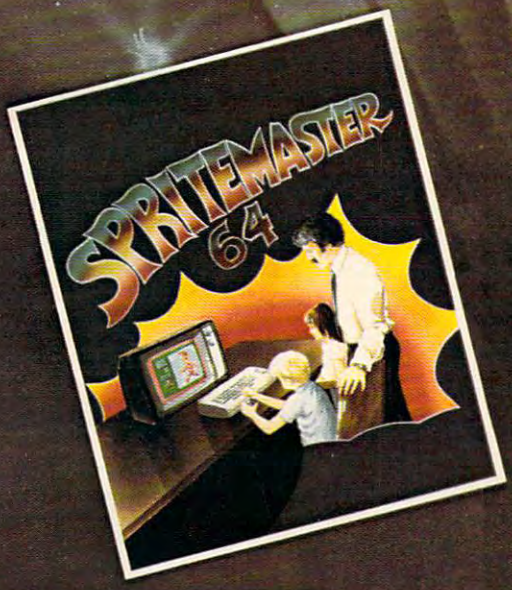
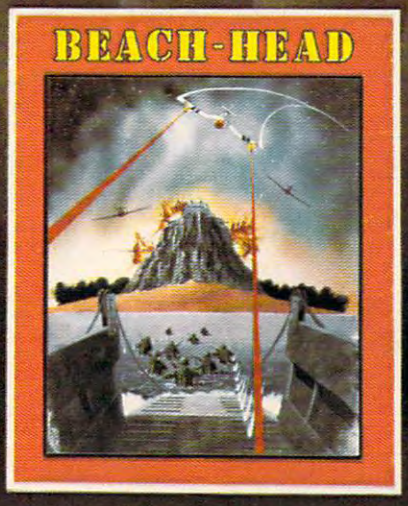
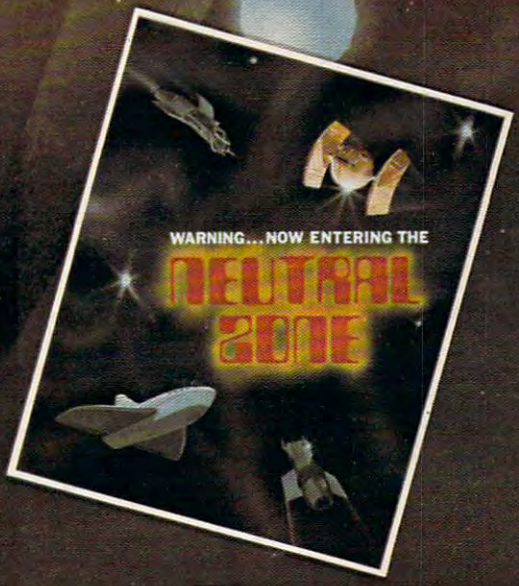
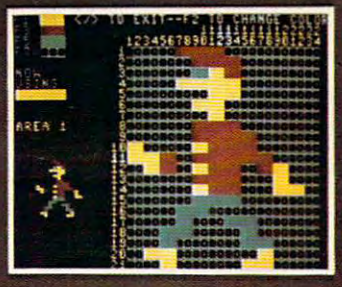
COMMODORE 64* SOFTWARE

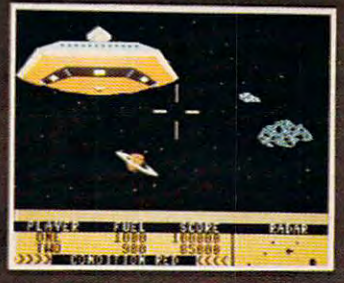
ACCESS











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You can find out more about the Tasman Turtle by writing:

Bill Glass
Tasman Turtle
260 Beacon Street
Somerville, MA 02143
(Or call: 617/492-0660)

You can find out more about the Robotics Literacy Course by writing me:

Fred D'Ignazio
2117 Carter Road, SW
Roanoke, VA 24015

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Spelling Quiz

Edward Perrin

Learning to spell is simplified by this program. It lets you create weekly lists of up to 20 words each, save the lists to tape or disk, and then retrieve the lists for practice sessions. For Atari and VIC.

"Spelling Quiz" allows you or your child to enter weekly spelling words into the computer and save them on tape or disk. All the words for an entire year can be saved at once or each week can be saved separately as the school year progresses.

The program allows you to enter up to 20 words at a time. Most weekly spelling assignments are no more than 20 words. The program prompts are self-explanatory, but it would be helpful to read through the following instructions.

Load in the program with the BASIC cartridge inserted. The loading time for tape is about four minutes.

Type in RUN, and after the title page you will be asked if you want to Create or Retrieve a list of words to work on. You will also be asked if you are using a Disk or Tape.

Creating Word Lists

To create a list, simply type in up to 20 words, no more than 20 letters each and with no leading or trailing spaces, one at a time, and hit the RETURN key. Be sure each word is spelled correctly before hitting RETURN. If you enter fewer than 20 words, type in an * following the last input. After the last word or * you will be asked to type in some sort of identifier for that particular list. Use "Chapter 4" or "List 189," for example. You must use some type of identifier that your child will understand. The identifier is used to make sure your child has retrieved the correct list.

Disk users will be asked to enter a filename. Only the filename is necessary; the program will supply the "D1:". Be sure to make the name unique and meaningful.

Tape users will need a blank tape or a tape which has been used to save other word lists. Be sure to note the tape counter number on a sheet of paper and store the paper with the word tape.

If you already have words stored, just follow the prompts to LOAD the words.

Check the list and the identifier to be sure that this is the list you wanted to use. If not, you have the option to LOAD a new list or create a new one as needed.

Once the words are LOADed in with the create or retrieve option, your child is ready to use the program. You now have the option to either spell a Certain number of words correctly, spell an unlimited number of words correctly, or End.

If you choose the C option, you will be graded, and the program will terminate when the number of words spelled correctly equals the number you entered at the prompt. If you choose the unlimited option (by pressing RETURN), you can spell only 10,000 words before the program terminates. It is easy to change the 10,000 to another upper limit. Change the number in the last line of the program to stop the program automatically at a preset number.

The Quiz Begins

When you have made all of the choices, the game is ready to play. The screen will show the number of the word being scrambled, the score (how many words you have spelled correctly), a scrambled word, and the attempt number. At the bottom of the screen is a GRAPHICS 0 window where you will type your answers. The word number on top will help if you cannot figure out the word. The program is supposed to check spelling competence rather than ability to unscramble words, so there

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is no penalty for not unscrambling correctly. Use this option as you wish.

Your child will then have three tries to spell the word correctly. If correct, the screen will respond with an encouraging CORRECT and a happy sound. After three tries, the program will give the correct spelling and set up a different screen to allow the child to practice the misspelled word.

Practice Screen

The practice screen will not allow misspellings. It does allow the child to exit when he or she wants to by pressing the *. In this mode, be sure to press the space bar after each word and not the RETURN. Pressing RETURN would cause the computer to register an error in the spelling.

After the number of correct spellings equals the number put in at the beginning, or if your child enters * instead of spelling a word during the main run, the quiz will end and the child will be graded on his or her performance. If you think the grading is too strict, change the limits in the grading subroutine in lines 9000-9400.

After the grading, the player can go back and retrieve or create and save a new file or use the same words that are already in the computer's memory. He or she also has the option to end at this time. If the player continues, the whole cycle repeats.

Spelling Quiz For The VIC

Marc Sugiyama, Programming Assistant

In Spelling Quiz for the VIC (Program 2), the words can be only 14 letters long; however, you are still allowed a maximum of 20 words. Remember, though, that memory is tight in an unexpanded VIC, so too many long words may cause an out-of-memory error. The percentage calculated at the end of the quiz reflects only the last 20 questions, not all of the questions asked during the session.

The VIC version of Spelling Quiz is easily converted to other computers; however, certain changes must be made. The cursor control characters (that is, those to clear the screen or to change the cursor's color) must be adapted to your computer. Three different POKE commands are used in this program. The first, to location 36879, controls the screen and border colors. The second POKE command, using location 214, changes the vertical position of the cursor. The last, involving location 204, turns the cursor on and off. When 204 contains a zero, the cursor is on; otherwise, the cursor is off.

Program 1: Spelling Quiz For Atari

```
2 REM  SPELLING QUIZ
10 DIM A$(20),B$(20),C$(20),D$(20),E
   $(20),F$(20),G$(20),H$(20),I$(20)
   ,J$(20),K$(20),L$(20),M$(20),N$(2
   0),O$(20)
20 DIM P$(20),Q$(20),R$(20),S$(20),T
   $(20),U$(20),ARRAY(20),Z$(20),STA
   NDINGS(20),ANS$(1),WORD$(520),INW
   ORD$(128)
30 DIM WEL$(38),DK$(15),ZZ$(1):TIME=
   0
40 GOSUB 3000
54 GOSUB 13000
55 PRINT "HOW MANY WORDS DO YOU WISH
    TO SPELL{3 SPACES}CORRECTLY BEFO
   RE ENDING THIS DRILL?{3 SPACES} E
   NTER 0 TO END PROGRAM "
56 TRAP 56:INPUT RIGHT:IF RIGHT=0 TH
   EN 4000
57 TRAP OFF:SCORE=0:ATT=0
58 GOSUB 5200:TRAP OFF
59 W1=0:W2=0:W3=0:W4=0:W5=0:W6=0:W7=
   0:W8=0:W9=0:W10=0:W11=0:W12=0:W13
   =0:W14=0:W15=0:W16=0:W17=0:W18=0:
   W19=0:W20=0
60 IF SCORE=RIGHT THEN 1000
65 NUM=1:W=INT(20*RND(1)+1)
70 GOSUB 7000:IF A$="{20 SPACES}" THE
   N NUM=-1:GOSUB 7000:GOTO 65
80 GRAPHICS 2:POKE 708,0:FOR AR=1 TO
    20:ARRAY(AR)=-1:NEXT AR:PRINT "
   {BELL}";"INPUT '*' TO END QUIZ"
90 POSITION 11,3:? #6;"SCORE";" ";SC
   ORE:POSITION 2,0:? #6;"#";W;" ON
   YOUR LIST"
110 FOR L=1 TO 20:IF A$(L,L)=" " THE
    N L=L-1:A$=A$(1,L):GOTO 115
112 NEXT L:IF L=21 THEN L=20
115 FOR LTR=1 TO L
120 ARR=INT(L*RND(0)+1):IF ARRAY(ARR
    )=1 THEN 120
125 P=ARR-1
130 POSITION P,7:? #6;A$(LTR,LTR):AR
   RAY(ARR)=1:NEXT LTR:POKE 708,200
135 TRY=0
137 TRY=TRY+1:ATT=ATT+1:POSITION 0,9
   :? #6;"ATTEMPT # ";ATT
140 INPUT Z$:IF Z$="*" THEN ATT=ATT-
   1:NUM=-1:GOSUB 7000:GOTO 1000
141 IF Z$=A$ THEN SCORE=SCORE+1:FOR
   N=100 TO 10 STEP -1:SOUND 0,N,10
   ,10:NEXT N:SOUND 0,0,0,0
142 IF Z$=A$ THEN POSITION 12,6:? #6
   ;" correct! ":FOR N=1 TO 300:NEXT
   N:GOTO 60
143 IF TRY=3 THEN FOR N=1 TO 100:SOU
   ND 0,20,4,10:NEXT N:SOUND 0,0,0,
   0:GOTO 2000
144 POSITION 0,2:? #6;" wrong... ":POS
   ITION 0,3:? #6;" try again... "
145 FOR N=1 TO 100:SOUND 0,11,4,10:N
   EXT N:SOUND 0,0,0,0
147 POSITION 0,2:? #6;"{8 SPACES}":P
   OSITION 0,3:? #6;"{11 SPACES}"
150 GOTO 137
1000 GRAPHICS 18:PRINT #6;"  your sc
     ore is ";SCORE
1010 PRINT #6:PRINT #6;"time to quit
      for now"
1020 ? #6:? #6:? #6;"{3 SPACES}CONGR
```


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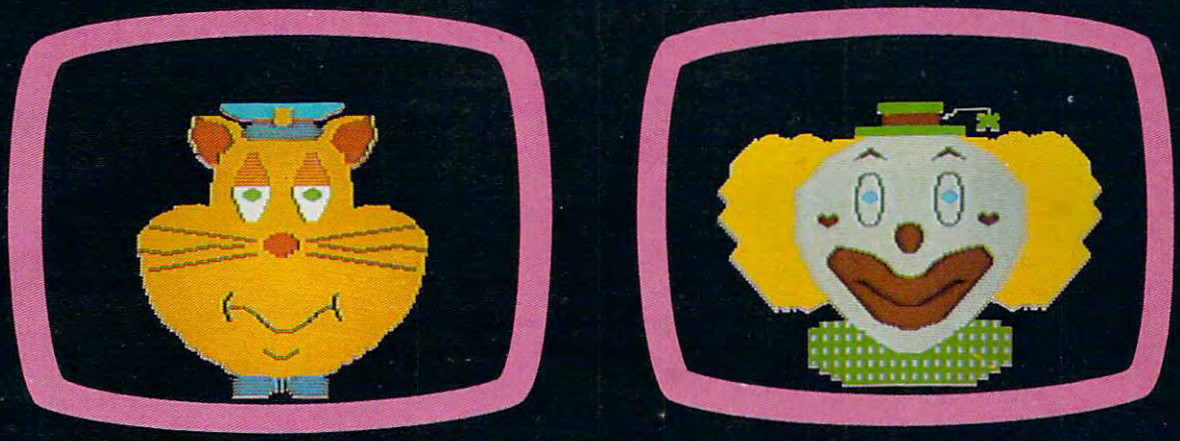
SOFTWARE MOVIES



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Commodore 64 Version Coming Soon!

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```
ATULATIONS"
1030 ? #6;"on a job well done!!":? #
     6:? #6;" QUIZ WILL REPEAT!"
1040 GOSUB 5000:SOUND 0,0,0,0:SOUND
     1,0,0,0:GOTO 9000
2000 POSITION 0,5:? #6;A$:POSITION 0
     ,4:? #6;"answer:":NUM=-1:GOSUB
     7000
2010 FOR N=1 TO 1000
2020 NEXT N:GOSUB 8000
2030 GOTO 60
3000 GRAPHICS 18:POSITION 0,4:? #6;"
     {3 SPACES}SPELLING  quiz"
3005 GOSUB 5000:SOUND 1,0,0,0:SOUND
     0,0,0,0:RETURN
4000 GRAPHICS 18:POSITION 0,2:? #6;"
     VERY GOOD WORK..."
4010 POSITION 0,6:? #6;"see you agai
     n later"
4020 POSITION 4,10:? #6;"bye for now
     "
4030 GOSUB 5000:GOTO 7030
5000 FOR N=1 TO 200
5010 SOUND 0,RND(0)*200,10,2
5030 NEXT N
5040 RETURN
5100 FOR N=1 TO 100:SOUND 0,N,10,10:
     NEXT N:SOUND 0,0,0,0:RETURN
5200 FOR N=255 TO 200 STEP -1:SOUND
     0,N,10,10:NEXT N:FOR N=225 TO 1
     50 STEP -1:SOUND 0,N,10,10:NEXT
      N
5210 FOR N=175 TO 100 STEP -1:SOUND
     0,N,10,10:NEXT N:FOR N=150 TO 5
     0 STEP -1:SOUND 0,N,10,10:NEXT
     N:SOUND 0,0,0,0:RETURN
7000 IF W=1 THEN B$=WORD$(1,20):A$=B
     $:W1=W1+NUM
7001 IF W=2 THEN C$=WORD$(21,40):A$=
     C$:W2=W2+NUM
7002 IF W=3 THEN D$=WORD$(41,60):A$=
     D$:W3=W3+NUM
7003 IF W=4 THEN E$=WORD$(61,80):A$=
     E$:W4=W4+NUM
7004 IF W=5 THEN F$=WORD$(81,100):A$
     =F$:W5=W5+NUM
7005 IF W=6 THEN G$=WORD$(101,121):A
     $=G$:W6=W6+NUM
7006 IF W=7 THEN H$=WORD$(121,140):A
     $=H$:W7=W7+NUM
7007 IF W=8 THEN I$=WORD$(141,160):A
     $=I$:W8=W8+NUM
7008 IF W=9 THEN J$=WORD$(161,180):A
     $=J$:W9=W9+NUM
7009 IF W=10 THEN K$=WORD$(181,200):
     A$=K$:W10=W10+NUM
7010 IF W=11 THEN L$=WORD$(201,220):
     A$=L$:W11=W11+NUM
7011 IF W=12 THEN M$=WORD$(221,240):
     A$=M$:W12=W12+NUM
7012 IF W=13 THEN N$=WORD$(241,260):
     A$=N$:W13=W13+NUM
7013 IF W=14 THEN O$=WORD$(261,280):
     A$=O$:W14=W14+NUM
7014 IF W=15 THEN P$=WORD$(281,300):
     A$=P$:W15=W15+NUM
7015 IF W=16 THEN Q$=WORD$(301,320):
     A$=Q$:W16=W16+NUM
7016 IF W=17 THEN R$=WORD$(321,340):
     A$=R$:W17=W17+NUM
7017 IF W=18 THEN S$=WORD$(341,360):
     A$=S$:W18=W18+NUM
7018 IF W=19 THEN T$=WORD$(361,380):
     A$=T$:W19=W19+NUM
7019 IF W=20 THEN U$=WORD$(381,400):
     A$=U$:W20=W20+NUM
7020 RETURN
7030 END
8000 GRAPHICS 18:POKE 708,100:? #6;"
     please type the word":POSITION
     0,1:? #6;A$
8005 POSITION 0,2:? #6;"and hit spac
     ebar..."
8007 POSITION 0,3:? #6;"UNTIL SCREEN
      IS FULL"
8010 POSITION 0,4:? #6;"or type * to
      return":L=0:COUNTER=0
8100 OPEN #1,4,0,"K:"
8150 L=L+1
8200 GET #1,CHAR
8300 CLOSE #1
8350 IF CHR$(CHAR)="*" THEN GOTO 60
8355 IF CHR$(CHAR)=" " THEN L=0:GOSU
     B 8400
8360 IF CHR$(CHAR)<>A$(L,L) THEN GOS
     UB 12000:GOTO 8000
8370 IF L=LEN(A$) THEN L=0
8400 COUNTER=COUNTER+1:PRINT #6;CHR$
     (CHAR);:TRAP 40000
8450 IF COUNTER>139 THEN GOTO 60
8500 GOTO 8100
8600 RETURN
9000 POKE 752,1:PRINT "HERE IS A LIS
     T OF HOW MANY TIMES EACH WORD W
     AS SPELLED CORRECTLY THIS TIME.
     "
9010 NUM=0:FOR W=1 TO 20:GOSUB 7000:
     NEXT W
9050 FOR N=100 TO 240:SOUND 0,N,10,1
     0:NEXT N:SOUND 0,0,0,0
9100 ? W1;" ";B$:? W2;" ";C$:? W3;"
     ";D$:? W4;" ";E$:? W5;" ";F$:?
     W6;" ";G$:? W7;" ";H$:? W8;" ";
     I$:? W9;" ";J$:? W10;" ";K$
9150 ? W11;" ";L$:? W12;" ";M$:? W13
     ;" ";N$:? W14;" ";O$:? W15;" ";
     P$:? W16;" ";Q$:? W17;" ";R$:?
     W18;" ";S$:? W19;" ";T$
9200 ? W20;" ";U$
9250 POKE 752,1:POSITION 25,3:PRINT
     "ATTEMPTS":POSITION 28,5:PRINT
     ATT:FOR N=1 TO 200:SOUND 0,255,
     10,8:NEXT N
9260 POSITION 25,7:PRINT "CORRECT":P
     OSITION 28,9:PRINT SCORE:FOR N=
     1 TO 200:SOUND 0,200,10,8:NEXT
     N
9270 TRAP 9400:PER=INT((SCORE/ATT)*1
     00):POSITION 25,11:PRINT "PERCE
     NT":POSITION 28,13:PRINT PER;"%
     "
9280 FOR N=1 TO 200:SOUND 0,100,10,6
     :NEXT N
9300 POSITION 25,15:? "GRADE:"
9310 IF PER>=95 THEN POSITION 27,17:
     ? " A ":POSITION 25,21:? "EXCEL
     LENT!!!"
9320 IF PER>=88 AND PER<95 THEN POSI
     TION 27,17:? " B ":POSITION 25,
     21:? "VERY GOOD!!!"
9330 IF PER>=78 AND PER<88 THEN POSI
     TION 27,17:? " C ":POSITION 25,
     21:? "GOOD!!!"
9340 IF PER>=70 AND PER<78 THEN POSI
```


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```
      TION 27,17:? "■D■":POSITION 25,
      21:? "■HMMMM!!■"
9350  IF PER<70 THEN POSITION 27,17:?
       "■F■":POSITION 25,21:? "■STUDY!
      !!■"
9360  SOUND 0,0,0,0:POKE 752,0:GOTO 5
      4
9400  PER=0:POSITION 28,13:PRINT PER:
      POSITION 25,11:PRINT "■PERCENT■":
      GOTO 9280
10000 WEL$="■WELCOME TO THE WORLD OF
      SPELLING QUIZ■":PRINT "{CLEAR}"
      :FOR N=1 TO 37:PRINT WEL$(N,N)
      ;:NEXT N:TIME=TIME+1
10010 OFF=40000:P=0:? :? "DO YOU WAN
      T TO ■C■REATE OR ■R■ETRIEVE THE FI
      LE";
10011 O$="{20 SPACES}":FOR N=1 TO 520
       STEP 20:WORD$(N,N+19)=O$:NEXT
       N
10012 ? :? :? "ONCE YOU CREATE A FIL
      E IT WILL BE{5 SPACES}STORED O
      N TAPE OR DISK SO YOU CAN
      {5 SPACES}INPUT THE WORDS FROM
      "
10013 ? "THE TAPE OR DISK INSTEAD OF
        TYPING{3 SPACES}THE SAME WOR
      DS IN EVERY TIME YOU PLAY."
10014 ? :? :? "TYPE IN ■C■ OR ■R■ AND HI
      T ■RETURN■ NOW!"
10015 TRAP 10014:INPUT ANS$
10017 TRAP 10017:? "ARE YOU USING ■TA
      PE■ OR ■DISK■":INPUT ZZ$:IF ZZ$(1
      ,1)<>"T" AND ZZ$(1,1)<>"D" THE
      N 10017
10020 IF ANS$<>"C" THEN GOTO 11000
10100 ? "TYPE IN WORDS NOW":N=1
10105 ? :? :? "■BE SURE EACH WORD IS
      SPELLED CORRECTLY BEFORE YOU P
      RESS■ RETURN{14 ■SPACES■}"
10110 FOR N=1 TO 400 STEP 20:INPUT I
      NWORD$
10120 IF N>399 THEN WORD$(401,520)="
       ":GOTO 10200
10125 IF INWORD$="*" THEN WORD$(N,52
      0)=" ":GOTO 10150
10130 WORD$(N,N+19)=INWORD$
10140 NEXT N
10150 ? "TYPE IN CHAPTER # OR LIST #
       ETC..."
10160 INPUT INWORD$:WORD$(401,420)=I
      NWORD$
10200 FOR N=1 TO 420 STEP 20:PRINT W
      ORD$(N,N+19):NEXT N
10202 IF ZZ$="D" THEN GOSUB 10500:TR
      AP 40000:OPEN #2,8,0,DK$:GOTO
      10209
10203 ? "POSITION THE TAPE AND TAKE
      NOTE OF{4 SPACES}THE COUNTER N
      UMBER.":? :? "PRESS THE PLAY A
      ND RECORD BUTTONS."
10204 ? :? "WHEN THE BUZZER SOUNDS,
      PRESS ■RETURN■"
10205 N=1
10206 TRAP 10207:LPRINT
10207 OPEN #2,8,0,"C:"
10209 N=1:FOR X=1 TO 4
10210 PRINT #2;WORD$(N,N+119):N=N+12
      0
10220 NEXT X:CLOSE #2
10300 GOTO 13000
10500 PRINT "YOU MUST NOW ENTER THE
      FILENAME{7 SPACES}(WITHOUT 'D:
      ') OF THE FILE TO ";
10520 IF ANS$="R" THEN PRINT "LOAD":
      GOTO 10530
10525 PRINT "CREATE"
10530 TRAP 10500:INPUT DK$:DK$(4)=DK
      $:DK$(1,3)="D1:"
10540 RETURN
11000 IF ZZ$="D" THEN GOSUB 10500:N=
      1:TRAP 40000:OPEN #2,4,0,DK$:G
      OTO 11025
11005 ? "TO LOAD WORDS THAT ARE STOR
      ED ON TAPE BE SURE TO POSITION
       THE TAPE AT THE{3 SPACES}CORR
      ECT COUNTER # YOU NEED."
11010 ? "WHEN BUZZER SOUNDS, PRESS ■R
      ETURN■ AND  WAIT FOR THE WORDS
      TO BE LOADED INTO  THE COMPUTE
      R..."
11020 N=1:OPEN #2,4,0,"C:"
11025 FOR X=1 TO 4
11030 TRAP 11040:INPUT #2,INWORD$
11035 WORD$(N,N+119)=INWORD$:N=N+120
11040 NEXT X
11045 CLOSE #2
11060 FOR N=1 TO 400 STEP 20:PRINT I
      NT(N/20)+1;" ";WORD$(N,N+19)
11067 NEXT N
11068 PRINT "{9 SPACES}";WORD$(401,4
      20)
11070 ? "■IS THIS THE GROUP OF WORDS
      THAT YOU{3 SPACES}WANTED (Y/N)■
      ";:INPUT ANS$:IF ANS$="N" THEN
       GOTO 10000
11075 GOTO 13019
11080 END
12000 FOR N=1 TO 100:SOUND 0,20,4,10
      :NEXT N:SOUND 0,0,0,0

12005 GRAPHICS 18:? #6;"■YOU typed ■";
      CHR$(CHAR);" ■this is■"
12010 POSITION 0,1:? #6;"wrong...TRY
       AGAIN"
12020 POSITION 4,3:? #6;"THE WORD IS
       "
12030 POSITION 0,4:? #6;A$
12040 POSITION 6,5:? #6;"READY???"
12050 L=0:FOR N=1 TO 400:NEXT N:RETU
      RN
13000 WEL$="■NOW YOU MUST MAKE A BIG
      DECISION!!!■":FOR N=1 TO 35:PRI
      NT WEL$(N,N);:NEXT N:NUM=1
13005 TRAP 13010:? :? "HIT THE ■RETUR
      N■ KEY WHEN READY";:INPUT A:IF
      A=0 THEN END
13010 PRINT "{CLEAR}{BELL}":TRAP OFF
13011 ? :? :? :? :? "DO YOU WANT TO
      USE THE LIST OF WORDS  ALREADY
       IN THE COMPUTER OR DO YOU WAN
      TTO LOAD IN A NEW LIST"
13012 ? :? :? "TYPE IN ■N■ FOR A NEW L
      IST OR HIT ■RETURN■TO USE  THE O
      LD LIST.":? :? :? "TYPE IN ■E■ T
      O END"
13013 ? :? :? "OF COURSE, IF THIS IS
       THE FIRST TIME  THROUGH THE P
      ROGRAM DURING THIS{7 SPACES}SE
      SSION YOU MUST HIT ■N■!!!"
13014 INPUT ANS$:IF ANS$="N" THEN GO
      TO 10000
13015 IF ANS$="E" THEN GOTO 4000
13016 IF TIME=0 THEN ? "{3 BELL}":GO
```


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```
      TO 13018
13017 GOTO 13019
13018 ? :? :? "THIS IS YOUR FIRST TI
      ME THROUGH THE{3 SPACES}PROGRA
      M. YOU MUST LOAD IN OR CREATE
      A NEW LIST NOW!":GOTO 13011
13019 PRINT "{CLEAR}"
13020 ? :? :? "IF YOU WANT TO PRACTI
      CE FOR A CERTAIN NUMBER OF TIM
      ES TYPE IN C AND HIT
      {5 SPACES}RETURN."
13025 ? :? :? "IF YOU WANT TO PRACTI
      CE UNTIL YOU GET TIRED JUST HI
      T RETURN."
13030 ? :? :? "IF YOU WANT TO QUIT,
      TYPE IN E."
13050 INPUT ANS$:IF ANS$="C" THEN GO
      TO 55
13060 IF ANS$="E" THEN GOTO 4000
13070 RIGHT=10000:GOTO 57
```

Program 2:
Spelling Quiz For VIC (Microsoft BASIC)

```
5 REM SPELLING QUIZ
10 DIMA%(14),W%(20),W$(20):TT=0
15 POKE36879,93:PRINT"{CLR}{2 DOWN}{RED}
   {4 SPACES}SPELLING QUIZ{2 DOWN}":GOTO3
   15
20 PRINT"{CLR}{2 DOWN}HOW MANY WORDS DO Y
   OU WISH TO SPELL":PRINT"CORRECTLY BEFO
   RE"
25 PRINT"ENDING?":PRINT"{DOWN}{WHT}RETURN
   {RED} TO END? ";:GOSUB380
30 RI=VAL(IN$):IFIN$=""THEN120
35 SC=0:AT=0:FORI=1TO20:W%(I)=0:NEXT
40 IFSC=RITHEN110
45 W=INT(20*RND(1)+1):A$=W$(W):IFA$=""THE
   N45
50 FORAR=1TO14:A%(AR)=0:NEXT:PRINT"{CLR}
   {4 DOWN}UNSCRAMBLE:{BLU}":L=LEN(A$):FO
   RLT=1TOL
55 AR=INT(L*RND(1)+1):IFA%(AR)THEN55
60 PRINTMID$(A$,AR,1);:A%(AR)=1:NEXT:TR=0
65 POKE214,20:PRINT:PRINT"{RED}PRESS
   {WHT}RETURN{RED} TO END"
70 PRINT"{HOME}CORRECT{WHT}"SCTAB(13)"
   {RED}WORD{WHT}"W
75 TR=TR+1:PRINT"ATTEMPT"AT+1"{4 DOWN}"
80 POKE214,3+TR*3:PRINT:PRINT"{DOWN}{WHT}
   TRY#"TR:PRINT"{RED}? ";:GOSUB380:IFIN$
   =""THEN110
85 AT=AT+1:IFIN$<>A$THEN95
90 CR$=LEFT$("R"+CR$,20):PRINT"{DOWN}CORR
   ECT!":FORN=1TO500:NEXT:W%(W)=W%(W)+1:S
   C=SC+1:GOTO40
95 IFTR=3THEN115
100 CR$=LEFT$("W"+CR$,20)
105 PRINT"{DOWN}WRONG, TRY AGAIN.{UP}":FO
    RN=1TO700:NEXT:PRINT"{17 SPACES}":GOT
    O70
110 PRINT"{CLR}{2 DOWN}{2 SPACES}YOUR SCO
    RE IS{WHT}"SC:PRINTSPC(6)"{RED}
    {2 DOWN}WELL DONE":GOSUB370:GOTO155
115 PRINT"{DOWN}ANSWER{WHT} ":PRINTA$:FOR
    N=1TO1000:NEXT:GOTO125
120 PRINT"{CLR}{DOWN}GOOD WORK":END
125 PRINT"{CLR}{DOWN}{RED}TRY TYPING THE
    {SPACE}WORD{WHT}":PRINTA$:PRINT"{RED}
    {DOWN}PRESS {WHT}RETURN{RED} TO END":
    L=1
130 PRINT" {LEFT}";:POKE204,0
135 GETC$:IFC$=CHR$(13)THENPOKE204,1:GOTO
    40
140 IFC$<>MID$(A$,L,1)THEN135
145 POKE204,1:IFL=LEN(A$)THENL=0:C$=C$+"
    {SPACE}"
150 L=L+1:PRINTC$;:GOTO130
155 PRINT"{CLR}{DOWN}HERE IS A LIST OF HO
    W MANY TIMES EACH WORD{2 SPACES}WAS S
    PELLED CORRECTLY:"
160 FORI=1TO20:PRINT"{WHT}"I"{RED}{LEFT}"
    W%(I)W$(I):IFI=9THENGOSUB370:PRINT"
    {CLR}{DOWN}"
165 IFI<20ANDW$(I+1)=""THENI=21
170 NEXT:GOSUB370
175 PRINT"{CLR}{DOWN}ATTEMPTS{WHT}"AT:PRI
    NT"{RED}{DOWN} CORRECT{WHT}"SC:L=LEN(
    CR$):IFL=0THEN315
180 C=0:FORI=1TOL:C=C-(MID$(CR$,I,1)="R")
    :NEXT:PE=INT(C/L*100):PRINT"{RED}
    {DOWN} PERCENT{WHT}"PE"{LEFT}%"
185 CR$="":FORG=1TO5:READDA,G$,C$:IFPE<DA
    THENNEXT
190 DATA90,A,EXCELLENT,80,B,VERY GOOD,70,
    C,GOOD,60,D,HMMM,,F,STUDY
195 RESTORE:PRINT"{RED}{DOWN}GRADE{WHT}
    {RVS} "G$" {OFF}{RED}"C$"!":GOTO315
200 TT=1:P=0:PRINT"{CLR}{3 DOWN}{PUR}PRES
    S:{DOWN}":PRINT"{WHT}C{RED} TO CREATE
    {DOWN}":PRINT"{PUR}OR{DOWN}

205 PRINT"{WHT}R{RED} TO RETRIEVE A FILE
    {DOWN}":FORI=1TO20:W$(I)="":NEXT:GOSU
    B375
210 IFAN$<>"C"THEN280
215 PRINT"{CLR}{DOWN}ENTER UP TO 20 WORDS
    {2 SPACES}ONE BY ONE AND PRESS
    {2 SPACES}{WHT}RETURN{RED}"
220 PRINT"{DOWN}LIMIT EACH WORD TO 14 LET
    TERS.
225 PRINT"{DOWN}PRESS {WHT}RETURN{RED} WH
    EN YOU ARE FINISHED.
230 PRINT"{2 DOWN}BE SURE YOU SPELL THE W
    ORDS CORRECTLY"
235 PRINT"{DOWN}{WHT}ENTER YOUR WORDS
    {DOWN}{RED}":FORN=1TO20
240 PRINT"{WHT}"N"{RED}? ";:GOSUB380:IFIN
    $=""THEN250
245 W$(N)=IN$:NEXT
250 PRINT"{DOWN}ENTER AN IDENTIFIER":PRIN
    T"{DOWN}? ";:GOSUB380:IFIN$=""THENIN$
    =" "
255 W$(0)=IN$:PRINT"{CLR}{2 DOWN}":FORI=1
    TO20:IFW$(I)=""THEN270
260 IFPOS(0)+LEN(W$(I))>20THENPRINT
265 PRINTW$(I)",";:NEXT
270 PRINT:PRINT"{WHT}"W$(0):PRINT"{DOWN}
    {WHT}POSITION THE TAPE{RED}":GOSUB370
275 PRINT"{CLR}":OPEN2,1,1,W$(0):FORI=0TO
    20:PRINT#2,W$(I):NEXT:PRINT#2,W$(0):C
    LOSE2:GOTO315
280 PRINT"{DOWN}POSITION THE TAPE":GOSUB3
    70:PRINT"{CLR}{2 DOWN}"
285 OPEN2,1,0:INPUT#2,W$(0):PRINT"{DOWN}N
    AME {BLU}"W$(0)"{RED}{DOWN}"
290 FORI=1TO20:INPUT#2,W$(I):IFPOS(0)+LEN
    (W$(I))>20THENPRINT
295 PRINTW$(I)" ";:NEXT:CLOSE2
300 PRINT:PRINT"{DOWN}{RED}IS THIS THE GR
    OUP OF":PRINT"WORDS YOU WANTED";:GOSU
    B375
305 IFAN$="N"THEN200
310 GOTO345
```


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```
315 GOSUB370:IFTT=0THEN200
320 PRINT"{CLR}{2 DOWN}{PUR}PRESS:{DOWN}"
325 PRINT"{WHT}RETURN{RED} TO USE THE":PR
    INT" WORDS ALREADY IN THE{2 SPACES}CO
    MPUTER{DOWN}"
330 PRINT"{PUR}OR{DOWN}":PRINT"{WHT}N
    {RED} TO LOAD A LIST{2 DOWN}":PRINT"
    {PUR}OR{DOWN}":PRINT"{WHT}E{RED} TO E
    ND{DOWN}"
335 GOSUB375:IFAN$="N"THEN200
340 IFAN$="E"THEN120
345 PRINT"{CLR}{2 DOWN}{PUR}PRESS:{DOWN}"
    :PRINT"{WHT}RETURN{RED} TO PRACTICE":
    PRINT" UNTIL YOU GET TIRED{DOWN}"
350 PRINT"{PUR}OR{DOWN}":PRINT"{WHT}C
    {RED} TO PRACTICE A":PRINT" CERTAIN N
    UMBER OF":PRINT" TIMES{DOWN}"
355 PRINT"{PUR}OR{DOWN}":PRINT"{WHT}E
    {RED} TO QUIT{DOWN}":GOSUB375:IFAN$="
    C"THEN20
360 IFAN$="E"THEN120
365 RI=10000:GOTO35
370 PRINT"{DOWN}{2 SPACES}PRESS {WHT}RETU
    RN{RED}";
375 PRINT"? ";:GOSUB380:AN$=LEFT$(IN$,1):
    RETURN
380 IN$="":ZL=0
385 POKE204,0:PRINT"*{LEFT}";
390 GETZ$:IFZ$=""THEN390
395 POKE204,1:PRINT" {LEFT}";:IFZ$=CHR$(1
    3)THENPRINT:RETURN
400 IFZ$=CHR$(20)ANDZLTHENZL=ZL-1:IN$=LEF
    T$(IN$,ZL):PRINTZ$;
405 IF((Z$>"/"ANDZ$<":")OR(Z$>"@"ANDZ$<"[
    "))ANDZL<14THENPRINTZ$;:IN$=IN$+Z$:ZL
    =ZL+1
410 GOTO385                                  ©
```


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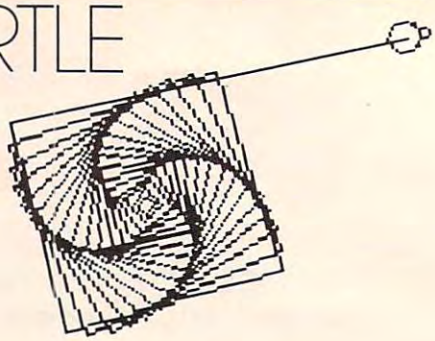
FRIENDS OF THE TURTLE



David D Thornburg, Associate Editor

Ed Emberley's Drawing Procedures

Part of the appeal of turtle graphics is that it allows complex pictures to be built from simple building blocks. This feature arises from the fact that each shape description or procedure describes the shape itself, independently of its starting point or orientation. For example, once a square is defined with the procedure:

```
TO SQUARE :SIZE
   REPEAT 4 [FORWARD :SIZE RIGHT 90]
END
```

the computer can use this procedure to create a square of any size at any starting location and orientation.

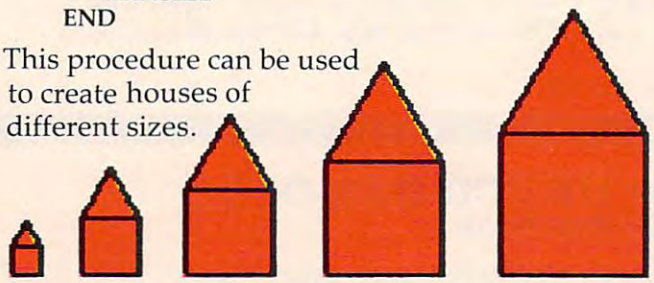
If the user has built up a set of useful geometric procedures, these can be combined to create more complex figures. If one also has a procedure for drawing triangles:

```
TO TRI :SIZE
   REPEAT 3 [FORWARD :SIZE RIGHT 120]
END
```

then a procedure for drawing a house can be created from a combination of a square and a triangle:

```
TO HOUSE :SIZE
   SQUARE :SIZE
   FORWARD :SIZE RIGHT 30
   TRI :SIZE
END
```

This procedure can be used to create houses of different sizes.



Many turtle graphics enthusiasts create libraries of basic figures from which quite interesting pictures can be created.

As an active proponent of turtle graphics and procedural problem-solving, I was delighted to find Ed Emberley's independent discoveries along these lines.

Ed Emberley has written several books on illustration for children. His books of particular interest to readers of this column would include: *Ed Emberley's Drawing Book of Animals*, *Ed Emberley's Drawing Book*, *Make a World*, *Ed Emberley's Big Orange Drawing Book*, and *Ed Emberley's Big Purple Drawing Book* (all published by Little, Brown and Co.).

Mr. Emberley's illustration technique is built on the idea that, just as words are created from an alphabet of letters, pictures can be created from an alphabet of shapes. He shows how to create myriad figures using circles, rectangles, arcs, lines, triangles, and other simple pieces. By building the figure piece by piece, the young artist is never overwhelmed by trying to deal with the whole figure at once. The following series of illustrations (courtesy of Mr. Emberley) shows how one can create a clown's head almost entirely from circles and circle parts.

If you were to create this figure using turtle graphics procedures, you would need only procedures for a circle, an arc, a rectangle, and the squiggles for the hair.

Ed Emberley does not normally use a computer to create his illustrations. The clown figures shown on the next page are a happy exception to that, as he created them on an Apple computer using the KoalaPad touch tablet with the Micro

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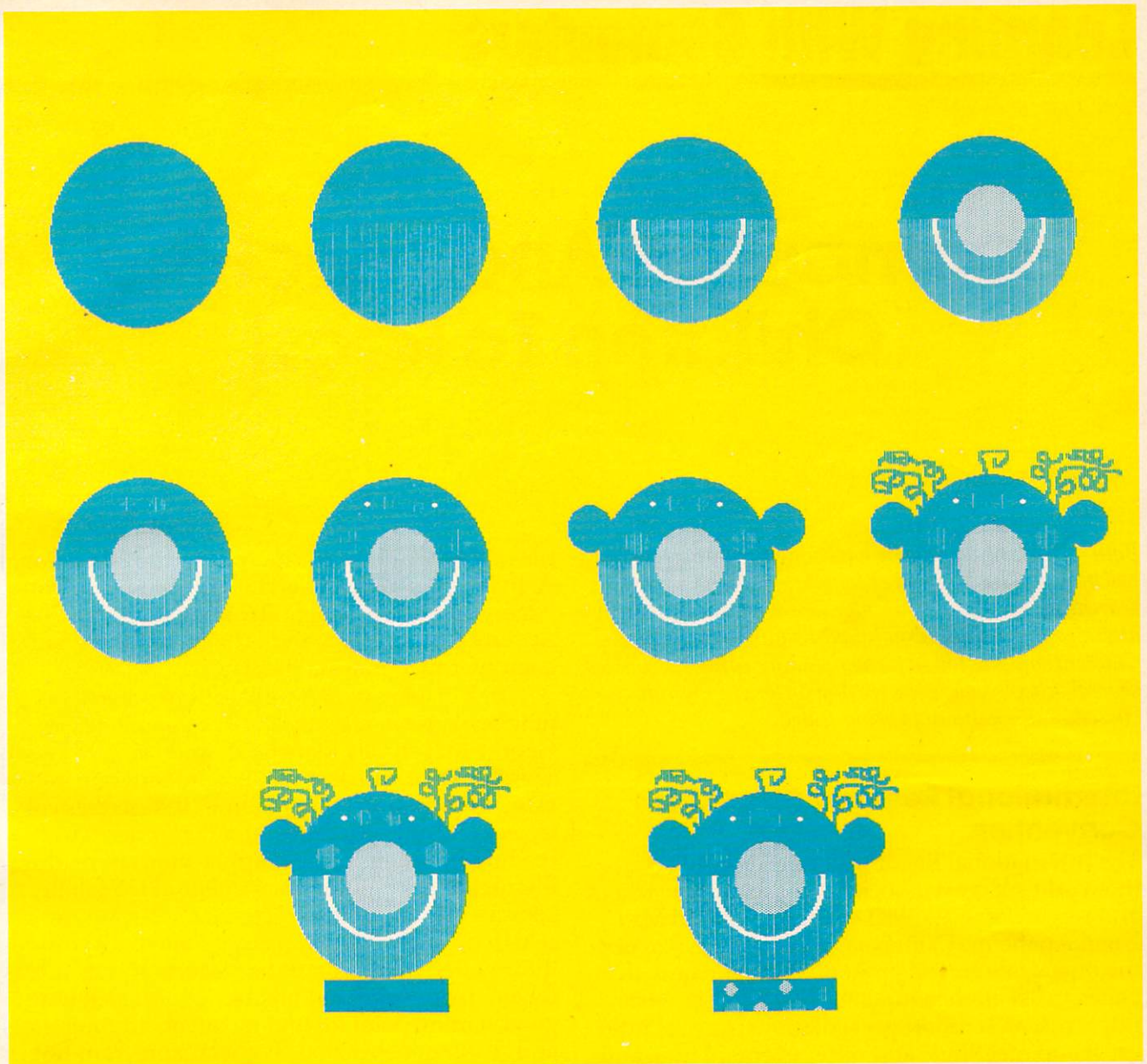
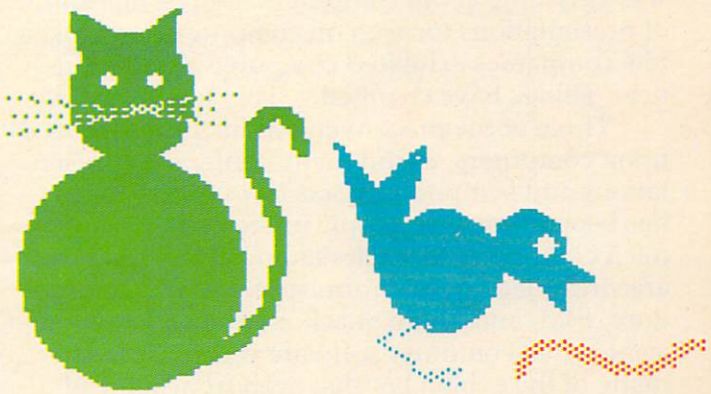


Illustrator software. I am encouraging him to use Logo also to see how he likes it.

Just as Mr. Emberley's books can be a source of inspiration to those of us who build pictures using turtle graphics, they can also be wonderful tools for teaching procedural problem-solving – for teaching people how to solve larger problems by breaking them into bite-sized chunks. For this reason I encourage the use of his drawing books by teachers of computer programming. Not only are the children learning to solve problems with procedures, but they are also learning how to create charming illustrations at the same time.

I created the next figure myself to show that almost *anyone* can learn to make pictures in this manner.



For those of us who have been in the field a long time, the discovery of Mr. Emberley's excellent contributions is refreshing. Clearly, he is a Friend of the Turtle! ©

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Learning With Computers

J.B. Shelton and Glenn M. Kleiman

Computers And Teaching Children To Read

Both authors of this report have long been interested in teaching children to read. Kleiman, previously a researcher at the National Center for the Study of Reading, attended the 1983 International Reading Association Convention. Shelton, a former reading tutor, has visited several schools where the IBM-sponsored program discussed in this column is being tested.

International Reading Association Convention

The International Reading Association (IRA) is the world's largest association of reading teachers and researchers. Its 1983 convention, held May 2-6 in Anaheim, California, reflected the size of the organization. The program booklet required 58 pages to list all the workshops, symposia, institutes, research report presentations, special interest group meetings, and other events. Thousands of teachers and researchers attended, and almost 250 companies exhibited their products.

Three years ago, at the 1980 convention, there was very little about computers. Only a handful of presentations focused on computers, and just a few companies exhibited computer-based products. Things have changed.

Three of the preconvention institutes focused upon computers, as did many conference presentations and symposia. A special interest group has been formed by people interested in using microcomputers to teach reading. The exhibit area included booths from Apple, Atari, Commodore, IBM, and Radio Shack. Perhaps most significant is that computer software was included in many of the exhibit booths, even from some of the major textbook publishing companies. Scott Foresman, Random House, Ginn, Houghton Mifflin, Scholastic, Milliken, Borg-Warner Educational Systems, Developmental Learning Materials, Walt Disney Educational Media, Educational Activities, Hartley, Follett Library Book Company, American Educational Software, Computer Curriculum Corporation, and other companies had computer materials on display.

In a display of IRA publications, there was a new book, *Computer Applications in Reading*, by George Mason, Jay Blanchard, and Danny Daniel. This book is a valuable resource for anyone interested in computers and reading. It describes college and university centers for computer-based reading programs, school applications in reading instruction, computer assessment of readability, sources of computer services and software, research on computers in reading, and background information about computers. Much of the book is taken up by annotated bibliographies, so it is a good starting point for finding out about computers and reading instruction. It is available from IRA, 800 Barksdale Road, Box 8139, Newark, DE 19714.

A new journal, *Computers, Reading and Language Arts*, was also being promoted. It contains articles, book reviews, software reviews, and news, all focusing on "the day-to-day use of computers in teaching basic skills in subjects like reading, writing, and spelling." For more information about this journal, contact Modern Learning Publishers, Inc., 6517 Liggert, Oakland, CA 94611.

At the IRA convention, there was clearly tremendous interest in using computers to teach reading. There were discussions of the potential of computers to help motivate children, to provide drill and practice in phonics and word recognition, to administer and score tests, and to improve comprehension skills. Many teachers, administrators, and researchers expressed optimism about the possible uses of computers.

However, there was far more said about

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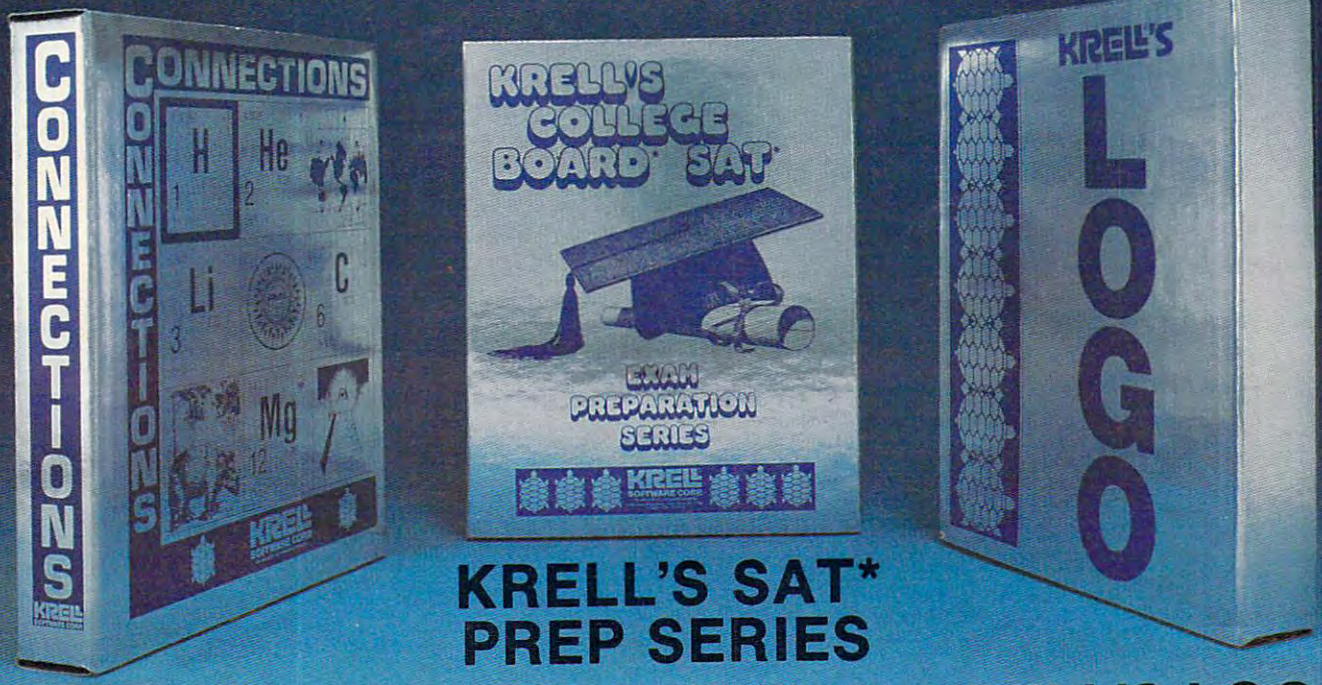

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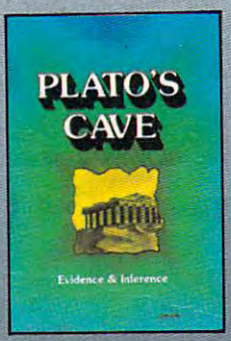

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plans, potentials, and desires than about how computers are already being used. The presentations, for the most part, focused on the need for teacher training and the process of implementing computers in schools, and selecting and evaluating software – the beginning steps of using computers. Reading educators are just getting started with computers. It will be a few years before presentations at IRA can discuss what actually happens when computers are used in teaching children to read.

"Our kindergartners, four months into the school term, are writing sentences. They have to be enjoying, as well as learning from, the computers to show the dedication they do."

Writing To Read

One reading program already being used was shown at the IBM exhibit booth and at a separate display. The program is part of a comprehensive reading instruction package for kindergarten and first-grade children. Developed by Dr. John Henry Martin and called "Writing to Read," this approach to teaching reading is being tested by schools in eight states and in Washington, D.C., with 10,000 children participating. Wake County, North Carolina, with 2,900 kindergarten children in 34 schools, is the largest single participant in the national test. The program runs on IBM Personal Computers, and testing is funded by IBM. Dr. Martin's company, JHM Corporation, is supervising the program and, at the end of a two-year test period, Educational Testing Service will conduct an evaluation.

The introduction of Writing to Read into the schools was threefold: teachers and principals were given a two-day training seminar and a system management manual; parents viewed an orientation film and experienced a hands-on session; and the children were prepared in the classroom for the computer lab procedures.

The Program In Action

At Briarcliff Elementary School in Cary, North Carolina, the reading lab contains four IBM Personal Computers, one printer, eight electric typewriters, and ten tape recorders. Each child spends one hour per day in the reading lab. The computer segment lasts 15 minutes. The remaining time is spent in work center activities – children review their words, use typewriters to write, and listen to, and read, stories.

At the computer stations, the children work in pairs, using IBM Personal Computers with synthesized voice output and color graphics. Wearing headphones, the children listen and respond to the synthesized voice and graphics display.

The computerized lessons are designed to teach children letter-sound correspondences. The lessons use a "phonemic alphabet" which represents each of the 42 sounds of English by one symbol. That is, this approach uses a special teaching alphabet that makes the letter-sound correspondences consistent. For example, "cat" would be written as "Kat," and "through" as "throo." The children are introduced to all 42 phonemes by working with 30 words. The selected words include all the sounds and are represented by pictures – dog, cat, bed, rabbit, fish, and so on. The children learn the 30 words in ten cycles, each with three words.

The symbols for the sounds are displayed around the perimeter of the computer screen (these symbols are letters, letter pairs such as "th," and letters with markings, such as for long and short vowels). A color picture appears on the computer screen, with the word spelled both phonetically (rabit) and in standard English (rabbit). The computer (using a digitized female voice) intones: "Say rabbit." There is a pause for the children to say the word aloud. They are then instructed in the phonemic spelling, sound by sound. The voice requests an "r" and waits for the correct letter on the keyboard to be pressed. Incorrect key presses are simply ignored. When "r" is pressed, the phoneme "r" moves from its place at the perimeter of the screen to midscreen. The voice repeats, "Say rabbit," and the children again recite the word. This sequence continues until the whole word is spelled out. The procedure is very repetitive. As each new word is selected, the computer says the word, asks the children to repeat it, spells the word aloud, and asks the children to take turns spelling it several times. Since phonemic spellings are emphasized, the children must spell "rabbit" with only one "b" – the computer ignores any pressing of "b" after the first one.

After the learning phase, the computer work goes on to a "mastery test." Students are asked to spell the words they have just learned. If they make two errors, the computer takes them back to the learning phase. Following success on the mastery test, there is a "make words" phase, in which all the phonemes the children have learned so far are reviewed and combined into new words. There are also some game activities, such as one where the children must repeatedly type "mouse" quickly enough to keep a mouse pictured on the screen moving away from a cat.

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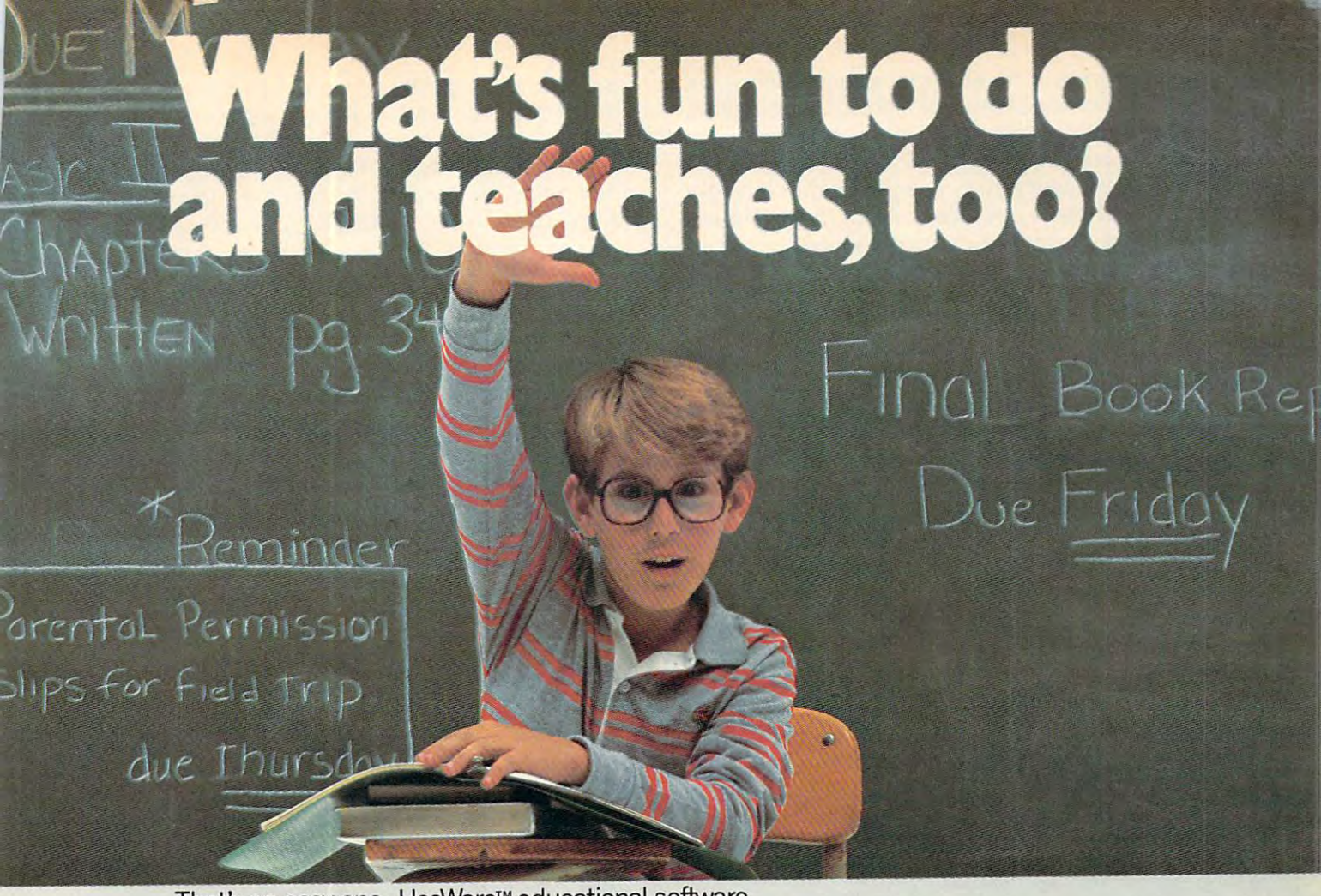

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The work-center activities complement and supplement the computer lessons. At the work-journal station, the children use workbooks which provide practice with the three basic words just learned, present additional words that have the same phonemes, and leave room for children to write new words. At the make-words center, the children write and illustrate words. At the classics listening center, they listen to stories on tape and read along with the actual books. This familiarizes them with standard spelling. At the typewriter station, children use IBM Selectric typewriters to write the words they have learned, combine them into sentences and, when they are ready, begin to write stories.

Program Effectiveness

Writing to Read has many similarities to other approaches to teaching reading. For example, it shares the use of a phonetic alphabet with approaches using the International Teaching Alphabet. The emphasis on letter-sound correspondences and on having children say the words and sounds repeatedly reminds us of such structured phonics approaches as the DISTAR method. However, the overall blend of computer and workstation activities is Dr. Martin's own synthesis, reflecting his experience as a teacher and school administrator and his philosophy of education.

Writing to Read has been enthusiastically received by the teachers and children at Briarcliff School. The principal, Mary Jane McReynolds, noted: "Our kindergartners, four months into the school term, are writing sentences. They have to be enjoying, as well as learning from, the computers to show the dedication they do."

Several minor problems, such as the mastery tests being too rapid and the headphones not working well, have been remedied. Kathleen Burt, head of Briarcliff School's Kindergarten program, reports: "We're more than pleased; we have high hopes. You can't separate reading and writing, and this is a logical approach toward teaching them together. It combines many of the best teaching methods we use in the classroom with the technological advantages of the computer."

The Writing to Read approach is an eclectic one, combining phonics, writing, and the reading of classical children's stories. Some educators would object to certain aspects, such as using nonstandard phonetic spellings and having children begin learning letter-sound correspondences before they learn "whole-word" or "sight" recognition of common words. These are classic issues in the teaching of reading, issues that have been debated for many years. We will not enter into this debate here, but we do want to point out that the computer does not settle any of these issues. Computers can be used in any approach to teaching reading. But computers do not tell us how or what to teach, and they do not automatically solve children's reading problems.

Dr. Martin and IBM are to be commended for their efforts to integrate computers into a complete approach to teaching reading, and for subjecting their approach to large-scale testing and evaluation. However, they are using the computer for only one purpose – to teach letter-sound correspondences to beginning readers. We hope to see other methods of teaching reading begin to incorporate computers, and to see computers used to help children develop more advanced reading skills. ©

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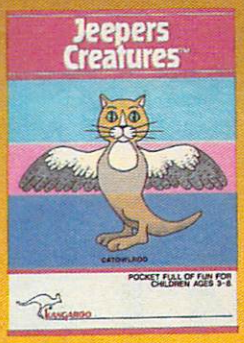

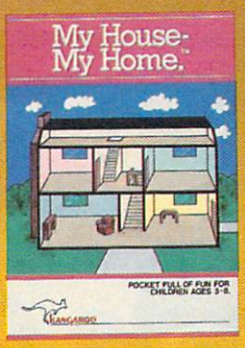

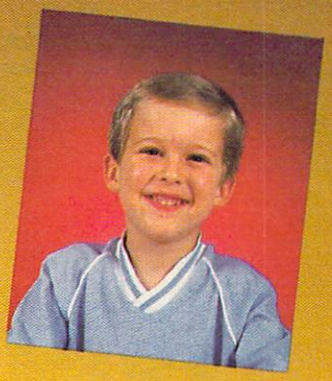

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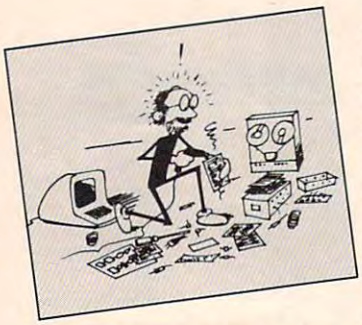
Islands Of Learning

Fred D'Ignazio, Associate Editor



I am afraid that homes and schools are swiftly becoming islands of computer learning. I am afraid that unless something is done to coordinate this learning, the tremendous educational potential of personal computers might never be realized.

I've been speaking on this subject at several educational conferences, including the National Educational Computing Conference in Baltimore, the Florida Instructional Computing Conference in Tampa, and the Hollins College conference on "Computers in the Schools."

In Tampa, my speech was entitled "Linking Computers in the Classroom and the Home." After the speech, one of the people in the audience came up and introduced himself as Kenneth Komoski, Educational Director of the Educational Products Information Exchange (EPIE).

Ken and I sat down and chatted. We discovered that each of us independently had decided that the critical area in educational computing was neither the classroom nor the home. Instead it was the *connection* or the *gap* between the two.

To show how similar our thinking was, here's a quote from one of Ken's recent articles:

> It's important for parents to work cooperatively with educators and community leaders to make decisions about computers and educational software.... At stake is not only the quality of computer instruction in the schools, but also the full educational potential of microcomputers for your child, your family and your community. If parents and schools do not work together, much of this potential may be lost.
>
> Kenneth Komoski, *Network* (3/83).

Ken told me about the work he had been doing. He mentioned that his organization, EPIE, had recently joined forces with Consumers Union to evaluate educational computing products. Evaluations are published in a monthly *MICROgram*. (Subscriptions to *MICROgram* are available from EPIE-Consumers Union, P.O. Box 839, Watermill, NY 11976.)

Millions Of Programs

Hundreds of new educational software packages are appearing each month. Families and schools are buying these packages by the *millions*. In 1982, 1.4 million educational software packages were sold. Experts predict that 4 million packages will be sold this year.

Families are buying the software and schools are buying the software, but there is little or no coordination between the two. This is the source of Ken's and my concern.

The Miracle Machine

This lack of coordination creates a real problem. The biggest impact of computers will probably be on kids using computers at home. Yet families have the least experience in setting up a formal curriculum of instruction.

Many parents buying computers are hoping that the educational programs that their kids use will teach the kids without any parental guidance. Or that the programs at least won't do any harm.

But are these parents placing too much faith in the computer?

Ever since they were first invented, computers have been seen as a miracle solution to all sorts of problems. But people have learned the hard way that computers do nothing on their own. If computers are given the right instructions, they can help. But people still do most of the work.

The same is true for computer learning. The computer cannot teach a child on its own. Parents

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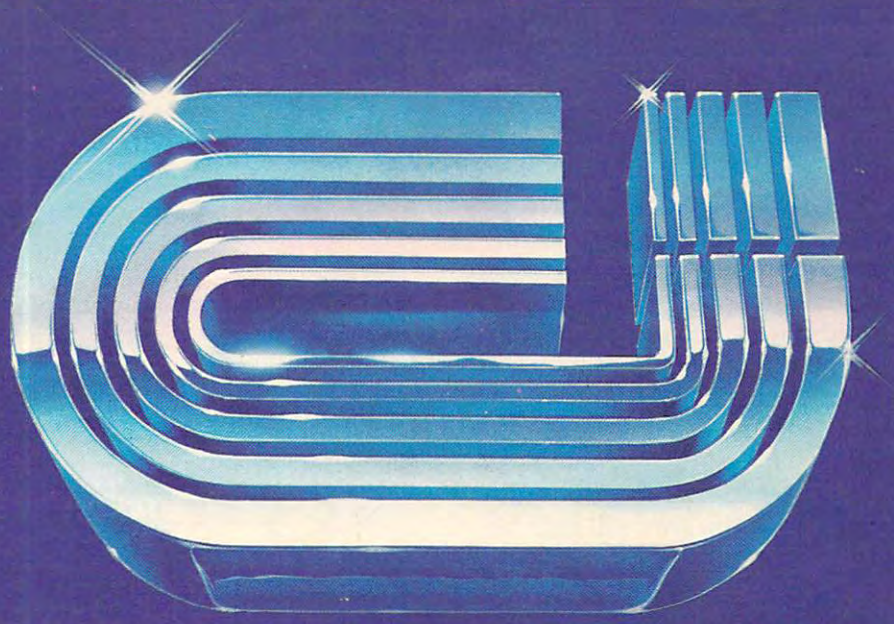

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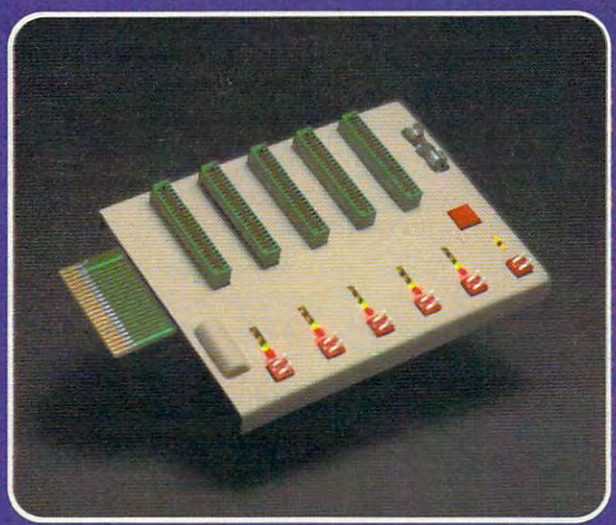

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and teachers still need to do most of the work. They need to create an environment and a curriculum fitted to the needs and age level of each child. Then the computer can be a valuable assistant.

The Impact Of Computer Learning

We have another problem. Computer learning at home is likely to be unguided and uncontrolled. Yet unless computer learning at school and at home is better coordinated, the impact of computer learning will be much greater at home.

Look at the ratio of kids to computers at home and in the schools. At home the ratio is great; at school it is miserable. This is not a nice thing to admit, but it's true. One reader recently wrote me that at her school the ratio was 400 kids to only one computer. "But," she admitted, "I suppose that's better than no computers at all."

At home the ratio is much smaller, of course. Either it's nonexistent, because the family doesn't want or can't afford a computer, or it's something like two or three kids per computer.

And when you think about how much exposure each child will get to educational software at home, the situation looks even worse.

Software prices are beginning to drop rapidly. Quality educational software will soon be available at affordable prices (from $5 to $30 a package). Yet at school the software must run on the same computer that is in demand by (perhaps) hundreds of schoolchildren. This makes it unlikely that a child using a computer at school will be able to sample and fully experience the full range of software that his or her school can afford.

At home, on the other hand, a child's family might buy two or three dozen packages, and the child will have the opportunity to fully experience *all of them*.

The lesson here is that the *impact* of computers will be much greater on kids learning at home.

A Riot Of Computer Learning

In recent columns, I have discussed educational computing in the classroom and in the home. In one column, I wrote about the "riot" of learning that will soon be taking place in homes that have computers. I called it a *riot* because computer learning at home will be spontaneous, uncontrolled, and, perhaps, destructive.

Parents have always depended on teachers to provide formal instruction for their children, especially in basics such as arithmetic, writing, and reading. Now there are dozens of math drill programs, typing tutors, spelling instructors, and reading "games."

Parents are buying these programs and turning the computer into a vehicle to teach these skills at home. But in most cases the computer "tutor" will not have a parent looking over its shoulder. The tutor will be teaching the child, but its lessons won't be integrated into a balanced curriculum especially suited for the child.

And this is just the beginning. The computer's effect on home learning will soon increase dramatically. At the end of the next twelve months there will be software on the market to teach every conceivable subject or skill to kids of almost every age. There will be geography programs, programs to teach chemistry, astronomy, art, dancing, songwriting, juggling, current events, and world religions.

Parents will buy this software, but kids will be expected to use it on their own.

The Cereal-Box Strategy

Schools and families will buy millions of educational programs. Schools will buy programs only after they have evaluated the programs' pedagogical soundness and relevance to teachers' existing curricula.

How will parents choose among the hundreds of educational programs on the market? They will buy programs the way they buy everything else. They will choose a particular package because:

- Their child responds to an ad on the back of a box of cereal by crying, "I want that program, Mommy!" And how can the mommy refuse? After all, the program is educational. And it's a lot better than getting the kid the laser blaster that was advertised on the box of cereal the family finished last week.
- Software will soon be on sale at special software stores and at almost every sales outlet imaginable, including local convenience marts, department stores, bookstores, drugstores, beauty salons, hardware stores, and supermarkets. It will be sold alongside how-to manuals, mass-market books, and other inexpensive consumer items. It will become as cheap and as convenient to buy as a detective novel, a romance novel, or a carton of milk.
- Software will soon be packaged as glossily as cosmetics and rock records. Ads on TV, on the radio, and in stores will make buying software as appealing as buying a new kind of lipstick, deodorant, sports car, or diet soda. It will look like an offer that can't be refused.
- Buying software will help people keep up with their neighbors who are also buying software for their kids. After all, a responsible parent can't sit still and watch her kids slip behind. And even the President of the United States admits they're not getting the education they need at school. The only way to get the kids educated is to give them an early start on learning at home. And the only way that can be managed is with a computer – and lots and lots of software.

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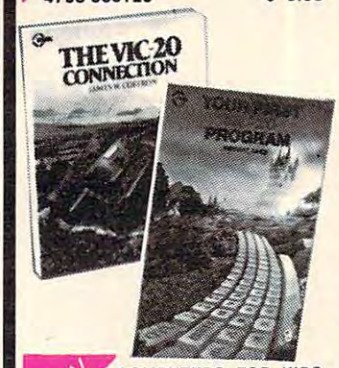

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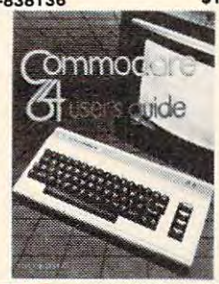

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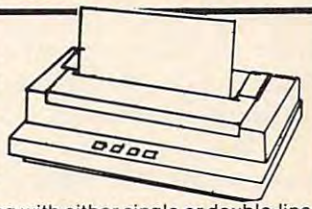

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Help From Software Publishers

Can't parents depend on educational publishers and computer companies to advise them in making their purchases?

Not likely. Educational publishers and computer companies will likely have little or no interest in coordinating the software that children use at home and the software they use in school. Nor will they be concerned with how their software fits into a child's development and into his or her learning experiences.

That's why the average home's computer learning environment will be riotous. Most parents won't have the training or the time to properly select educational software. Nor will they have the skill to build that software into a comprehensive "Home Learning Program" for their children.

Schools have this training and skill, but they are not currently part of the home software selection and evaluation process.

Islands Of Learning

I see two islands of learning that will soon be created by computers. One island will be the school, the other the home.

In the school, computer learning will be structured, well organized, well thought out, properly sequenced, comprehensive, and pedagogically sound. Unfortunately, it will also be minimal, since each kid will have an absurdly small amount of time using any particular package. The effect of computer learning at school will be diluted by the huge number of kids trying to share a few computers.

In the home, computer learning will have a great impact, because kids will have the opportunity to spend a great amount of time on the computer and richly experience each program. Also, there is great potential for home learning to be exceptionally creative, open-ended, informal, self-motivated, and self-guided.

Unfortunately, this potential probably won't be realized. Children's home computer-learning will be blunted by a lack of any plan; by lack of coordination with a child's physical, emotional, social, and intellectual development; by a lack of non-computer learning activities that support the computer instruction; by improper sequencing of materials and concepts; and by the gaps in learning caused by a family's arbitrary purchase of software packages.

Looking Ahead

If present trends continue, and schools and homes become islands of computer learning, what will be the result? What will be the effect of computer learning on our children? What kind of kids will we be turning loose in the public schools? How frustrated will computer-literate kids become when they don't find the same computer resources at school that are available at home? Will non-mainstream kids be left behind? And, if so, how will they ever catch up? (They won't catch up after they leave school. In the future, the average workplace – factory or office – will be even more computerized than the average home.)

If present trends continue, there is the possibility that the effect of computer learning at school will be minimal. It is likely that the effect of computer learning at home will be profound, yet it may also be profoundly destructive. It is also possible that the enormous potential of computer learning at home and at school might never be realized.

Can we permit this? Are there any alternatives?

Building Bridges

There are alternatives. We can link computing at home and computing at school. We can build bridges between these islands of learning. The bridges will permit a two-way flow of expertise and resources. The sharing of computers, software, and learning strategies can make it possible to realize the computer's great potential as a learning tool for children and their entire family.

Ken Komoski's plan for building these bridges is similar to my own. Ken (in his *MICROgram* and elsewhere) stresses "concrete programs and policies." I emphasize communication. Both elements are important. What we need, at minimum, is:

1. *Community-wide Training.* Teachers, parents, and children need to attend common training sessions to learn how to use computers and how to evaluate, select, and get the most out of educational software.

2. *Community-wide Access.* Parent-teacher organizations should set up *computer cooperatives* to evaluate computer software and hardware sold by local vendors. Discounts (Ken's idea) should be offered to parents who buy the computers and software recommended by the cooperative. Low-income families in the community should get special deals: computers and software should be available for families to lease, lease-purchase, buy at a discount, or check out from a co-op library.

3. *Communication.* The co-op should hold regular public meetings and publish a monthly newsletter to make all the parents in the community aware of the diverse aspects of educational computing, including:

- Past, present, and planned applications of computers in the school (by teacher, subject, and grade).
- Educational applications of computers in local homes (by manufacturer, name of software, subject, age of children).
- Recommendation of the best new educa-

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tional software and hardware; results of evaluations and tests performed at local schools and by local parents.

- Opportunities for Action: Community Computer Faires, Computer Flea Markets and Yard Sales, Parents' Brag Nights, involvement in software and hardware evaluation committees, donation of used hardware and software to the co-op library, etc.

4. *Sharing*. The co-op needs to set up libraries of hardware and software.

Families will be buying much more hardware and software than schools. *And they will be going through it much faster.* The co-op should get families to donate, loan, or sell (at a discount) the old software and hardware that their kids have outgrown. This strategy will create an enormous reservoir of materials that can be used in the classroom and by families who otherwise would have no access to them.

In addition, this strategy will create a *Supply Depot* of computer parts, including disk drives, cables, monitors, computer circuit cards, wires, plugs, and connectors. Since computer models change so rapidly, this Depot could become an invaluable resource for the schools and the community at large. Having backup computer supplies will make it possible to keep computers up and running for longer periods of time. It will make it possible to put more students on the computers and allow the students to use a wider variety of software packages.

What Do You Think?

I am convinced that the most important area in educational computing will be what is done to link educational computing in the classroom and in the home.

What do *you* think?

I would like to hear your ideas about this subject. Is it important? Will it become more important in the future? What are some of the dangers if nothing is done? What are some of the strategies we can adopt to link computing in the classroom and the home? What issues haven't I covered?

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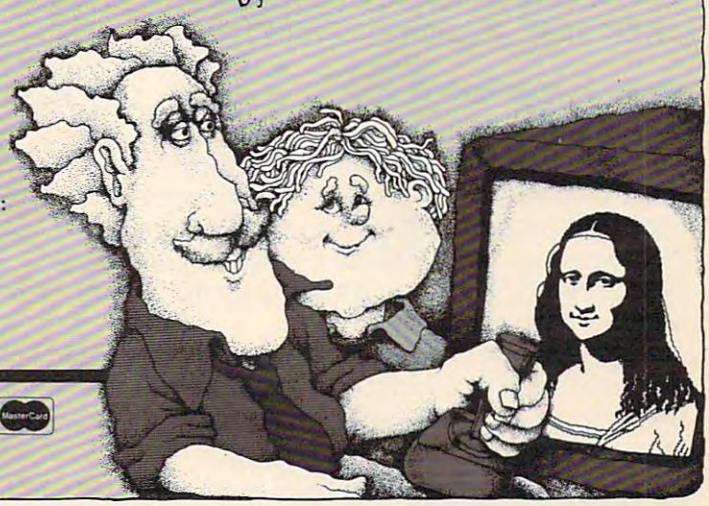

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Merging BASIC Programs From Commodore Disk

Jim Butterfield, Associate Editor

It's often very useful to be able to merge two programs. Here, Jim Butterfield steps through a disk merger program that is helpful also in understanding how programs are formatted and stored on disk. For all Commodore machines.

Programs can be merged using a curious technique with cassette tape – see "BASIC Program Merges: PET And VIC," COMPUTE!, June 1982, page 158. We can also do a disk merge in a much more straightforward manner.

Disk Advantages

With disk, we can have several files going at the same time. Thus, we can read two separate programs and write out the new combination program as a single activity.

With a disk unit, we can read in programs as if they were sequential files. This means that we can manipulate a program as if it were data; for that matter, we can write a data file which may be later used as a program. This opens the door to sophisticated activities, such as programs that analyze other programs, or programs that write programs.

The Merge Program

To show how it's done, and to provide a useful capability, we'll walk through some simple programming which will merge two programs. This MERGER program will work on all Commodore disk-based systems: VIC-20, Commodore 64, and PET/CBM. It's written in BASIC to enable you to see how everything works.

As we walk through the program lines, we'll point out special considerations that we need to take into account when reading and writing program files (as opposed to data files).

First, we identify the program:

```
100 PRINT "PROGRAM MERGER"
```

Each of the two input files will have individual working values. For example, C$ is the line of code we are working on; N is the line number. Let's make room:

```
110 DIM A$(2),B$(2),C$(2),N(2)
```

Let's open the error channel so we can spot problems:

```
120 OPEN 15,8,15
```

Now we'll ask for the name of the first program to be merged. We'll OPEN the file as a program (note the ,P for Program), then we'll check for problems and quit if we see trouble:

```
130 INPUT "PROGRAM 1";X$
140 OPEN 1,8,2,X$+",P,R"
150 INPUT#15,E,E$,E1,E2
160 IF E THEN PRINT E$: CLOSE 15: END
```

One extra thing to do here. The first two bytes of a program file contain the program's start address. We will assume that we won't need this information, since VIC and 64 programs will relocate automatically, and PET/CBM programs must start at address 1025. Finally, we'll grab the first line of the program by calling subroutine 420 (more on this when we reach it).

```
170 GET#1,A$,A$: J=1: GOSUB 420
```

We're ready to repeat the sequence for program two. In this case, we'll allow the user to reply "N" in order to specify that no program two exists. In such a case, we'll merge program one with nothing, and just copy program one. But there's a bonus which we'll discuss later.

```
180 INPUT "PROGRAM 2 (OR 'N')";X$
190 IF X$="N" THEN N(2)=1E9: GOTO240
```


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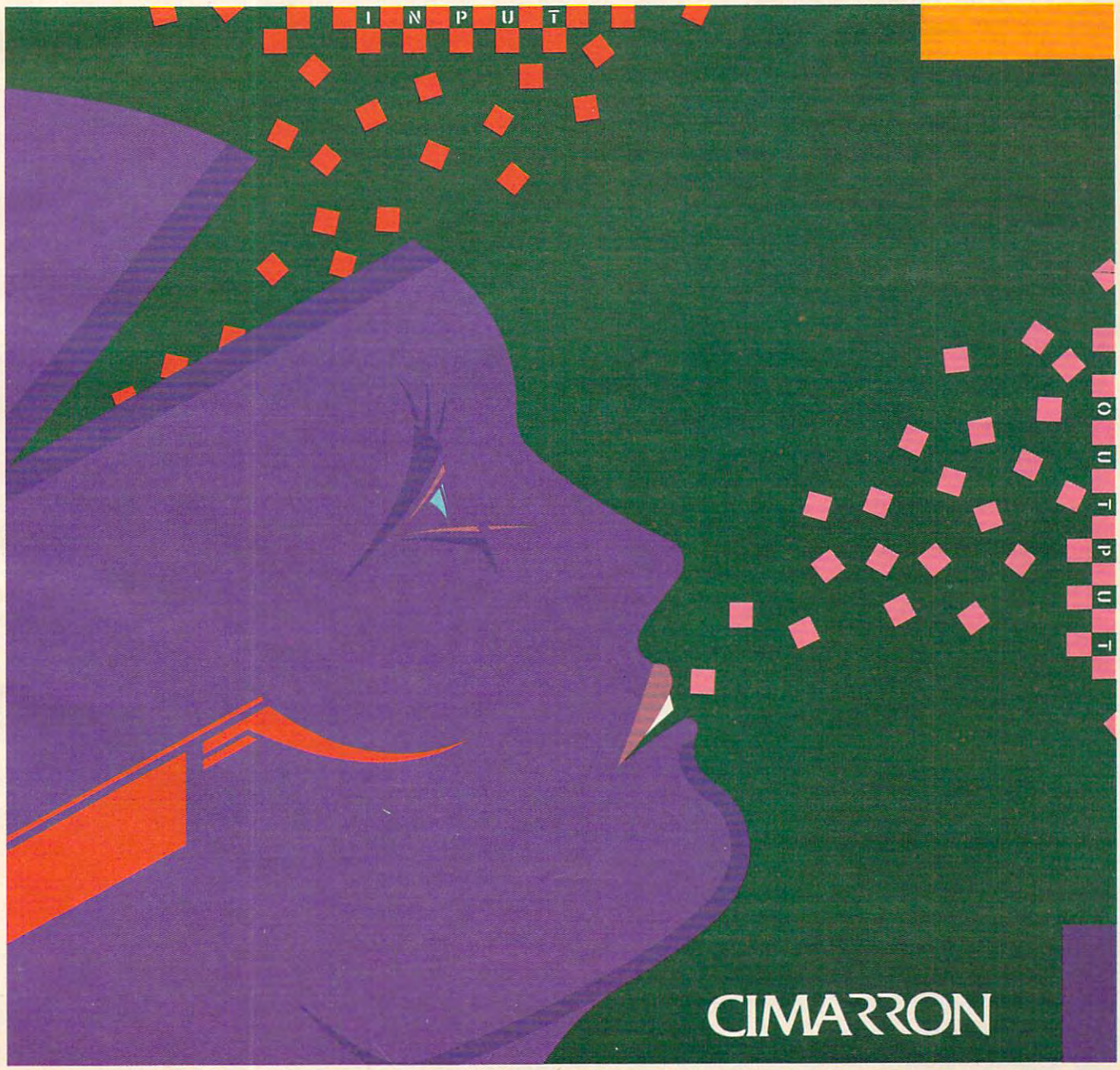

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```
200 OPEN 2,8,3,X$+",P,R"
210 INPUT#15,E,E$,E1,E2
220 IF E THEN PRINT E$: CLOSE 15: END
230 GET#2,A$,A$: J=2: GOSUB 420
```

Now we'll ask for the name of the new, merged file that we are about to create. We OPEN with ",.. ,P,W"; in other words, program file in write mode.

```
240 INPUT "NEW FILE";X$
250 OPEN 8,8,8,"0:"+X$+",P,W"
260 INPUT#15,E,E$,E1,E2
270 IF E THEN PRINT E$: CLOSE 15: END
```

You may recall that we threw away the start addresses from our program input files. Before we start to write our output file, we must insert a start address so that the format is correct. VIC and 64 won't care, but PET/CBM needs an address of 1025, so that's what we'll supply in two bytes:

```
280 PRINT#8,CHR$(1);CHR$(4);
290 REM COMPARE LINES HERE
```

The above REMarks line says it all. We have a line from each program. The line numbers are held in N(1) and N(2). We wish to take the lowest line number; if they are the same, we'll take from file two:

```
300 X=2
310 IF N(1)<N(2) THEN X=1
```

When we reach the end of a file, we make the line number impossibly large. If both line numbers are way up there, we are finished and can wrap up our output file:

```
320 N=N(X):IF N>1E8 GOTO 380
```

Now we're ready to print the BASIC line from file X (X is 1 or 2). We'll need to know the format in more detail. The first two bytes of each line are called a "forward link." We don't need to work them out precisely: provided they are not zero bytes, they will be rebuilt when the program is loaded into the computer. So we can print a couple of CHR$(1)'s.

The next two bytes are the line number, in binary. We happen to have this information in bytes A$(X) and B$(X) – we obtained this in the subroutine at 420 – and we can just print them.

The line of BASIC follows. That's in C$(X); and the line must be followed by a binary zero, or CHR$(0), to terminate it properly. So the whole line goes:

```
330 PRINT#8,CHR$(1);CHR$(1);A$(X);B$(X);C
    $(X);CHR$(0);
```

Now we want to replace the line we've just used. We could read from file X with a call to 420 – but wait a moment. If both line numbers are the same, we want to replace them both. That's what a merge is about: one line overwriting another when the numbers match.

```
340 FOR J=1 TO 2
350 IF N(J)=N THEN GOSUB 420
360 NEXT J
```

We've handled the line in question. Let's go back and do some more.

```
370 GOTO 300
```

If we've reached the end – no more input lines – we terminate the output file with two zero bytes (a "null" forward link) and close down.

```
380 PRINT#8,CHR$(0);CHR$(0);
390 CLOSE 1: CLOSE 2: CLOSE 8: CLOSE 15
400 END
410 REM READ LINE OF BASIC
```

Here comes our subroutine to read from file number J (J may be 1 or 2). First, we grab the first two bytes (the "forward link"). We don't need these, except for one thing: if they are both zero bytes, we are at the end of the BASIC program.

Zero bytes arrive in an odd way. You'd think that the GET statement would receive the equivalent of CHR$(0), a single character containing zero bits. Nope. Due to an eccentricity of BASIC, they arrive as a "null string"; no bytes at all. So that's what we must test for:

```
420 GET#J,A$,B$
430 IF A$="" AND B$="" GOTO 540
```

Now we go for the line number, which we read into A$(J) and B$(J). If they happen to be null strings, we correct them to CHR$(0). Once we've done that, we can calculate the value of the line number and put it into N(J):

```
440 GET#J,A$(J),B$(J)
450 IF A$(J)="" THEN A$(J)=CHR$(0)
460 IF B$(J)="" THEN B$(J)=CHR$(0)
470 N(J)= ASC(A$(J))+ ASC(B$(J))*256
```

We've arrived at the BASIC line text itself. Let's gather it into a string called C$(J). As we collect the bytes, we must watch for the zero byte (or null string, to us) that flags end-of-line:

```
480 C$(J)=""
490 GET#J,A$
500 IF A$="" GOTO 550
510 C$(J)=C$(J)+A$
520 IF ST=0 AND LEN(C$(J))<254 GOTO 490
```

The above line checks for anomalies. If ST is not zero, we've reached the end of file, or we're having trouble with the disk interface. Either way, we want to warn the user or quit. And if C$(J) is getting too long, we must be into something that isn't really a BASIC program. In either case, we'll drop into a warning statement:

```
530 PRINT "PROBLEM FILE ";J
```

If we see the "forward link" of two zeros that flags end-of-BASIC, we set the line number to a ridiculously high value:

```
540 N(J)=1E9
```


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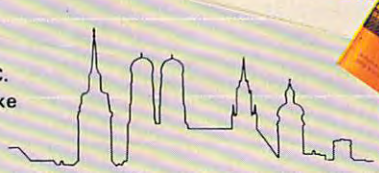

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And in any case, we return to the calling point:

```
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```

A Caution

When you type in this program, be sure that lines 330 and 380 end with a semicolon. If you miss this, you won't get a program; you'll get a mess.

Beginning programmers may not have seen statements such as GET#J,..., where a variable selects which file will be used. A little thought will reveal how it works and will possibly open up new trains of thought on the effective use of BASIC.

Free Bonus

Programs produced by MERGER will load into any Commodore machine. As mentioned before, VIC-20 and Commodore 64 (and the new B series) will automatically relocate programs to the proper address. For the PET and CBM, we have supplied the start address needed by these somewhat less flexible loaders.

This means that a simple run of MERGER with one input program file (replying "N" to the second file name) will convert a program into PET-loadable form.

This is not a wholesale conversion program, of course. A program may be loadable to another machine, but still won't run because the POKEs and PEEKs are incompatible.

Using MERGER

You might like to keep your favorite subroutines as small programs on disk, and merge them into other programs as needed. Be sure to keep your line numbers within compatible ranges so that the new program lines don't overwrite needed parts of a program.

Many calculation programs run using DATA statements. If these statements are saved as a program file, they can be merged into the calculation programs as needed, saving a great deal of retyping.

Perhaps most important of all: a careful reading of this program will reveal a good deal about how programs are formatted and stored on disk.

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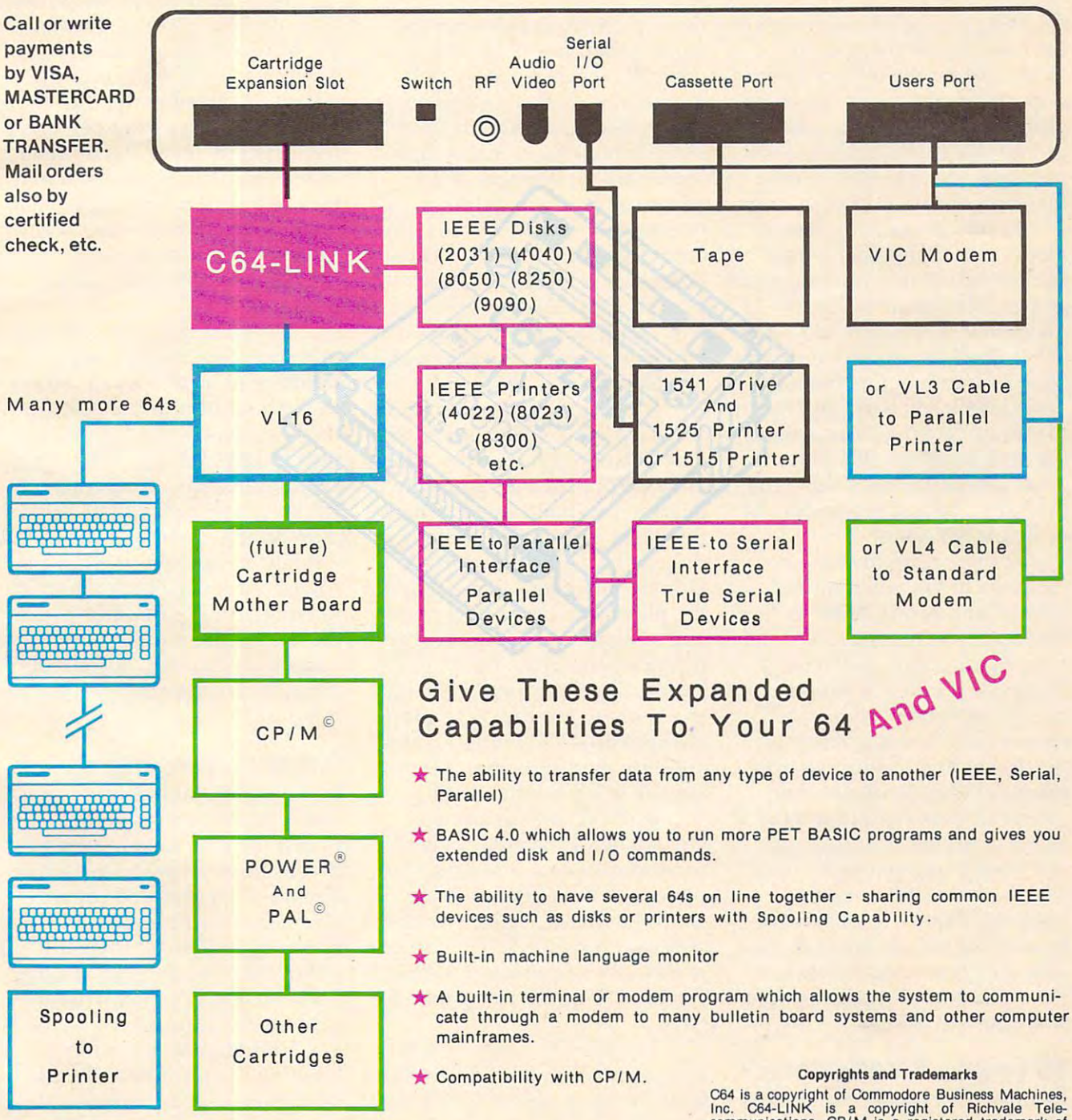

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Jumpman

James Trunzo

Creating a good first impression isn't the easiest thing in the world, especially if the audience is made up of experts. An even more difficult task is to sustain or improve upon that good impression over a period of time. *Jumpman* succeeds in both cases.

In the face of cynical comments like "It's probably just like the rest of the climbing-motif games," *Jumpman* easily conquers that skepticism and establishes itself as a software classic. No true arcade-game fan who takes joystick in hand and begins to manipulate *Jumpman* around the screen will be able to walk away without adding this product to his Atari, Commodore 64, or Apple collection.

It's tempting to compare *Jumpman* to the much more widely ballyhooed *Miner 2049er*. The comparison would be unfair. *Jumpman* is much, much more. The basic premise is simple: you are the Jumpman, a superhero whose great leaping ability is needed to thwart the dastardly efforts of the Alienators. The Alienators have infiltrated the 30 levels of Jupiter headquarters and booby-trapped every floor with bombs. Utilizing your jumping abilities, you must defuse all the bombs on each level and save command headquarters. It all sounds rather simple and clear-cut. Not so.

30 Levels, 5 Variations

As hinted, *Jumpman* comes with 30 game levels, each one unique. The 30 levels are divided into three difficulty levels with five game variations in all. The three difficulty levels consist of a beginner's level, made up of eight "easy" floors; an intermediate level, consisting of ten moderately difficult floors; and the advanced level, containing twelve very complex floors. The other two game variations are Grand Loop, which lets you play all 30 levels consecutively, and Randomizer, which allows you to play a random selection of all levels.

It is this variation that makes *Jumpman* the excellent game that it is. Each level presents a different type of problem. Some are out-and-out hand-eye coordination tests, requiring excellent reflexes and quick thinking. Others, however, demand that the player call upon cleverness and imagination in addition to joystick gamemanship. For example, Hot Foot, one of the ten levels in the intermediate game, is impossible to complete unless you discover the correct sequence to defuse the bombs.

In the Atari version, reviewed here, the game begins with a full-blown title page, complete with delightful animation, excellent music, a game demo and, if you have played before, a review of previous high scores. Pressing SELECT starts your game.

You are first asked to select a game variation and difficulty level by using the OPTION key. Next, after pressing START, you indicate how many players, from one to four. Once the preliminaries are out of the way, the contest begins.

The first level scrolls down from the top, accompanied by the title of that particular screen. The title is then replaced by a variety of information: the number of the current player, the difficulty level, the number of remaining Jumpmen (shown by small renditions of Jumpman lined up eager to get into action), the player's current score, and the player's remaining bonus points.

Once the screen has settled into place and the necessary information is displayed, one of the seven Jumpmen allotted at the beginning of each game appears somewhere on the screen. What else appears depends on the level being played. It always is an arrangement of girders, but it might be accompanied by ropes, ladders (stationary or moving), and/or floating elevators. The number of combinations is amazing, and the configuration of the girders is always unique.

Off And Jumping

During play, Jumpman scurries about the structures on the screen with astonishing animation as he attempts to overcome obvious obstacles and copes with other hazards such as speeding bullets which come out of nowhere, floating blocks that home in and fire at him like a cannonshot, and swooping bats.

Jumpman is moved by pushing the joystick in the direction you wish him to travel. Make him jump by pressing the fire button and pushing the joystick

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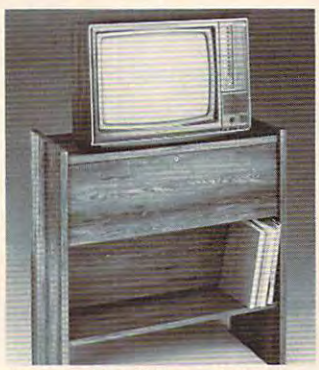

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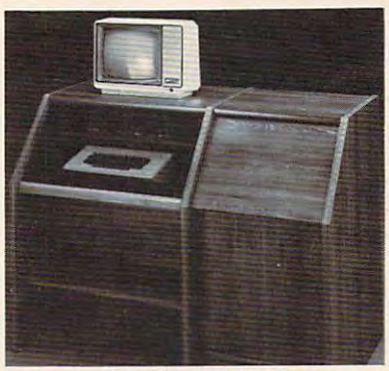

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in the direction you want him to jump. Be forewarned: keep the joystick pushed in the given direction until the jump is completed. Otherwise, you may very well see Jumpman clinging desperately to the lip of a girder, legs kicking and arms flailing, only to fall to his demise.

Scores are achieved in a number of ways: by defusing bombs, killing creatures, discovering and defusing hidden bombs in the puzzle levels, and by completing levels. Also, points are awarded for any Jumpmen remaining at the end of the game. Also, bonus scoring can really add to your score. Each screen begins with a bonus score total of 1500. Every few seconds, 100 points are deducted. Any bonus points remaining at the completion of a screen are added to the total points score. Obviously, the quicker Jumpman defuses all the bombs on a given level, the more bonus points will be added to the grand total.

Jumpman comes with the several additional options. First, you have the option to change Jumpman's speed. Simply press the appropriate number on the keyboard, from 1 to 8, anytime during play. A medium speed is selected by default if you make no selection. Changing the speed of Jumpman changes your strategy. Jumpman is a little more difficult to control at high speeds.

High Scores Recorded

A vanity board allows players to record high scores. A High Score screen appears at the end of any game in which a player qualifies. He or she may enter via joystick up to three initials next to the score achieved. All information is then automatically saved to disk. In addition, a letter will appear to the right of the score indicating at what level the score was achieved. For example, a letter B will appear by the score if it was accomplished while playing at the beginner's level. High scores can also be cleared, assuming no write-protect tab was placed on the disk, by simply pressing the CLEAR key while the game is initially loading into memory.

All in all, *Jumpman* is a fine game. There are excellent hi-res graphics, intricate animation (wait until you see Jumpman scurry up or down a rope), and enjoyable but unobtrusive circus-like music that plays at the end of each level. These and other nice touches reveal the degree of attention the writers paid to small details and put *Jumpman* head and shoulders above most other games, climbing games in particular.

Epyx, better known for its adventure games (especially the Dungeonquest series), has created what should become an arcade classic.

Jumpman
Epyx
Automatic Simulations, Inc.
Sunnyvale, CA 94086
Retail price: $39.95 ©

Synthy 64

Richard Mansfield, Senior Editor

Music can be a complicated affair – you've got pitch, rhythm, tone, and duration/loudness factors to cope with for each musical moment. When you're *digitalizing* music (playing it from a computer), you've added to the complexity because you've got to program lots of numbers. The 64 has many built-in facilities for programming expressive, subtle music, but there's a price: the programmer must specify a good deal about each note.

Synthy 64 is an excellent solution to this dilemma. It allows you full access to the 64's extraordinary sound capabilities, but it greatly simplifies the programming for you. You can avoid

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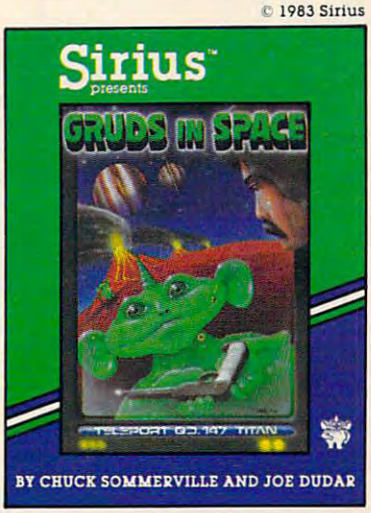

Game design by Chuck Sommerville and Joe Dudar. Package, program and audio visual © 1983 Sirius. All right reserved.

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massive amounts of mysterious POKEs or DATA statements. Just as BASIC makes programming easier because you work with English words, *Synthy 64* makes music programming much more understandable. You work with the notes as they would apply to a piano, rather than with frequency numbers. You indicate a C in the third octave as C3, not as 1097.

This example, however, only touches on the efficiency with which you can enter complex music via *Synthy 64*. Because it is a *language*, like BASIC, you can make *Synthy 64* perform complicated tasks with relative ease. In fact, you program it very much the way you program BASIC: line numbers, LIST, RUN, SAVE, INPUT, error messages, and other BASIC-like commands all work the way you're familiar with. And all the music-specific commands are straightforward and easy to use. Voices, portamento, filtering, tempo, and envelope are simple to program, and even conveniences such as REPEAT a phrase and synchronizing are provided for in the *Synthy 64* language.

To give you an idea, here's one of the early examples from the software's documentation:

```
1 RUN
10 T120
20 C5/4 D E F G A6 B C
30 END
```

This will play a scale from the fifth octave C (C5) using quarter notes (/4). The octaves start with A, so you must put the /6 in, but only when changing to a new octave. Line 10 tells the computer how many quarter notes to play per minute. If you don't set a tempo, the default is 100.

All of *Synthy 64* is similarly well thought out and easy to learn and use. Even esoterica such as ring modulation and special bandwidth filtering become both comprehensible and usable. A 41-page booklet and three sample compositions round out the package. If you've been frustrated because you know your 64 has a lot of music inside it, but you've been unable to get at it – this might well be the tool you've been waiting for.

Synthy 64
Abacus Software
P.O. Box 7211
Grand Rapids, MI 49510
$35 (tape), $38 (disk)

VICFORTH From Human Engineered Software

Peter Busby

VICFORTH is an excellent cassette-based implementation of the Forth language for the Commodore VIC-20. Included in the sturdy 8K cartridge are such features as standard 16-line, 64-character-wide editing screens, many new Forth words (commands) that take advantage of the VIC-20 capabilities, ingenious automatic compensation for memory expansion and, best of all, the power to redefine fundamental Forth words.

A minor objection to VICFORTH – it cannot directly access the 3K memory expansion module. (Neither can BASIC when simultaneously expanded upward.) But without resorting to machine language, Forth can easily be persuaded to use the lower 3K RAM module for tables or even, with care, for dictionary space. This language is so flexible that it often presents several solutions to a problem.

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FORTH signs on with a cyan display and green border, indicating the normal operating environment in which programs are run, words executed and perhaps defined, and peripherals interfaced. Five special words control the tape cassette: WRITE/WRITES saves screens to tape, READ/READS loads screens from tape and LOADS loads and compiles screen 1 from consecutive blocks on tape, maximizing RAM usage with the cassette as virtual memory.

Entering 1 EDIT shifts the format to the EDITOR vocabulary, displaying screen 1 on the top 16 lines with a six-line workspace below, all with a white background. The editor includes many commands for finding, moving and eliminating blocks of material on the screens. Seven commands are programmed to the function keys, and the cursor controls are revectored to the 64-character-wide screen which scrolls horizontally.

Pressing INSERT changes the border to yellow and places the editor in direct screen function, in which the material is normally written to the screen. RETURN then leaves the INSERT mode, and STOP/RESTORE returns to the reset environment. This raises a second objection: the first key entered after reset is usually flagged an error. The habit quickly forms of pressing RETURN after reset, which causes the VICFORTH prompt to be displayed, "OK".

Limitations And Enhancements

Error codes conform to the Forth Interest Group's specifications. The 12 errors are indicated by an arrow and a number, cross-referenced to the instruction manual. Full error messages could be displayed at the cost of some memory, as shown in the manual, since MESSAGE is one of 13 *vectored* words provided. Vectoring allows the user to easily change VICFORTH's I/O

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port interfacing to recognize, for instance, a new printer configuration at the user port.

Other standard fig-Forth definitions missing here are 20 disk-handling words and a few redundant or virtually defunct words. An experienced programmer, with the fig-Forth installation manual in hand, could revector VICFORTH to handle disks. Also, the monitor is missing, but by dropping the memory limit variable EM appropriately and calling the VIC-20 Kernal machine language LOAD, a monitor such as Micromon may be installed. A new word DUMP displays the contents of a range of memory in four-byte lines.

Indeed, any machine language program, the Kernal (Commodore's set of subroutines called from a table), and even the BASIC subroutines in ROM are easily accessed with the word SYS, which has an enormous advantage over BASIC's SYS: the parameters for the accumulator, X and Y registers, and the carry flag can be passed back and forth (so to speak) – invaluable, as Forth often becomes very primitive in its operations.

About 50 words are added to fig-Forth, and many others are defined in the manual to access the VIC-20's features, including words for color and sound control, several predefined Kernal routines, and printer and user-port commands.

A third objection to Tom Zimmer's VICFORTH is the loss of Commodore's screen editor from the operating environment. With the VIC's BASIC editor, normally when RETURN is pressed the interpreter accepts what is on the display – what you see is what you get. In VICFORTH the sequence of keys pressed is acted upon regardless of the display: it is not possible to cursor into a previous line, correct or add to it and press RETURN to reexecute that line. This is partially compensated for by using the editing screens for defining and running procedures, but it seems a shame to lose that powerful interactive editor.

What about that favorite VIC-20 feature, programmable characters? As it happens, the editing screens almost coincide with the internal RAM required for redefining display characters. With straightforward manipulation, for instance, by moving the dictionary pointer the requisite amount (e.g., $1800 DP !) and, after compilation from the screens is complete, using the Kernal to load directly into that space, Greek, Katakana, or whatever characters desired may be made to appear.

Documentation

Finally, the manual: HES provides exceptional documentation. The 80-page instruction book – though not a beginner's handbook – has enough examples and detail in it to clarify much of VICFORTH. An example of the breadth of this concept is the eight pages devoted to adjustments to the recommended *Starting Forth*, from the Forth Interest Group, upgrading that tutorial manual to the VICFORTH version. A slight irritation is the use of £ for the symbol # throughout; otherwise the manual does seem to be error-free and complete.

Forth is a fast – very fast – compact, interactive, flexible language, though more arcane than BASIC, perhaps, and including less simple string manipulation. When for the sake of speed or complexity it is necessary to program closer to the level of machine language, Forth's power becomes decisive. This cartridge from Human Engineered Software is by far the most exciting "peripheral" for my computer. VICFORTH could become the center of programming action on your VIC-20.

VICFORTH
by Tom Zimmer
Human Engineered Software
71 Park Lane
Brisbane, CA 94005
$59.95

Flower Power Math Fun

Tony Roberts, Assistant Managing Editor

Flower Power Math Fun.

Flower Power Math Fun is an attractive, challenging math drill game that adapts itself to the abilities of the player.

The program includes exercises with whole numbers, fractions, and decimals, and it allows the player to choose addition, subtraction, multiplication, or division problems. A decimal-fraction conversion exercise is also included. The range of the game makes it effective for a child just learning math concepts, and challenging to an adult wishing to refine his ability to solve problems in his head.

The program automatically keeps track of each user's progress, with room for about 100 files on the disk, giving it added value in a classroom situation.

Planting The Garden

Each time a student runs the program, he is asked for his name. Let's say James is playing the game. After he types his name, the program searches the disk to see if any information

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about James is available. If so, the screen will ask, "Are you the same James who played before?" If the answer is yes, the computer recalls the information about James's past experiences with *Flower Power Math Fun*. If this particular James hadn't played before, the computer would ask him to select a unique name for purposes of the program. Perhaps Jim, or James D.

Then it's time to choose the type of problems to solve, and the game begins. The object is to fill the garden at the bottom of the screen with flowers by answering math problems correctly. A flower sprouts if the answer is correct. If the answer is wrong, a weed shoots up, and the student is given two more chances to answer correctly. If the correct answer is supplied, the weed is replaced by a flower and the game continues. If each of the three tries is incorrect, the weed remains in the garden.

There is room in the garden for ten plants – flowers or weeds. Once the garden is full, the exercise is over, and the student is given the option of playing again.

Keeping Track Of Skill Levels

The first time each of the 13 games is played, the computer sets the skill level at 1.0. If problems are solved quickly and correctly, the skill level is increased and the problems become more difficult. When a student answers incorrectly, the skill level decreases. Through this method, the program keeps a student of any level working at the edge of his capabilities.

The program also awards points for correct answers, based on the time it takes to provide the right answer. Nothing is subtracted for a wrong answer, and nothing is added for an answer that is too long in coming.

At the end of each session, the student's skill level and score are saved on disk. The next time he plays, he'll be able to pick up where he left off.

The program requires precise answers. For example, if a fraction addition exercise had produced the problem $\frac{3}{8}+\frac{3}{8}$, the computer would not accept an answer of $\frac{6}{8}$. The program would prompt the player: "Reduce your fraction."

Unemotional Graphics

Flower Power Math Fun is not an arcade game. Aside from the garden, with its colorful flowers and green weeds, a sun, and a couple of birds in the sky, nothing flashy has been designed into the program. Officials at Softwave Productions use the word "unemotional" to describe *Flower Power Math Fun*'s graphics. "It's enough to keep them interested, but not enough to distract them."

There is no music, and there are no explosions to disturb others in a classroom. The only sound produced by the program is a series of notes which slide up on a right answer, down on a wrong answer.

A session with the program could last as long as time permits. If several students hope to have their chance to play, a student could complete one exercise in about five minutes.

The instructions that come with the program are sparse, but little guidance is needed. A report program included with the game allows a teacher to review the progress of each student either on screen or via a printout. The information available to the teacher includes the student's name, skill level, and high score for each of the 13 exercises. In addition, the report program can be used to erase one or all records from the disk.

A Challenge For All

The package describes the game as fun for ages 5-15. A five-year-old would be able to handle many of the problems at lower skill levels, and the higher levels can present a challenge to older players, even those far past the age of 15. The problems at the higher levels of the whole number addition exercise, for example, have you adding 8- and 9-digit numbers without using pencil and paper.

Using *Flower Power Math Fun* regularly, for even just a short time, would sharpen almost anyone's ability to solve math problems mentally. This is not the kind of game that will keep kids riveted to the keyboard during all their after-school hours, but it can satisfy and challenge computer-loving kids in the more sedate setting of a schoolroom.

Flower Power Math Fun is available for the Commodore 64 and Apple II computers.

Flower Power Math Fun
Softwave Productions
156 Drakes Lane
Summertown, TN 38483
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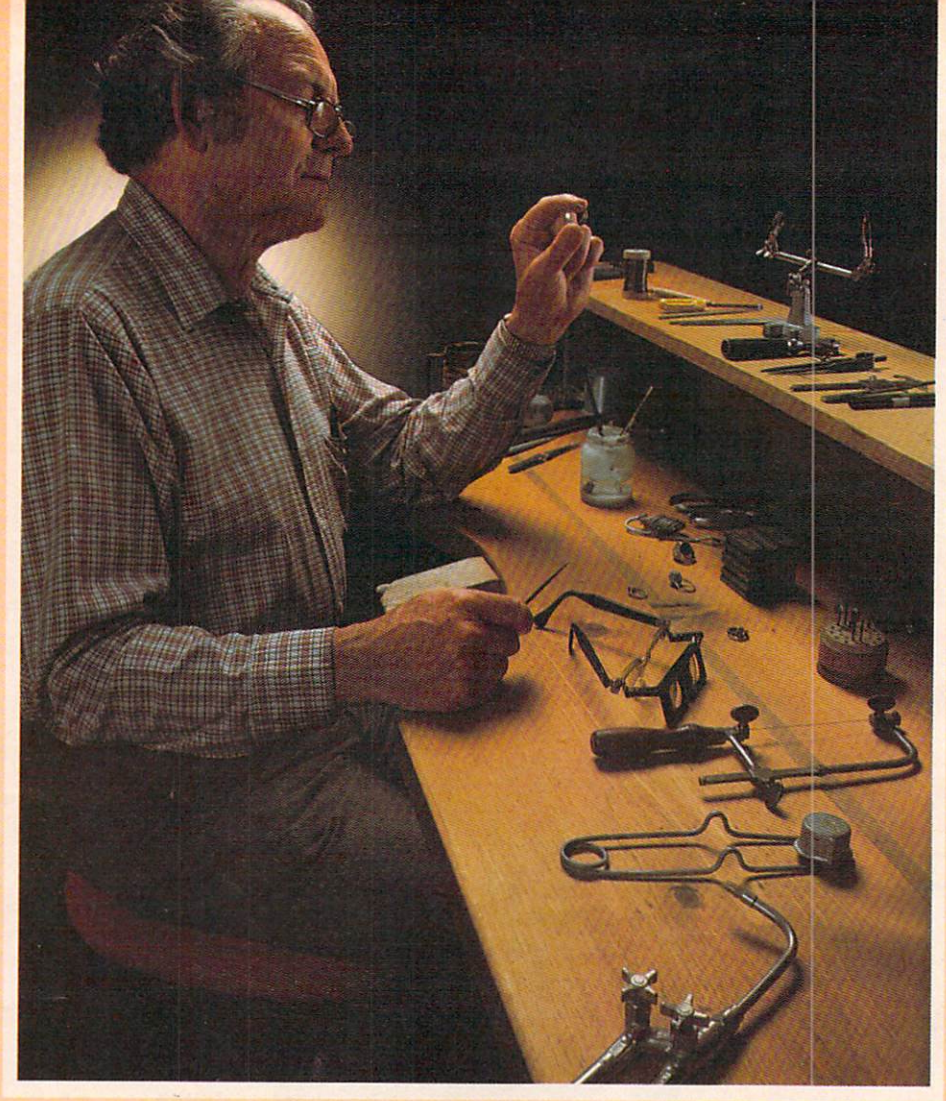

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Mothership For Timex/Sinclair

Derek Stubbs

Mothership is a fast and engaging space game for the Timex/Sinclair 1000 with 16K RAM. It has several features which make it unique.

You are the pilot of a Starlight fighter flying in a long canyon (called a Zarway), reminiscent of the last battle scene in *Star Wars*. The fast-moving graphics help to create this illusion.

Out in space, at the end of the canyon, is the giant mothership which launches waves of drone fighters along the Zarway toward you. You can evade them or blast them with your laser, but you must be careful not to crash into the sidewalls of the Zarway.

The object of the game is to destroy the Mothership, which can evade your lasers and will fire back if you get too close. The game has three levels – and can be played by one or two players.

Though *Mothership* is very difficult, the controls make it easier to play. You use groups of keys rather than single keys to move your fighter or fire your laser. This makes the game seem like an arcade game where you concentrate on the screen and just "feel" the controls. For example, the bottom line of keys is the fire button. You can use your thumb to tap this line at the right time while your other fingers guide your fighter.

This package, from Softsync, is presented well. The fast and realistic graphics and the easy controls make it one of the best Timex/Sinclair 1000 spacewar games I have seen. It is comparable to the excellent game *Winged Avenger* from Savage Software.

Depending on the difficulty level chosen, anyone over the age of five can spend many hours playing and enjoying *Mothership*.

Mothership
Softsync
P.O. Box 480
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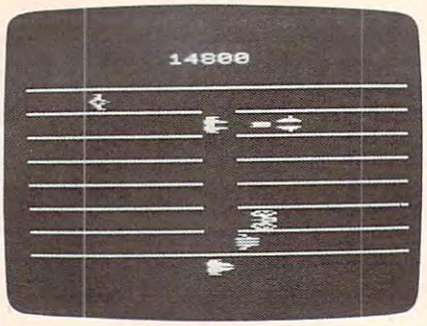

Guide your ship up and down the center alley and fend off the aliens in Turmoil.

Turmoil For VIC, 64, And Atari

Tony Roberts, Assistant Managing Editor

For quick-draw joystick artists and connoisseurs of shoot-and-run videogames, *Turmoil* (Sirius Software) may be the fulfillment of your dreams.

The game, which is available on disk for the Commodore 64 and on cartridge for the VIC-20 and Atari computers, is guaranteed to leave you with cramps in your joystick hand, and may temporarily short-circuit your ability to concentrate under pressure.

Turmoil was designed by Mark Turmell, who is responsible for several other successful Sirius Software games, including *Fast Eddie*, *Beer Run*, and *Free Fall*.

The object of the game is familiar: destroy the aliens before they destroy you. The complications include five alien ships, ghost ships, arrows, and prizes that turn into supersonic cannonballs if you fail to collect them.

Attacking The Aliens

Imagine your screen divided into seven horizontal traffic lanes which the aliens use to traverse your monitor. Down the center is a vertical lane, in which your ship flies.

Fly your ship up and down the center alley and blast those aliens. They'll be on you quickly, so keep your thumb on the fire button. Each alien ship moves back and forth at a different pace, and the faster the ship moves, the more points it is worth.

In the first of the game's nine levels, things will be relatively simple. Zip up and shoot left, zip down and shoot right. Repeat. Repeat. Repeat. Watch the score soar.

Toss In A Few Curves

Before you have a chance to get bored with your success at shooting everything that moves, you'll be overrun with problems and wondering how you can save your skin.

Mixed in with the alien vessels will be a few arrows. If you fail to wipe out the arrows on their first pass across the screen, a metamorphosis occurs, and you have to cope with a tank – and a heavily armed one at that. Shooting a tank head-on won't destroy it, but it does knock it back a bit. To defeat a tank, let it pass and blast it from behind.

The Prize Eye

Occasionally you'll see something that looks like a flashing eye at the end of one of the aliens' traffic lanes. This is a prize, and it's worth your while to pick it up quickly.

Under normal circumstances, you'll remain in the center alley, flying up and down. However, when a prize is visible, you'll be

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allowed to fly down the traffic lane to pick it up.

If you fail to claim the prize, it mutates into a supersonic cannonball and behaves much like a pong-game ball that's gone haywire. It bounces back and forth so fast that getting a clean shot at it is nearly impossible. With a supersonic cannonball on the loose, it's usually just a matter of seconds before your ship has been hit and you're calling in the reserves.

If you can claim your prize, return quickly to the center alley, or you'll be smashed by an indestructible ghost ship.

Aliens, More And Faster

You begin the game with five ships, one in play and four in reserve. Wipe out all the aliens before they wipe you out, and you'll automatically move to the next level and receive a bonus ship to add to your reserves, up to a maximum of six.

As you advance to higher levels, the play becomes faster, and the aliens become more numerous. As an added treat, after you reach level four, the alien traffic lanes occasionally become invisible.

If the aliens get the best of you, as they are bound to, press the fire button to start a new game beginning at the level on which you started. It is possible to start at a higher level, or to change levels during the game, by pressing the f5 key on Commodore machines or the SELECT key on the Atari.

Turmoil is an appropriate name for this game. There are no patterns to memorize or complicated strategies to develop. Building a hefty point total depends solely on your ability to survive amid chaos.

Turmoil
Sirius Software, Inc.
10364 Rockingham Drive
Sacramento, CA 95827
(916)366-1195
Atari cartridge, Commodore 64 disk, $34.95
VIC-20 cartridge, $34.95 ©

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The Commander – A Command Extension Facility

Jim Butterfield, Associate Editor

The Commander is a 4K ROM for PET/CBM computers with 4.0 BASIC, which extends the capabilities of BASIC programs. It's a little different from editing "enhancers" and is worth a few extra comments.

There are essentially two types of BASIC-helper programs: editing and runtime.

Editing Aids

Editing packages help you prepare a program. They may give you ease of program entry, renumbering, search and change capability, and other features to help you build the program and spot errors.

Once the program is complete, the editing package has done its job. The completed program will now run by itself. If you have prepared a program using BASIC-Aid, POWER, Sysres, or a similar package, the final program can run on any PET/CBM – even ones without the editing facility.

In other words, if you give a friend a copy of a program that you've written using one of the super-editors, he or she will be able to load it and run it. There's more: since the final program runs without using the editor, it will run at full BASIC speed.

Runtime Aids

Runtime packages help the program run. This means that everyone who wishes to run a program containing a runtime package feature must also have the package. A software house which created products using the Commander, for example, would need to specify that all purchasers of these packages must also have the appropriate runtime package.

A potential difficulty of runtime packages can be that programs using them may slow down, due to the extra overhead. Many packages use a "wedge" technique that slows everything down – sometimes a little, sometimes a lot. The Commander doesn't have this problem: its functions are invoked only when the program calls them in with a suitable SYS command.

The Objectives

An editing package tries to solve the question "What's missing from the machine's regular editing features?" A runtime package addresses the question "What's missing from BASIC?"

People may have different preferences and thoughts about what's missing, based on their experience with other BASICs and other languages. The Commander has chosen these:

PRINT USING: Formats a floating point variable into a string with a specific length and format;

WINDOW: Clears a specific area of the screen, on either 40- or 80-column machines;

FRAME: Prints a screen message, enclosed in a frame, for the user's benefit;

INSERT, APPEND, DELETE: Allows a program to be changed as it runs;

COM LITERALS: Repacks strings to help the above change features;

OVERLAY: Allows a program to call another program to continue the run;

RETURN CLEAR: Cancels all GOSUB and FOR/NEXT loop status;

COMPUTED GOTO: Allows a GOTO address to be calculated;

MAT PRINT#, MAT INPUT#, MAT INIT, MAT ZER: Allows arrays to be saved, recalled, and cleared quickly;

ENHANCED GET, STRING: Allows more powerful INPUT from keyboard or file.

Invoking The Commands

Using the Commander, you would invoke these functions with a SYS command. First, you'd be expected to set up variables which set the range of activities needed. For example, to delete lines 300 to 400 in a running program, you'd type in these lines:

```
360 BL =300      (Begin Line 300)
370 EL =400      (End before Line 400)
380 GT =400      (When complete,
                  GOTO 400)
390 SYS 40006    (Delete)
```

The SYS may be different, depending on the particular ROM chip fitted. When the program reaches line 390, it will delete all lines from 300 to just below 400 – including the above lines – and will continue running at line 400.

This is astonishing. We've made a significant change in a running program and yet the program can continue running, complete with live variables. We can't do that even if we stopped the program and made a change or deletion: our variables would disappear.

The Commander allows a program to modify itself as it runs, without loss of variables. That's amazing. It's also dangerous, and some computer scientists might argue that it's bad practice. The argument runs like this: BASIC is intended to be a "fixed framework" program, and all BASIC programs should be written that way. Self-modifying programs are foreign to BASIC: but with the Commander, you can have them.

Chaining And Such

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overlaying are rather complex activities on a PET/CBM. The Commander gives you shortcuts which make the job easier. The OVERLAY command, for example, says "throw away the old program and variables and start the new one I have named." INSERT, APPEND, and DELETE commands, on the other hand, allow the user to modify or replace the running program with new programming and keep going, complete with variables in place.

The system takes care of most activity needed to preserve variables (using what the manual calls a "Common" facility), but one kind of variable needs a little extra work to preserve: "literal" strings. This is the type of string defined by a statement such as X$="PASS 1". The string is used where it lies in the program line; deleting the program line will make the string disappear. A special Common command may be used to move this kind of string into a safe place.

PRINT USING

The PRINT USING facility doesn't print; it just formats numbers into a string, from which you can print them. It has a reasonable complement of formatting facilities – punctuation, commas, etc. – but doesn't include advanced features such as floating dollar signs, asterisk fill, or special negative symbols such as "CR" or parentheses.

A small deficiency of the PRINT USING feature on the package I tested was that numbers are not rounded; they are truncated. This could cause problems if the user doesn't watch for it, since a financial number such as 6.35 might be held within the computer as 6.34999999; this would truncate to 6.34, which is wrong. The user can cover this possibility by adding .005 to the value before calling PRINT USING: but it would be better if the Commander covered this case.

Odds And Ends

The FRAME and WINDOW commands allow nice screen displays to be generated easily. CONVERT to ASCII can be useful to interface to standard ASCII (non-Commodore) printers, if the interface hardware doesn't do it already for you. RETURN CLEAR allows you to exit from subroutines and loops in an unorthodox manner, and computed GOTO works conveniently and well. The programmer should use these features with caution, since they could lead to "cute" programming that may cause debugging problems.

There are two special I/O commands. STRING INPUT allows information to be input from disk, including punctuation such as commas or colons; it's an improvement over BASIC, which trips up on these. There are MAT PRINT# and MAT INPUT# commands to save and recall arrays; these are written and read in a highly compacted form to save time and disk storage space. Files so written are not strongly compatible with other programs; you would have considerable difficulty getting them back with a conventional set of INPUT commands, so you'll want to use MAT INPUT# to do the corresponding input job.

The other MAT commands are a simple set of array commands which allow you to clear an array quickly (set to zero or null string). There's a gimmick which might be useful: you don't have to clear the whole array, since you can start partway through and clear from that point on.

Packaging

The Commander comes in two versions. Version 11-4 goes into socket UD11 (or UD4 on older machines) and has SYS addresses in the range 40000 to 40110; version 12-3 is for socket UD12 (or UD3 on older machines) and has SYS addresses in the range 44000 to 44110. If your computer already has one ROM chip in place, you can order the version which fits your blank socket; otherwise, it doesn't matter.

Documentation is complete, but a little fuzzy. The manual will seem cryptic to the beginner – for example, the Common facility is described in detail even though in most cases it's automatically invoked when needed. However, the Commander comes with a demonstration diskette, which serves as wonderful documentation. The user is invited to stop the demonstration programs and invoke various features. By using this diskette, the user will enjoy a well-paced training experience.

Programs written using the Commander will always need the Commander. You must be prepared to live with this; but once you do, you'll find a host of dynamic features at your fingertips.

Many of the features are useful; and the capability of having a program modify itself while running is exceptional. Using the Commander, there are new possibilities for your system.

The Commander
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Commander Systems Inc.
4505 Jackson Street
Hollywood, FL 33021

Picnic Paranoia For Atari

James V. Trunzo

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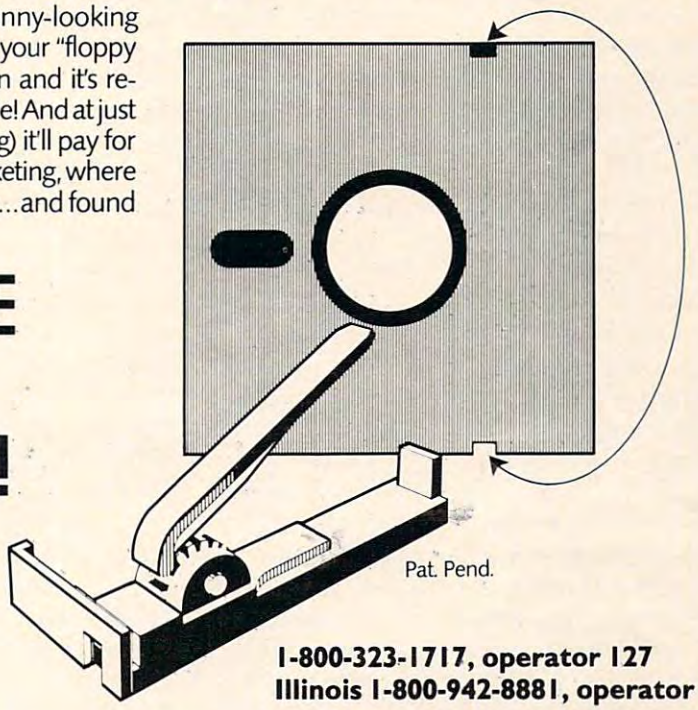

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Is this a sci-fi movie about insects gone berserk, on TV at four o'clock in the morning? No, it's *Picnic Paranoia*, written by Russ Segal and produced by Synapse Software.

Picnic Paranoia is a refreshingly different hi-res arcade game that is much more than just another simple variation on a theme. The only similarity between *Picnic Paranoia* and, say, *Centipedes* or *Millipede* is that insects are the antagonists. But unlike those games and many others, the "villains" in this game aren't out to attack you directly. They are after something even better – your food.

As the title suggests, *Picnic Paranoia* deals with that universal summer pleasure, the picnic. The game puts you in the role of George, the beleaguered picnicker, and puts you right in the middle of four rectangular, food-covered picnic tables.

The tranquility of the moment is shattered, however, by the appearance of the first of many black ants intent upon pushing the food off the table, across the lawn, and off the screen. They are aided in their endeavors by spiders (a real nuisance) and wasps (downright vicious) – though neither spiders nor wasps have any desire for your food.

Armed with a flyswatter, you must dispatch the insects as quickly as possible and thus prevent them from carrying off your feast. It all sounds rather simple, doesn't it? Well, it isn't. Without quick reflexes, intent concentration, and some strategy, you are soon overwhelmed by the sheer number of insects scurrying all over the screen.

How George Swats

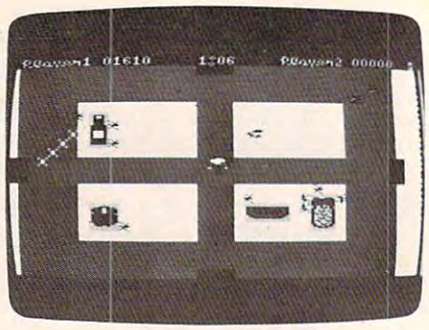
The mechanics of *Picnic Paranoia* are, for the most part, clean, and they function without a hitch. George, who is moved around the screen by a joystick, swats the assorted nasties in one of two ways. By depressing and holding the button on the joystick and moving the stick slightly in the direction George is facing, he achieves one slap with the flyswatter. By continuing to press the joystick in a given direction, he walks and swats at the same time. George walks faster when he isn't swatting – something to keep in mind if no insects are in his path.

The only aspect that takes some getting used to is the technique needed to return food to the table after it has been pushed onto the lawn by the ants. This is important because food on the table is worth more points than food on the ground, and at least one food item must be on a table at the end of each round or the game comes to an end.

To return food to the table, George must swat the food, drag or push it to a table, and release it by swatting it again. The fire button must be released before you attempt to drag or push the food.

Picnic Paranoia plays through a series of 90-second rounds. During this time, George can score points in two ways: (1) by killing insects, and (2) by preventing his food from being pushed off the screen. The ants, spiders, and wasps are worth 10, 20, and 40 points, respectively, multiplied by the round just completed. An ant killed on round five, for example, would be worth 50 points. The value of any food remaining at the end of each round can range anywhere from 30 to 100 points times the given round, depending upon the food's final position. Food still on the table is worth twice as much as food left on the ground. After the first 5000 points have been scored, and for every 10,000 points after that, you earn a bonus.

However, unlike most games, *Picnic Paranoia* does not reward you with an extra player



Swatting at hordes of marauding ants while dodging a bee in Picnic Paranoia.

(you are given three Georges at the beginning of the game). Instead, you are given a can of bug spray, which can be brought into play by hitting the space bar on the computer. The can of spray then traverses the screen three times, killing all insects on the screen at the time. Powerful stuff, but no points are awarded for insects sent to "bug heaven" by the spray. Special concepts like the bug spray will make owners of *Picnic Paranoia* enjoy the contest all the more.

Strategic Moves

Strategy enters the game in several ways. A red "door" is located in the middle of each of the four sides of the playing field. By entering a door, George is able to pop out on the other side of the screen. Making good use of the doors allows you to quickly maneuver him around the picnic grounds, arrive at trouble areas sooner, and often save food from being pushed off the screen.

A second strategy is so obvious that it might be overlooked. Each insect is unique and creates different problems. By recognizing each insect's characteristics, you can determine your best attack at any particular time during a round. The ants can't hurt George, but they are the only insect that can carry off the food. This must always be foremost in your mind.

Spiders can bite George, sending him to the middle of the screen in a state of temporary paralysis. However, the spiders

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are most annoying for the webs they spin, blocking pathways and thus making movement impossible until the webs are swatted and destroyed. Since speed is an integral part of the game, the webs can exert a significant influence on the eventual outcome of the contest.

Finally, the wasp's sting is more than twice as potent as the spider's bite. It, too, sends George to the middle of the screen, but leaves him immobile much longer. The wasp is difficult to hit, and as soon as one is eliminated, another appears.

A third bit of strategy involves the use of the bonus can of bug spray. For maximum benefit, the timing must be right. Use it too early, and you will still have the greater part of the round left to play. Use it too late, and you may have wasted an opportunity to save it for a more crucial moment in a following round.

The last strategy will be familiar to those who have played such games as *Missile Command*. In the later rounds, after you have lost several food items, as you undoubtedly will, do not waste your effort defending empty tables. Concentrate on attacking the insects surrounding tables that still have food on them. Just as in *Missile Command*, where it is of maximum importance to keep at least one city safe (and ignore empty earth), in *Picnic Paranoia* you must keep at least one piece of food on a table. Therefore, minimize the area you must cover by, for example, zeroing in on the two tables with the most food on them.

Picnic Paranoia offers several options for the gamer. In what has become standard practice with most video and computer games, *Picnic Paranoia* offers five levels of difficulty. Selecting a higher difficulty level simply starts the game off at an advanced round. Because each 90-second round features more and more insects, by beginning at a higher round, you face a greater challenge right from the start.

The game also offers a day or night option. By selecting the night option, you change the green lawn playing screen to a solid black. This is not to suggest, however, that the night option is simply cosmetic. When you are playing at night, you cannot see the picnic tables, and movement is difficult. It is easy to run George into a corner of one of the invisible tables. Playing at night increases the difficulty of *Picnic Paranoia* much more than just selecting a higher difficulty level.

Picnic Paranoia also offers some of the finest graphics and sound available today. From the opening song and graphics of the title page – a delightful animation accompanied by a rousing rendition of the "Flight of the Bumblebee" – to the game-ending animation where literally scores of ants push George off the screen and spell out (with their bodies) "THE END," the hi-res graphics are excellent.

Great attention has been paid to detail in all areas: the foods on the table look absolutely edible and are identifiable, not just shapes of familiar objects. George himself is a sight to behold, complete with a tiny brush mustache and hat. Even the insects are finely done, the wasp drawn with constantly fluttering wings, stripes, and stinger. George's face turns red with embarrassment when stung. A cacophony of sounds matches the graphics to round out this fine effort, and, as you would expect, all animation is flicker-free.

Picnic Paranoia is available from Synapse Software in either cassette or disk format. It runs in 16K.

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INSIGHT: Atari

Bill Wilkinson

Last month, I said that this month's column would include the final part of the series on writing self-relocatable code. Unfortunately, that project has turned out to be bigger than I thought it would be, so I am going to put it off a month and devote an entire column to it. However, as compensation, I will finally discuss the "new" Atari graphics modes I hinted at a couple of months back. Before I get to the juicy stuff, though, I'd like to continue a little of the ranting and raving that I started last month.

How To Shed 50 Kilobytes Without Even Trying

I heard (from two different sources) the official Atari "line" regarding the new 1050 disk drives. It seems that Atari chose to utilize only 128 bytes per sector and only 127K bytes of file space per drive in order to achieve "increased reliability." Honest. Do you believe it?

Actually, that's pure computer puckey (to paraphrase Colonel Sherman Potter). And it's ridiculous for several reasons.

First off, Atari is implying that double-density drives are unreliable. If that's true, then IBM, Radio Shack, Commodore, and a lot of other computer companies are in real trouble. Actually, Atari and Apple are the ony major computer companies still relying on single-density technology as their primary modus operandi. And, despite Atari's claims, even Atari's 1050 is actually using true double density.

It turns out – based on what we have gleaned from the specs of DOS III at this time – that Atari formats the 1050 drive with 40 tracks of 32 sectors each, with 128 bytes per sector. That's a total of 160K bytes. Most double-density manufacturers achieve either identically the same total (40 tracks times 16 sectors times 256 bytes) or slightly more (40 tracks times 18 sectors times 256 bytes equals 180K bytes – the format used by most Atari-compatible drives such as Percom, Astral, Micro-Mainframe, etc.). So why does Atari claim only 127K bytes?

Real simple: DOS III only supports 127K bytes. Shall I say that I don't know why Atari chose this limitation? With a relatively minor modification, and by using only another 64 bytes of memory per drive, DOS III could have supported a full 180K drive.

Now, as it turns out, I do happen to know the real reason Atari chose 128 bytes per sector. And I know this from the most reliable of sources, one of the DOS III's designers.

It seems that so many of Atari's own products violate Atari's own "rules" (especially those about respecting the LOMEM pointers), and so many other products also reach outside DOS to do direct sector disk I/O that Atari's planners were fearful of the impact of changing either LOMEM or the sector size. Hence the scheme of DOS III.

A secondary impact of the LOMEM problem was that it caused more and more of DOS III to be moved to the diskette from memory, to be called in as overlays when the user requested a function not in memory. Even the keyboard menu processor eventually got moved to disk. The result of all this? While DOS III may be the easiest-to-use DOS yet, it still suffers from the time-consuming swaps to a MEM.SAV file when you want to achieve something as simple as getting a disk directory.

(Of course, there is a very, very elegant way to completely avoid the LOMEM problem on the new Atari XL computers. Why not move the DOS into the as-yet-unused extra memory? Why waste 14K bytes of RAM? I probably shouldn't drop this idea in Atari's laps [I should sell it to them], but it will take them at least six months to even discuss it, so I figure it's OK.)

As I said last month, DOS III contains a nice little file manager. It's a crying shame that it wasn't released three or four years ago, since it seems ideally suited to an 810 size drive. But it doesn't look to me like a system for the long haul, when larger and larger drives become available for the new Atari computers.

And lest too many of my critics cry "foul" for my promoting OSS's version 4 DOS (which will allow up to 32 megabytes per disk drive), let me hasten to say that I am *not* suggesting that version 4 and the 1050 are necessarily the answer. What I *am* saying is that Atari could have achieved virtually the same results by sticking with DOS 2.0 and extending it to handle up to 120K bytes of file space (with 128 byte sectors – it will handle 240K bytes with 256 byte sectors).

Well, enough. I promise no more on this subject until I give you the patches to DOS 2.0s to give you 120K bytes on a 1050. In the meantime, ask yourself this question: if DOS III is limited to 127K bytes of file space, how will Atari handle the double-sided, double-density drive in the 1450XLD, which will have a capacity of at least 320K bytes? Atari, will you answer?

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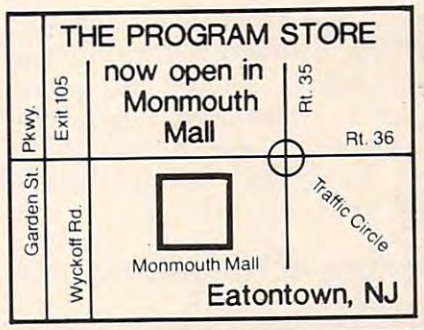

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One more comment. I just want to say that, aside from the 1050, I am impressed with all of Atari's new hardware products. And I even like some of their new software. I think Atari is back on its feet and running hard.

Four Equals Seven

Many of the games currently on the Atari market use custom-designed character sets for background displays. The classic example of this is, of course, *Eastern Front* by Chris Crawford. That beautiful scrolling map he displays is actually composed of "characters." This works because a couple of the ANTIC graphic modes allow the programmer to treat each pair of bits within a character cell as one of four colors.

In fact, by controlling the high order bit of the character to be displayed, the programmer may choose two different sets of four colors. Which would be really nice except for the fact that only one of the colors can change between the two sets, thus there is a total of five displayable colors.

If you don't remember and/or understand all that, don't worry. There's a better way. A way which will get you seven colors! The method only works on machines with a GTIA installed, but I hope that all COMPUTE! readers have added a GTIA by now. (If you have purchased a machine in the last year and a half or so, you got a GTIA with your machine. If you have an old machine with a CTIA, the upgrade cost is nominal.)

The credit for finding and documenting this until now hidden feature of the Atari must go to Steve Lawrow, the author of our MAC/65 assembler. He did a nice job of investigating all the ramifications and provided me with the table which I've reproduced here. Before I go into the details of the table, though, let me briefly describe how one accesses two new Atari Graphics modes.

Getting At The New Modes

First, the new modes are variations on BASIC GRAPHICS 1 and GRAPHICS 2 (and, by extension, GR. 17 and GR. 18). And the method of producing the variations is so simple that it's almost funny that no one stumbled on it before. Simply turn on the GTIA's special color mapping mode. And what, pray tell, is that? In this case, it is the upper bit of GPRIOR, the priority select register.

GPRIOR is a hardware register that has its OS shadow location at $026F (decimal address 623). That means (for those of you not familiar with shadow locations) that by changing the RAM location $026F you cause the OS to change the appropriate hardware register for you. (And see COMPUTE!'s book *Mapping the Atari* if you need to know more.)

Briefly, then, you need simply to turn on the upper bit of GPRIOR in order to activate these new modes. There are, however, some caveats to be observed. Perhaps the easiest way to observe the toughest potential problem is to turn on your Atari, go into BASIC, and do a POKE 623,128.

What do you see? Garbage on the screen, if you have a GTIA. Unfortunately, activating the GTIA destroys the normal character display mode(s). More on this later.

Now, on to the table. When you tell BASIC to PRINT #6 in Graphics modes 1 and 2, it prints larger than normal characters to the upper portion of the screen. In particular, though, the characters are available in several different colors. Try this little program to see what I mean: GRAPHICS 2 : PRINT #6; "AaAa" (where the underlined characters are typed in inverse video).

And why do you get four different colors? Because the upper three bits of each of the characters are different. In particular, the upper three bits for the four characters shown are 010, 011, 110, and 111, respectively. Because you are in Graphics mode 2, all four characters came out as uppercase letters.

Now, the bytes which are put in screen memory are actually translations of the bytes which you PRINTed. In particular, when the bytes shown are translated to screen codes, they end up with upper bits of 00, 01, 10, and 11, respectively. The upper two bits of the bytes placed in screen memory determine the color to display; the bits in the character set determine which bits will be "turned on" on the screen.

The concept used in our "new" graphics mode is similar. In particular, the upper two bits of the bytes placed in screen memory determine the color MAP to use. The actual bits in the character set determine which color will be selected from the appropriate map. In other words, we have added yet another level of color indirection to the Atari!

In GRAPHICS 10, memory is organized in groups of four bits. The value of the four-bit nybbles determines which color register is displayed. Thus, since there are nine color registers (five for the primary graphics and four for player/missile graphics), there are a maximum of nine independently displayable colors. (Yes, I know that you can get 16 colors in GRAPHICS 9 and 11; but in those cases the colors are not truly independent.)

In GRAPHICS 1+ and 2+ (well, I had to call them something, didn't I?), pairs of bits (instead of four-bit nybbles) determine the color register to use. Remember, though, that the pair of bits can only select a color from the particular MAP which has been selected by the two upper bits of the character on the screen.

And, finally, this implies that the other six

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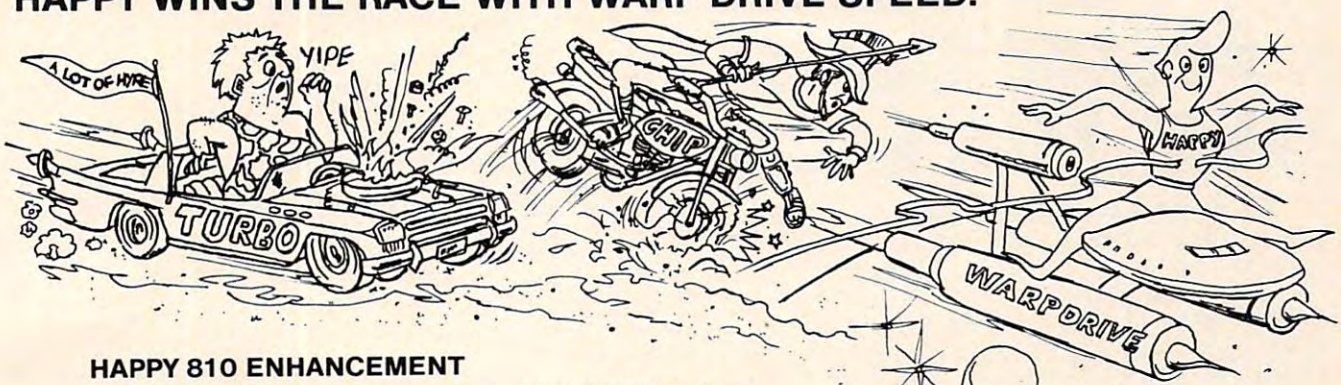

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bits of the character on the screen select the particular character from the character set memory, just as normal GRAPHICS 1 and 2 do.

Does that sound complicated? It should, because it is. Anyway, now is the time to look at the table. It shows the MAPs that are available.

Color Selection Under GRAPHICS 1+ And 2+

Bit Pairs Of Color Selectors In Character Memory

Upper Bits of Character on Screen (Map Selector)	00	01	10	11
00	704	704	704	704
01	704	705	712	709
10	704	706	712	712
11	704	707	712	711

And, you presumably ask, what are the numbers shown in the table? Simply the location of the color register which will be displayed when you use the given bits within the given map. For example, 704 is PMCOL0 (player color 0) and 712 is PFCOL5 (playfield color 5). However, the easiest way to change the color registers, in this instance, might be to refer to them via the locations shown in the table.

So, writing POKE 704,0 will make the background color black. Writing POKE 712,152 will give you a nice blue for bit pattern 10 in MAPs 01, 10, and 11. A little observation of the table will show you that MAP 00 is essentially useless: it always gives you the background color, regardless of the bit patterns in the character memory.

On the other hand, bit pattern 00 always gives you background color, regardless of the MAP used, so it may prove useful in many circumstances. For the rest, note that MAP 10 gives you only three colors, but it is the only MAP which gives color 2 (706). Sigh. The system is not totally flexible, but it is handy.

First thing next month we'll put this all together with a little BASIC program that demonstrates the capabilities of the new modes. ©

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- How can a machine language programmer take advantage of the sophisticated routines in Atari BASIC?

Intermediate to advanced Atari programmers will find a wealth of useful and interesting information in *The Atari BASIC Sourcebook*.

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Much more than a simple source code listing, this book explains how BASIC works and why. All major routines are examined and explored. The authors go into detail about the internal design, the stack, input/output statements, and much more. When you finish reading this book, you will have an in-depth understanding of how to put Atari BASIC to work for you in ways you never thought possible.

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64 EXPLORER

Larry Isaacs

We are pleased to welcome Larry Isaacs and his new column, "64 Explorer," to the pages of COMPUTE!. Larry has extensive experience in programming with 6502-based machines.

To get things started, here's the first of a two-part article on a little understood but important feature of BASIC, the STATUS variable.

This is the first of a two-part series dealing with a feature of BASIC which is not too well documented, the STATUS variable. It is used to detect the success or failure of input/output operations. I came to this realization while writing a disk copy program. At one point I thought I had the program fully operational. I was surprised to discover that the program was copying all but the last byte in the file, causing the copy to be one byte shorter than the original.

Fortunately I was able to quickly determine that the problem was not in my programming. The program worked exactly as I intended it to. Instead, my error was that I made an assumption concerning the STATUS variable which turned out to be incorrect. An error arising from an erroneous assumption can be a very tough one to find. Everything looks right, and doesn't work.

Tracking Down A Mistake

After discovering my error, I reread the documentation to find where I might have overlooked something relating to my mistake. (By documentation, I mean the *Commodore 64 Programmer's Reference Guide* and the *1541 Floppy Disk User's Manual*.) After a thorough reading, I wasn't able to find anything saying that my assumption wasn't valid. I even found an example program in the *1541 User's Guide* which makes the same mistake I did. Fortunately, I had some previous experience which led me to quickly suspect and correct my assumption. It can be quite frustrating if you don't have that experience, and have to acquire it the hard way. Since the STATUS variable is not documented very thoroughly, and is crucial to proper I/O (input/output) communications, perhaps we should try to discover the necessary information ourselves. The all-important question we need to answer is: "What does the STATUS variable really tell us?"

Before starting our investigation, a little introduction to the STATUS variable may prove helpful. The purpose of the STATUS variable is to provide an indication of the completion status of the last input/output operation. It is supposed to indicate, among other things, when an error occurs in the I/O operation, and when the end of the data is reached while reading a file. The end of the data in a file is more commonly called end-of-file, abbreviated *EOF*. My invalid assumption involved this EOF indication.

The STATUS variable acts like a normal variable in most respects. It may be used in an expression just like any other variable, and may be abbreviated ST. However, it differs from other variables in that *you* can't give it a value. It only returns a value. Here are a few examples showing how the ST variable might be correctly used:

```
1050 SS=ST:REM SAVE THE STATUS IN VARIABL
     E SS
2000 IF ST<>0 GOTO 9999
3110 EOI=ST AND 64:REM GET EOI STATUS
```

An example of an incorrect use of the ST variable would be:

```
100 ST=ST-64
```

where the statement attempts to assign a value to ST. This results in a SYNTAX ERROR.

STATUS Can Catch Errors

The value returned by the STATUS variable is used to detect if anything unusual happened during the last I/O operation. The unusual things that may occur will vary depending on which device is involved. The *Reference Guide* describes the meaning of the STATUS variable only for the cassette and serial bus devices, such as the 1541 disk drive. Therefore, we will concentrate on these. In either case, the value returned by the ST variable will be a *signed byte*. To keep things simple, think of this as a byte of memory holding a number which can range from -128 to +127. This differs from an *unsigned byte* which can hold values from 0 to 255.

Instead of getting into a discussion of bits and binary numbers, we will interpret the unsigned byte as being the sum of a unique combination of numbers from the group: 1, 2, 4, 8, 16, 32, 64, -128. An important restriction is that these

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numbers may appear in the sum only once. The presence of one of these numbers in the sum equivalent to the value of ST will indicate the presence of a particular condition. Let's explain this a little further.

You can find which numbers make up the sum by repeating the following steps, using the ST value as the initial remainder: (1) Subtract the next number in the group from the current remainder, starting with -128 and proceeding toward 1. Subtracting -128 is the same as adding +128. (2) If the result is positive and less than 128, include the subtracted number in the sum and use the result as a new remainder. (3) If the result is negative or greater than or equal to 128, don't include the subtracted number in the sum, and then keep the old remainder. When the remainder becomes zero, you will have the numbers which make up the sum. Here are a couple of examples to show how it's done.

```
ST = 115
     - 64   (-128 IGNORED, 115 + 128 > 128)
       51   (64 INCLUDED)
     - 32
       19   (32 INCLUDED)
     - 16
        3   (16 INCLUDED)
     -  2   (8 AND 4 IGNORED)
        1   (2 INCLUDED)
     -  1
        0   (1 INCLUDED)
115 = 64 + 32 + 16 + 2 + 1

ST = -120
    +128
        8   (128 INCLUDED)
     -  8   (64,32,16 IGNORED)
        0   (8 INCLUDED, 4,2,1 IGNORED)
-120 = -128 + 8
```

Using STATUS With Tape

Since more readers are likely to have the cassette unit instead of a disk drive, we will first investigate the STATUS variable as it relates to cassette. To begin, let's take a look at what the STATUS variable indicates when accessing the cassette.

VALUE	MEANING
1	not used
2	not used
4	SHORT BLOCK
8	LONG BLOCK
16	UNRECOVERABLE READ ERROR
32	CHECKSUM ERROR
64	END OF FILE
-128	END OF TAPE

(Note: This information can be found in the *Commodore 64 Programmer's Reference Guide* on page 85.)

Since the END OF FILE indication was the one I had trouble with, let's begin there. The primary question we want to answer is "When will the STATUS variable indicate we are at EOF?" Will EOF be indicated as the last byte of the file is read, or will EOF be indicated when you try to read one byte beyond the last byte?

To answer this, all we need is a simple little test program. This test program should first write a cassette file containing a few bytes. Then it should instruct us to rewind the cassette. Finally, it should read the cassette file, displaying each byte and the ST variable as each byte is read. Here is a test program to do this, which will be called "TEST 1":

```
100 OPEN 1,1,2,"TEST"
110 PRINT#1,"ABC";:CLOSE 1
200 PRINT "REWIND THE CASSETTE."
210 PRINT "PRESS RETURN WHEN READY."
220 INPUT Z$
300 OPEN 1,1,0,"TEST"
310 FOR I=1 TO 5
320 GET#1,Z$:PRINT I,Z$,ASC(Z$+CHR$(0)),S
    T
330 NEXT I:CLOSE 1
```

As you can see, lines 100-110 write the file, 200-220 ask you to rewind the cassette, and 300-330 read the file. The 2 in the OPEN command in line 100 specifies that the file is being opened for writing with an END OF TAPE marker to be written when the file is closed. You might note that the program reads five bytes from the file, though only three bytes are written. This is done so we might answer another question, namely, "What happens if you read past the end of the file?" Executing TEST 1 will cause the following to appear on the display screen:

```
PRESS RECORD & PLAY ON TAPE
OK
REWIND THE CASSETTE.
PRESS RETURN WHEN READY.
?

PRESS PLAY ON TAPE
OK
 1    A    65    0
 2    B    66    0
 3    C    67    64
 4         0     0
 5    T    84    0
```

This includes all of the prompts which occur during program execution. Since it is the displayed data which will answer our questions, we'll limit ourselves to that in the tests which follow.

The first column of the displayed data shows a count of the bytes in the file. The second column displays the character, with the third column giving the numeric value (called the *ASCII value*) of the character. The last column shows the value of the ST variable after the GET command which fetched the character.

From this data, we are now prepared to answer the first question. The EOF indication appears with the reading of the last byte of the

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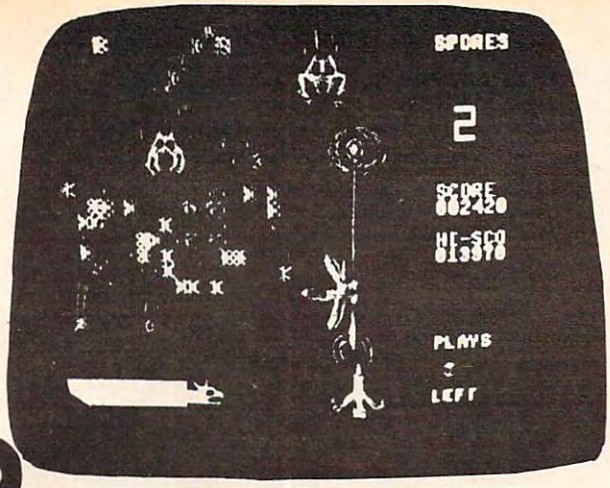

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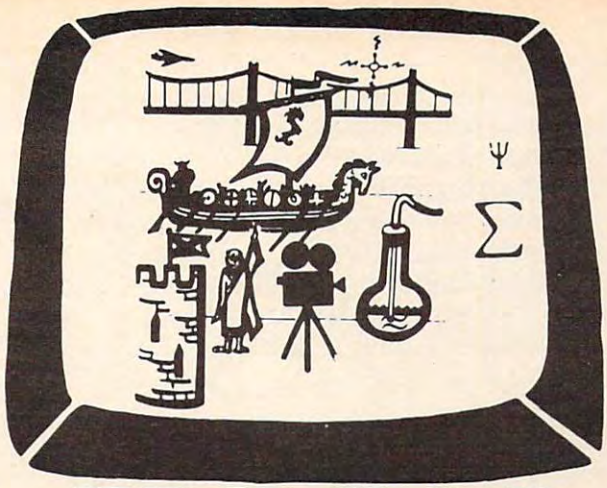

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cassette file.

Concerning the second question, we now have some test results to examine. First, note that the test program read the two additional bytes with no apparent ill effects – no errors occurred, etc. Second, we can see the EOF indication went off once the next byte was read. And third, notice the first byte following the last one we wrote (i.e., the C) is suspiciously a zero. Since a zero byte doesn't correspond to a displayable character, there is a blank space in the second column where a character would have been. Zero bytes are often used when there is need of a byte which marks the end of something. Thus, it is not too surprising to find one here. But if a zero byte is being used to mark the end of a file, what is going to happen if a zero byte is written as part of the data in the file? To answer this question, let's modify the TEST 1 program to make another test program. Make the following changes to TEST 1 to make "TEST 2":

```
100 PRINT#1,"A";CHR$(0);"C";:CLOSE 1
```

As you can see, TEST 2 will write a zero byte in place of the "B" written by TEST 1. Executing the TEST 2 program displays the following results:

```
1     A     65    64
2           0     0
3     C     67    64
4           0     0
5     T     84    0
```

Ah ha! This time we got two EOFs. Since it's not possible for a file to have two ends, one must conclude that what is given as an EOF indication, strictly speaking, doesn't indicate EOF. Instead it is a "next byte is a zero" indication. Provided you do not write any zeros as part of your data, then the zero byte at the end (which is added automatically by the 64) might properly provide the EOF indication. However, if you should accidentally read past the end of your data, you could be in trouble. It doesn't appear that the GET# command can tell if you've passed the end of the file.

The Cassette Buffer

At this point, you might be wondering where the data is coming from once you read past the end of the file. The answer to this is fairly simple. Whenever data is read or written to a cassette file, it will be done in groups of 191 bytes, called blocks. There is an area of memory reserved to hold this block, called the *cassette* tape I/O *buffer*. In the case of writing a cassette file, the data is stored in the cassette buffer until the buffer becomes full (that is, contains 191 bytes). At this point the BASIC program will temporarily stop executing while the cassette motor is turned on and the buffer contents written to the cassette.

Now the buffer is considered empty, and execution of the BASIC program resumes. When the buffer becomes full again, another block is written. When the program closes the cassette file, a zero byte is placed following the most recent byte stored in the buffer and the entire buffer written as the last block in the file. This means there may be bytes following the zero byte which are left over from the previous buffer full.

A similar process occurs for reading a cassette file. Blocks are read from the cassette into the cassette buffer, and then read from the buffer until it becomes empty. As you might have guessed by now, the bytes we are reading after the end of the file are the leftover bytes in the buffer.

So far, our two test programs wrote only three bytes to the file. This implies that our cassette file contains only one block of data. Since our test programs wrote an END OF TAPE marker following the file, it might be interesting to find out what will happen if we read past the one block. To find out, make the following change to the TEST 2 program to make "TEST 3":

```
310 FOR I=1 TO 196
```

This reads five bytes past the one block of data in the cassette file. Executing the TEST 3 program displays the following as the last five lines.

```
192     <     60    0
193           3     0
194   [C]     252   0
195           3     0
196           32    0
```

The [C] is the character which would be entered by pressing the COMMODORE key plus C. The first four numbers turn out to be the beginning and ending addresses of the cassette I/O buffer. From this I would assume that the END OF TAPE marker is simply an additional 191-byte block written after the file. It seems to have no terminating effect while data is being read. I suspect that the END OF TAPE marker has an effect only if encountered while the 64 is searching for a file with a specific name.

Well, that's about all the experimenting we have space for in this column. In next month's column we will continue with a few more experiments on the cassette, then look into the disk drive. ©

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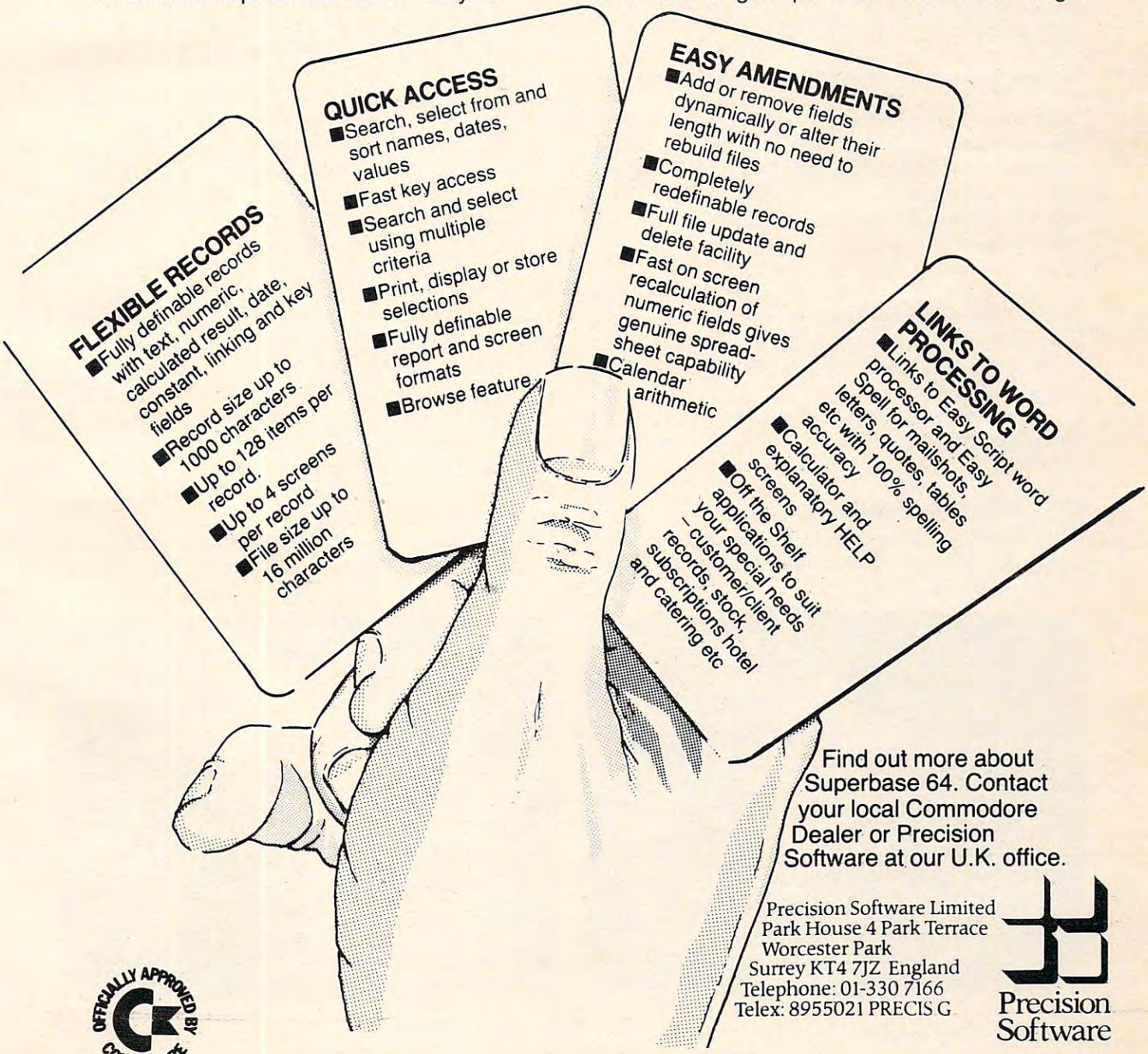

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SPIRALIZER

Chayim Avinor

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Running The Program

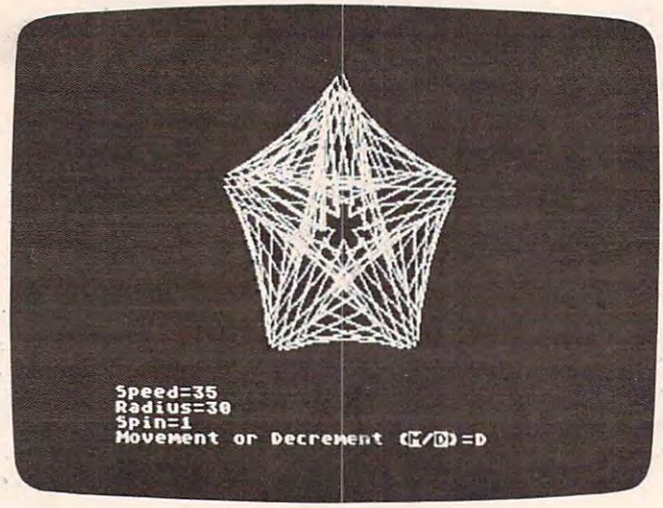
After typing RUN and RETURN, you are asked to type in the relative speed between the two radii. This is actually the number of loops the pattern is going to have. You can choose an answer between -50 and 50. If you type 4 and RETURN, your pattern will have four complete loops. If you type -6 there will be six loops, but they'll be on the inner side of the pattern.

Use the back arrow to delete a character. If you simply press RETURN without typing in a number, the program will default to a value of 5, and will print it on the menu. Large numbers cause the program to draw straight segments, because of the large steps. The patterns thus produced are quite nice, too.

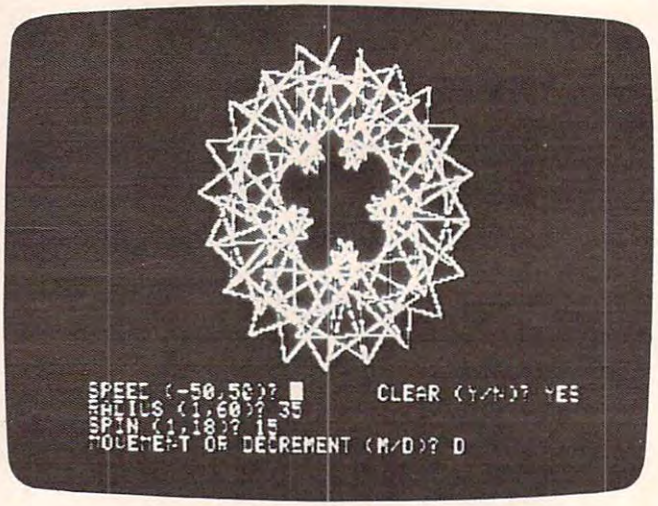
A pattern with three loops is easily understood, but what would a pattern with two loops look like? How about one loop? Could a pattern possibly have zero loops? Try them and see.

The second number you are asked to enter is the radius. This determines the ratio of the radii. You can choose any number between 1 and 60. A small number would make the inner radius small and the outer radius large, and vice versa. Like the first input, you can simply press RETURN and take the default value of 35.

Next you are asked for the spin. An answer larger than 1 will make the pattern rotate while it



"Spiralizer," Atari version.



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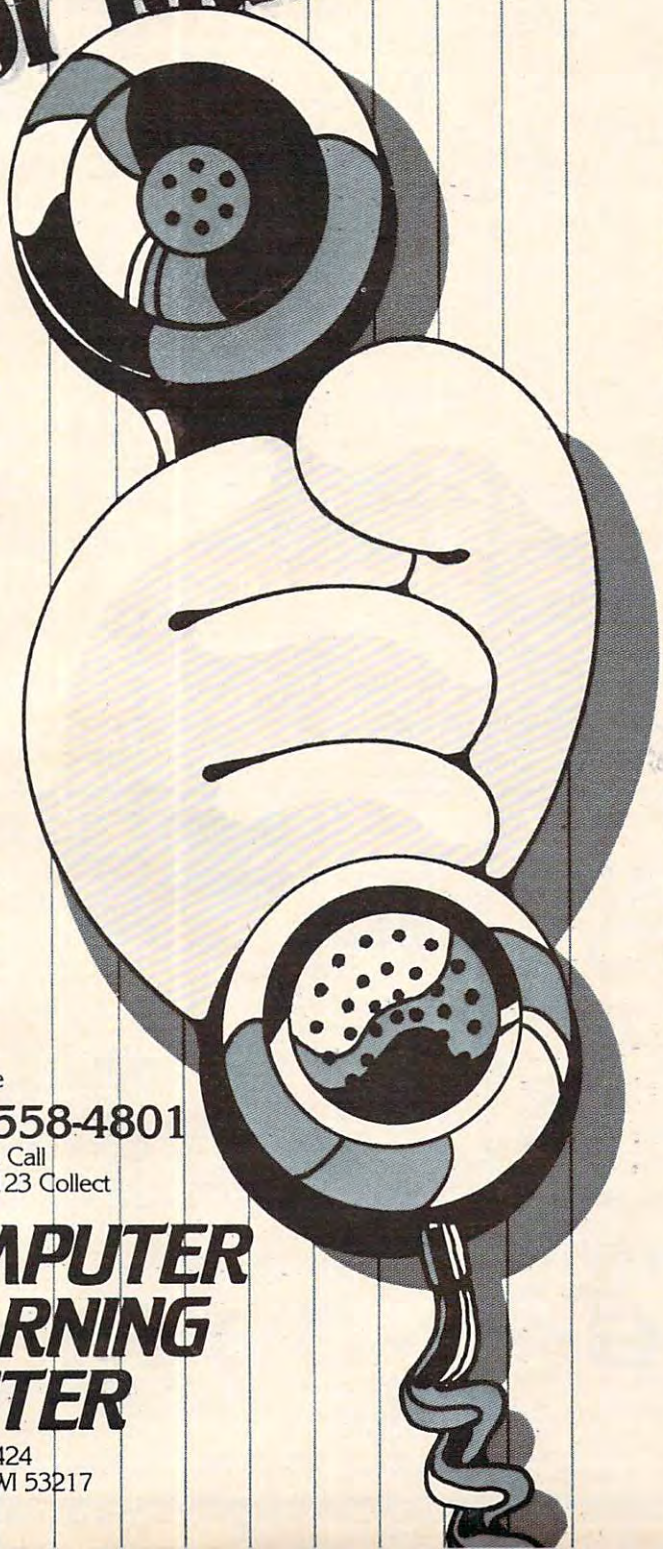

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is drawn, and, of course, the number of loops will change. You can choose between 1 (no spin) and 18. When spinning, the lines remain smooth and curvy, but it takes more time to draw the complete pattern. If you decide to quit while a pattern is being drawn, press any key and the program will return to the menu. To escape from the program, use RESET.

Added Features

Now things become more complicated. You are asked, "MOVEMENT OR DECREMENT (M/D)?" If you choose M, the whole pattern will move while it is being drawn. If the spin is 1, the pattern will be drawn five times while it moves. If the spin is greater than 1, the pattern will move until it finishes rotating. If the spin is greater than 1 but less than 9, you will not be asked for this input.

Pressing D will cause the pattern to decrease in size while being drawn. The rules here are the same as above. If you press RETURN, the default value is NONE, and none of the above actions will take place.

Last, you are asked if you want to clear the screen. If you decide not to, then the new pattern

VIC, Atari, And Color Computer Notes

Patrick Parrish, Editorial Programmer

To create different spiral patterns with "Spiralizer," you must first type in several variables (speed, radius, etc.). Try different values for these variables or simply press RETURN (ENTER on the Color Computer) to use default values.

For the VIC version of Spiralizer, you need the Super Expander cartridge. With this version, you can overlay as many as five spiral figures on the high-resolution graphics screen. The Atari and Color Computer versions allow you to overlay as many patterns as you wish.

As with the Apple version, the Atari and VIC versions let you return to the beginning of the program by pressing any key if you are not pleased with the patterns being drawn.

64 Notes

Gregg Peele, Editorial Programmer

Like the Apple, Atari, and Color Computer, the Commodore 64 is capable of high-resolution graphics. Unlike those computers, however, there are no specific commands in the 64's standard BASIC to create graphics on the high-resolution screen. At the time of this writing, the Video Support Package cartridge promised by Commodore is not yet available. We are left with a system of complex POKEs and formulas to accomplish simple hi-res graphics on the 64.

Program 5, the Commodore 64 version, consists of routines to plot points, draw lines, and clear the hi-res screen. All these routines are in machine language and are accessed with the SYS command. The hi-res screen in these programs is located at 8192 ($2000) and may be accessed from BASIC by two POKEs:

```
POKE 53272,PEEK(53272)OR 8
POKE 53265,PEEK(53265)OR 32
```

These POKEs put the screen in bitmap mode with a 320 x 200 high-resolution screen.

To access the plot routine, LOAD and RUN Program 5, and set up a BASIC program which begins with the two POKEs previously mentioned. Next, POKE the X coordinate into 53242. If the X coordinate is greater than 255, then POKE 53243 with 1 and POKE 53242 with X-256. If the X coordinate is less than 256, then POKE 53243 with 0. Now POKE the Y coordinate of the point into location 53240 and POKE a 0 into location 53241. Finally, SYS to location 49710 and your point will appear on the screen. To clear the screen, merely SYS 50039 and all points plotted will vanish. If you want to return to text screen, POKE 53272,21 and POKE 53265,27.

If you want to draw a line between two sets of coordinates, then POKE the first endpoint coordinate (X1) into 53220. As before, if the coordinate is greater than 255, then POKE 53221 with 1 and POKE 53220 with X1-256. If X1 is less than 256, then POKE 53220,X1 and POKE 53221,0. POKE the first Y coordinate into 53222 and POKE 53223 with 0. The coordinates of the other endpoint are now POKEd in starting with X2. If X2 is less than 256, then POKE 53224,X2 and POKE 53225,0. If X2 is greater than 255, then POKE 53224,X2-256 and POKE 53225,1. POKE Y2 into 53226 and POKE 53227 with 0. Once you have these coordinates in memory, use SYS49152 to plot your line on the high-resolution screen.

To use "Spiralizer" on the 64, run Program 5 and then Program 6. Program 6 does all these POKEs for you and will create endless variations of designs for you on the high-resolution screen.

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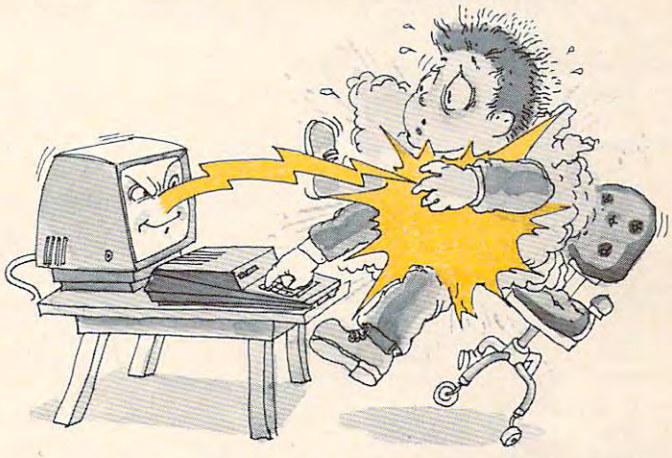

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will be drawn on the previous one. This feature allows you to make overlays of patterns.

For a nice sample, I suggest you try the following INPUTs: for speed, enter 7; for radius, 50; for spin, 18; then choose M for movement and clear the screen.

Experiment with different values, and you'll see some stunning designs.

Program 1: Spiralizer – Apple Version

```
10  ONERR  GOTO 90
60 R$ =  CHR$ (8): HCOLOR= 3:H$ = "
    " + R$ + R$ + R$ + R$
70  HOME : HGR
80  VTAB 9: HTAB 15: FLASH : PRINT "SPI
    RALIZER": NORMAL
90  POKE  - 16368,0:Z = 5: HTAB 1: VTAB
    21: PRINT "SPEED (-50,50)? ";: GOSUB
    380:K = Z
100  IF Z <  - 50 OR Z > 50 THEN 90
110 K = K - 1
120 Z = 35: PRINT "RADIUS (1,60)? ";:
    GOSUB 380:R = Z
130  IF Z < 1 OR Z > 60 THEN  VTAB 22:
    GOTO 120
140 R = R + 13:S = 1
150 Z = 1: PRINT "SPIN (1,18)? ";: GOSUB
    380
160  IF Z < 1 OR Z > 18 THEN  VTAB 23:
    GOTO 150
170 A = 1 / Z: IF Z > 1 AND Z < 9 THEN
    240
180 SM = 1:M = 2: PRINT "MOVEMENT OR DE
    CREMENT (M/D)? "H$;
190  GET X$: IF X$ =  CHR$ (13) THEN M =
    0:SM = 0: PRINT "NONE";: GOTO 240
200  IF X$ = "M" THEN SM = 0: GOTO 230
210  IF X$ = "D" THEN M = 0: GOTO 230
220  GOTO 190
230  PRINT X$;
240  VTAB 21: HTAB 24: PRINT "CLEAR (Y/
    N)? "H$;: GET T$: IF T$ <  > "N"
    THEN PRINT "YES": TEXT : CALL 62450:
    HGR
250  IF T$ = "N" THEN  PRINT "NO"
260 W = 1:Z = 139: IF M = 2 THEN Z = 80
    : IF A = 1 THEN W = 5:M = 1:Z = 12
    2
270  IF SM - A = 0 THEN W = 5
280  IF A < 1 THEN K = K + A
290 C = 0.001: IF A < 1 / 9 THEN M = M /
    2:C = C / 2
300 J = R:I = 79 - R
310  HPLOT Z,0
320  REM -MAIN LOOP-
330  FOR T = 0 TO 6.2831 / A * W STEP 0
    .06283:F =  PEEK ( - 16384): POKE
     - 16368,0: IF F > 127 THEN 90
340  IF SM THEN J = R * S:I = 79 * S -
    J:S = S - C
350  HPLOT  TO Z + T * M -  SIN (T) * J
     +  SIN (T * K) * I,79 -  COS (T) *
    J -  COS (T * K) * I: NEXT
360  GOTO 90
370  REM -INPUT SUBROUTINE-
380 L0 = 0:L1 = 1:B$ = ""
390  PRINT H$;: GET A$
400  IF A$ = "-" AND L0 = 0 THEN  PRINT
    A$;:B$ = A$:L0 = 1:L1 = 2: GOTO 39
    0
410  IF A$ =  CHR$ (13) AND L0 > 0 THEN
    Z =  VAL (B$): PRINT : RETURN
420  IF A$ =  CHR$ (13) THEN  PRINT Z: RETURN
430  IF A$ = R$ AND L0 > 1 THEN  PRINT
    A$;:B$ =  LEFT$ (B$, LEN (B$) - 1)
    :L0 = L0 - 1: GOTO 390
440  IF A$ = R$ AND L0 = 1 THEN  PRINT
    A$;:B$ = "":L0 = 0: GOTO 390
450  IF L0 > L1 THEN 390
460  IF A$ < "0" OR A$ > "9" THEN 390
470  PRINT A$;:B$ = B$ + A$:L0 = L0 + 1
    : GOTO 390
```

Program 2: Spiralizer – VIC Version

```
100 IF FL=1 THEN:GRAPHIC 4
110 FL=1:PRINT"{CLR}":POKE 36879,28:PRINT
    "{DOWN}{3 RIGHT}{YEL}U
    **************I":PRINT"
    {3 RIGHT}-{14 SPACES}-"
120 PRINT"{3 RIGHT}-{PUR}{2 SPACES}SPIRAL
    IZER{2 SPACES}{YEL}-":PRINT"{3 RIGHT}
    -{14 SPACES}-"
130 PRINT"{3 RIGHT}J
    **************K{BLU}"
140 POKE198,0:Z=1:PRINT"{2 DOWN}{RED}HOW
    {SPACE}MANY SPIRAL":PRINT"FIGURES (1-
    5) ?{4 SPACES}{3 LEFT}";:GOSUB550:F=Z
150 IF F<1 OR F>5 THEN PRINT"{4 UP}";:GOT
    O 140
160 FORP=1TOF:PRINT"{DOWN}{GRN}SPIRAL FIG
    URE #";P:GOSUB 690
170 FOR I=7T00 STEP-1:FORJ=1TO50:NEXT J:P
    OKE 38680,I:NEXT I
180 Z=5:PRINT"{OFF}{BLU}{DOWN}SPEED (-50,
    50) ?{4 SPACES}{3 LEFT}";:GOSUB 550:K
    (P)=Z
190 IF Z<-50 OR Z>50 THEN PRINT"{2 UP}";:
    GOTO 180
200 K(P)=K(P)-1
210 Z=35:PRINT"{DOWN}RADIUS (1,60) ?
    {4 SPACES}{3 LEFT}";:GOSUB 550:R(P)=Z
    *7
220 IF Z<1 OR Z>60 THEN PRINT"{2 UP}";:GO
    TO 210
230 S=1
240 Z=1:PRINT"{DOWN}SPIN (1,18) ?
    {4 SPACES}{3 LEFT}";:GOSUB 550
250 IF Z<1 OR Z>18 THEN PRINT"{2 UP}";:GO
    TO 240
260 FOR I=8120 TO 8163:POKE I,32:NEXT I
270 A(P)=1/Z:IF Z>1 AND Z<9 THEN PRINT"
    {2 DOWN}":GOTO 350
280 SM(P)=1:M(P)=2:PRINT"{DOWN}MOVEMENT /
     DECREMENT{2 SPACES}(M/D) ?{5 SPACES}
    {4 LEFT}";
290 GET X$:IF X$="" THEN 290
300 IF X$=CHR$(13) THEN M(P)=0:SM(P)=0:PR
    INT"NONE":GOTO 350
310 IF X$="M" THEN SM(P)=0:GOTO 340
320 IF X$="D" THEN M(P)=0:GOTO 340
330 GOTO 290
340 PRINT X$
350 PRINT"{12 UP}":NEXT P:C5=INT(RND(0)*6
    )+2
360 FOR P=1 TO F
370 W=1:Z=400:IF M(P)=2 THEN Z=401:IF A(P
    )=1 THEN W=5:M(P)=1:Z=370
380 IF SM(P)-A(P)=0 THEN W=5
390 IF A(P)<1 THEN K(P)=K(P)+A(P)
```


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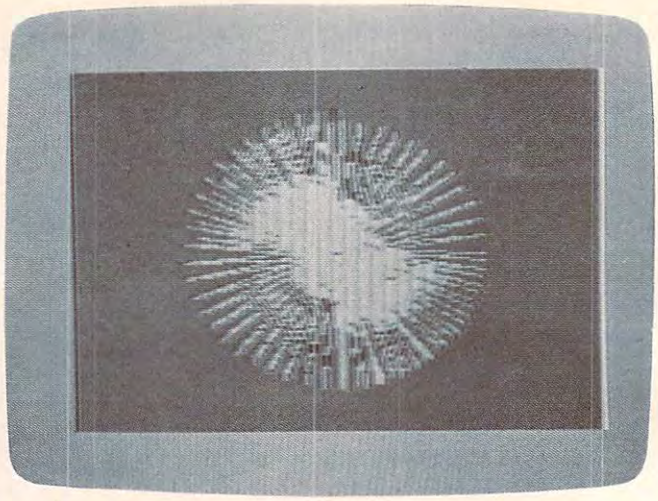
```
400 C=.001:IF A(P)<1/9 THEN M(P)=M(P)/2:C
    =C/2
410 J=R(P):I=400-R(P)
420 GRAPHIC 2:COLOR 1,2,C5,C5
430 POINT C5,125+(Z+100)/1.3,130
440 FOR T=0TO 6.2831/A(P)*W STEP .06283
450 IF PEEK(198)<> 0 THEN 100
460 IF SM(P) THEN J=R(P)*S:I=400*S-J:S=S-
    C
470 X=125+(100+Z+T*M(P)-SIN(T)*J+SIN(T*K(
    P))*I)/1.3
480 Y=520-COS(T)*J-COS(T*K(P))*I
490 IF X<0 OR Y<0 THEN 650
500 DRAW 1 TO X,Y:NEXT
510 NEXT P:GOSUB 690
520 GET R$:IF R$="" THEN 520
530 GOTO 100
540 REM -INPUT ROUTINE-
550 L0=0:L1=1:B$=""
560 GET A$:IF A$="" THEN 560
570 IF A$="-" AND L0=0 THEN PRINT A$;:B$=
    A$:L0=1:L1=2:GOTO 560
580 IF A$=CHR$(13) AND L0>0 THEN Z=VAL(B$
    ):PRINT:RETURN
590 IF A$=CHR$(13) THEN PRINT Z:RETURN
600 IF A$=CHR$(20) AND L0>1 THEN PRINT A$
    ;:B$=LEFT$(B$,LEN(B$)-1):L0=L0-1:GOTO
     560
610 IF A$=CHR$(20) AND L0=1 THEN PRINT A$
    ;:B$="":L0=0:GOTO 560
620 IF L0>L1 THEN 560
630 IF A$<"0" OR A$>"9" THEN 560
640 PRINT A$;:B$=B$+A$:L0=L0+1:GOTO 560
650 REM ERROR TRAPPING ROUTINE
660 GRAPHIC 4:PRINT"{CLR}{2 DOWN}COORDINA
    TES ARE OUT{3 SPACES}OF RANGE"
670 PRINT"{2 DOWN}TRY ANOTHER FIGURE":PRI
    NT"{2 DOWN}RETURNING TO MAIN MENU"
680 FOR I=1 TO 4000:NEXT:GOTO 110
690 FORV=15 TO 0 STEP -.5:SOUND245,0,0,0,
    V:NEXT:RETURN
```

Program 3: Spiralizer – Atari Version

```
100 DIM A$(3),X$(4)
110 GRAPHICS 2:SETCOLOR 2,0,0:SETCOL
    OR 0,9,10:POSITION 0,5:PRINT #6;
    "S P I R A L I Z E R":FOR I=1 TO
     750:NEXT I
120 OPEN #1,4,0,"K:"
130 GRAPHICS 8:COLOR 1:SETCOLOR 2,0,
    0
140 ? CHR$(125);:G=4:Z=5:POKE 752,0:
    POKE 656,0:POKE 657,2:PRINT "Spe
    ed (-50 to 50)?{3 SPACES}{3 LEFT}
    ";:GOSUB 450:K=Z
150 IF Z<-50 OR Z>50 THEN PRINT "
    {UP}";:GOTO 140
160 K=K-1
170 G=3:Z=35:PRINT "Radius (1 to 60)
    ?{3 SPACES}{3 LEFT}";:GOSUB 450:
    R=Z
180 IF Z<1 OR Z>60 THEN PRINT "{2 UP}
    ":GOTO 170
190 R=R+13:S=1
200 Z=1:PRINT "Spin (1 to 18)?
    {3 SPACES}{3 LEFT}";:GOSUB 450
210 IF Z<1 OR Z>18 THEN PRINT "{2 UP}
    ":GOTO 200
220 A=1/Z:IF Z>1 AND Z<9 THEN 290
230 SM=1:M=2:PRINT "Movement or Decr
    ement (M/D)?{4 SPACES}{4 LEFT}";
```



A sunburst of color can be seen in the VIC version of "Spiralizer."

```
240 GET #1,X:X$=CHR$(X):IF X=155 THE
    N M=0:SM=0:X$="None":? X$;:GOTO
    290
250 IF X$="M" THEN SM=0:GOTO 280
260 IF X$="D" THEN M=0:GOTO 280
270 GOTO 240
280 PRINT X$;
290 POKE 656,1:POKE 657,24:POKE 752,
    1:PRINT "Clear (M/D)?{3 SPACES}
    {3 LEFT}";
300 GET #1,V:A$=CHR$(V):IF A$<>"N" T
    HEN GOSUB 550:GOTO 320
310 PRINT "No";
320 W=1:Z=139:IF M=2 THEN Z=80:IF A=
    1 THEN W=5:M=1:Z=122
330 IF SM-A=0 THEN W=5
340 IF A<1 THEN K=K+A
350 C=1.0E-03:IF A<1/9 THEN M=M/2:C=
    C/2
360 J=R:I=79-R
370 PLOT Z+20,0
380 REM -MAIN LOOP-
390 FOR T=0 TO 6.2831/A*W STEP 0.062
    83:IF PEEK(764)<255 THEN POKE 76
    4,255:GOTO 140
400 IF SM THEN J=R*S:I=79*S-J:S=S-C
410 TRAP 420:DRAWTO (Z+T*M-SIN(T)*J+
    SIN(T*K)*I)+20,79-COS(T)*J-COS(T
    *K)*I
420 NEXT T
430 GOTO 140
440 REM -INPUT SUBROUTINE-
450 ZL=1
460 GET #1,V:IF V<>155 THEN 500
470 IF ZL=1 THEN ? Z:RETURN
480 SIGN=1:IF A$(1,1)="-" THEN A$=A$
    (2):SIGN=-1
490 Z=0:FOR I=1 TO LEN(A$):Z=Z*10+AS
    C(A$(I))-48:NEXT I:Z=SIGN*Z:? :R
    ETURN
500 IF V=126 THEN IF ZL>1 THEN ZL=ZL
    -1:PRINT CHR$(126);:GOTO 460
510 IF (V<48 OR V>57) AND V<>45 AND
    V<>46 THEN 460
520 IF ZL=6 THEN 460
530 PRINT CHR$(V);:A$(ZL)=CHR$(V):ZL
    =ZL+1
540 GOTO 460
```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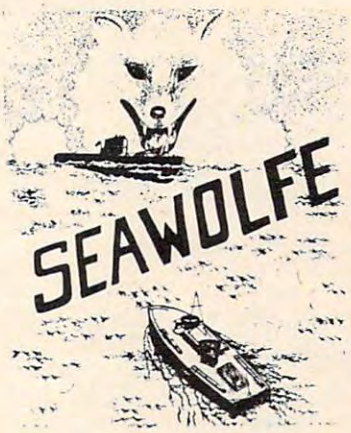

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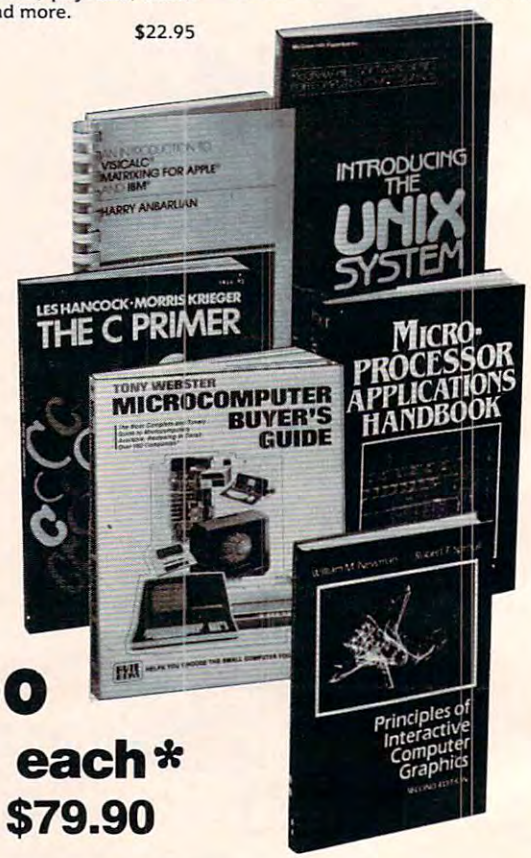

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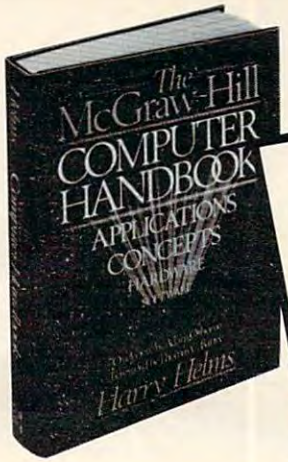

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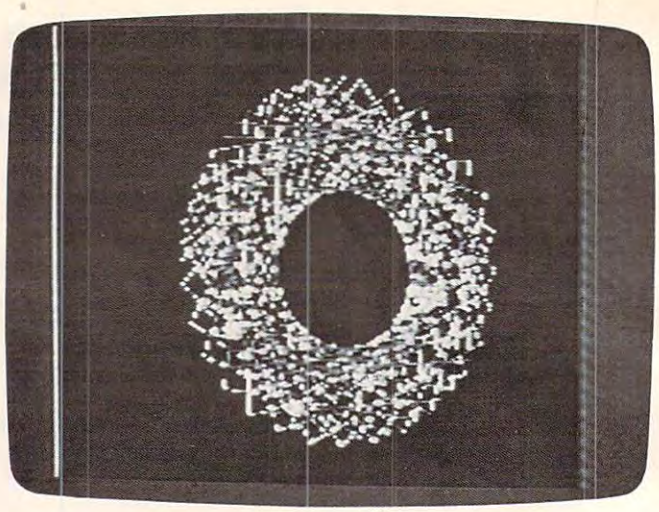
```
550 REM -TEXT WINDOW WRITE-
560 GRAPHICS 8:SETCOLOR 2,0,0
570 PRINT "Speed=";K+1:? "Radius=";R
    -13:? "Spin=";Z:POKE 752,1:PRINT
     "Movement or Decrement (M/D)=";
    X$;
580 RETURN
```

Program 4:

Spiralizer – Color Computer Version

```
10 CLS 0
20 PRINT@200,"SPIRALIZER";
25 FORT=1TO1000:NEXT
30 CLS 3
35 K=5
40 INPUT "SPEED (-50 TO 50)";K$
41 K=VAL(K$)
42 IF K$=""THEN K=5
45 IFK<-50ORK>50THEN40
47 K=K-1
48 R=35
50 INPUT "RADIUS (1-60)";R$
51 R=VAL(R$)
52 IF R$=""THENR=35
55 IF R<1 OR R>60 THEN50
57 R=R+13:S=1
60 INPUT "SPIN 1-18";Z$
61 Z=VAL(Z$)
63 IF Z$=""THENZ=1
65 IF Z<1OR Z>18THEN 60
70 A=1/Z:IF Z>1AND Z<9THEN200
80 SM=1:M=2
85 INPUT "MOVEMENT OR DECREMENT";X$
90 IF LEFT$(X$,1)<>"M" ANDLEFT$(X$,
   1)<>"D"THENM=0:SM=0:PRINT:PRINT
   "NONE";:GOTO200
95 IF LEFT$(X$,1)="M"THENSM=0:GOTO1
   90
100 IF LEFT$(X$,1)="D"THENM=0:GOTO1
    90
190 PRINT X$
200 PRINT:INPUT"CLEAR (Y/N)";T$
205 IF LEFT$(T$,1)<>"N"THENPRINT"YE
    S";:E=0:REMPUT CLEAR OF HIRES
210 IF LEFT$(T$,1)="N"THENPRINT"NO"
    {26 SPACES}
220 W=1:Z=139:IF M=2 THEN Z=80:IF A
    =1 THENW=5:M=1:Z=122
230 IF SM-A=0THENW=5
235 IF A<1THENK=K+A
238 C=0.001:IFA<1/9THENM=M/2:C=C/2
240 J=R:I=79-R
250 X0=Z:Y0=20{10 SPACES}
260 REM MAIN LOOP
270 FOR T=0 TO 6.2831/A*W STEP 0.06
    283
280 IF SM THENJ=R*S  :I=79*S-J:S=S-
    C
290 X1=Z+T*M-SIN(T)*J+SIN(T*K)*I
    {9 SPACES}
300 Y1=79-COS(T)*J-COS(T*K)*I:Y1=Y1
    +20
310 GOSUB 1000:X0=X1:Y0=Y1
320 NEXT
330 A$=INKEY$:IF A$=""THEN330
340 GOTO30
1000 SCREEN 1,1
1010 IF LEFT$(T$,1)="Y"ANDE=0THENPC
     LS:E=1
1020 LINE (X0,Y0)-(X1,Y1),PSET
1030 RETURN
```



"Spiralizer," Color Computer version.

Program 5:

Plot And Drawto Routine (64 Version)

by Gregg Peele, Editorial Programmer

```
10 I=49152:CK=0
20 READA:CK=CK+A:PRINT"{CLR}";CK:IF A=256
    THEN40
30 POKE I,A:I=I+1:GOTO 20
40 IFCK<>167356 THENPRINT"ERROR IN DATA S
   TATEMENTS"
49152 DATA 173,234,207,141,236,207,173
49160 DATA 232,207,141,238,207,173,235
49168 DATA 207,141,237,207,173,233,207
49176 DATA 141,239,207,173,236,207,56
49184 DATA 237,230,207,141,240,207,173
49192 DATA 237,207,237,231,207,141,241
49200 DATA 207,176,24,173,240,207,73
49208 DATA 255,141,240,207,173,241,207
49216 DATA 73,255,141,241,207,238,240
49224 DATA 207,208,3,238,241,207,173
49232 DATA 238,207,56,237,228,207,141
49240 DATA 244,207,173,239,207,237,229
49248 DATA 207,141,245,207,176,24,173
49256 DATA 244,207,73,255,141,244,207
49264 DATA 173,245,207,73,255,141,245
49272 DATA 207,238,244,207,208,3,238
49280 DATA 245,207,56,173,236,207,237
49288 DATA 230,207,141,192,207,173,237
49296 DATA 207,237,231,207,13,192,207
49304 DATA 240,15,144,24,169,1,141
49312 DATA 222,207,169,0,141,223,207
49320 DATA 76,169,192,169,0,141,222
49328 DATA 207,141,223,207,76,169,192
49336 DATA 169,255,141,222,207,141,223
49344 DATA 207,56,173,238,207,237,228
49352 DATA 207,141,193,207,173,239,207
49360 DATA 237,229,207,13,193,207,240
49368 DATA 15,144,24,169,1,141,246
49376 DATA 207,169,0,141,247,207,76
49384 DATA 224,192,169,0,141,246,207
49392 DATA 141,247,207,76,224,192,169
49400 DATA 255,141,246,207,141,247,207
49408 DATA 173,230,207,141,248,207,173
49416 DATA 228,207,141,250,207,173,231
49424 DATA 207,141,249,207,173,229,207
49432 DATA 141,251,207,56,173,244,207
49440 DATA 237,240,207,141,211,207,173
49448 DATA 245,207,237,241,207,13,211
49456 DATA 207,176,15,173,240,207,141
49464 DATA 252,207,173,241,207,141,253
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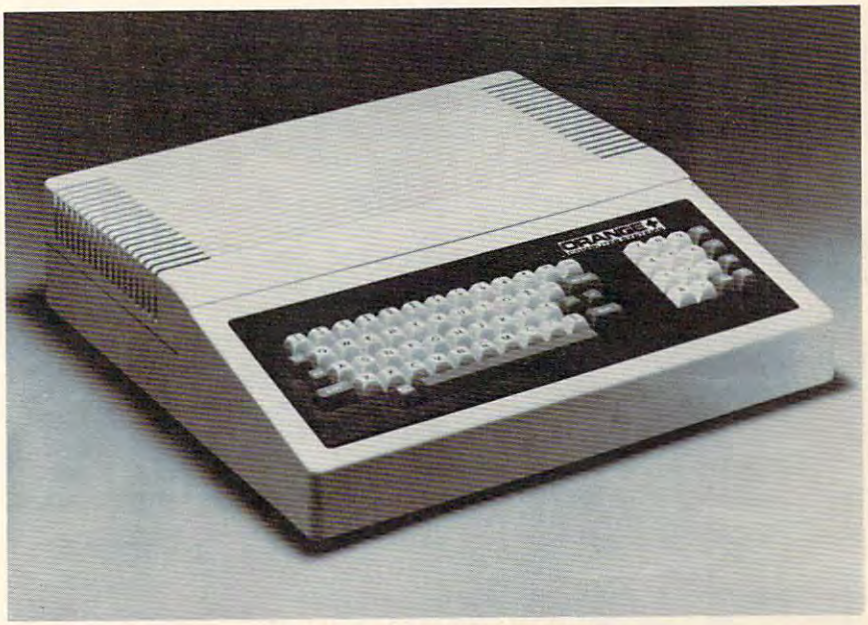

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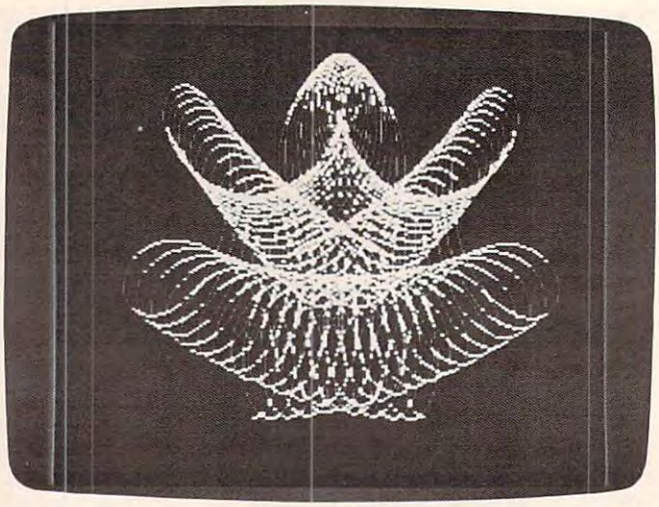
```
49472 DATA 207,76,40,193,173,244,207
49480 DATA 141,252,207,173,245,207,141
49488 DATA 253,207,173,252,207,141,254
49496 DATA 207,173,253,207,141,255,207
49504 DATA 56,173,252,207,237,244,207
49512 DATA 141,211,207,173,253,207,237
49520 DATA 245,207,13,211,207,208,17
49528 DATA 173,255,207,74,141,161,207
49536 DATA 173,254,207,106,141,160,207
49544 DATA 76,104,193,173,255,207,74
49552 DATA 141,227,207,173,254,207,106
49560 DATA 141,226,207,173,252,207,13
49568 DATA 253,207,240,27,173,253,207
49576 DATA 48,22,24,173,160,207,109
49584 DATA 240,207,141,160,207,173,161
49592 DATA 207,109,241,207,141,161,207
49600 DATA 76,142,193,76,45,194,56
49608 DATA 173,160,207,237,254,207,141
49616 DATA 211,207,173,161,207,237,255
49624 DATA 207,13,211,207,144,38,56
49632 DATA 173,160,207,237,254,207,141
49640 DATA 160,207,173,161,207,237,255
49648 DATA 207,141,161,207,24,173,248
49656 DATA 207,109,222,207,141,248,207
49664 DATA 173,249,207,109,223,207,141
49672 DATA 249,207,24,173,226,207,109
49680 DATA 244,207,141,226,207,173,227
49688 DATA 207,109,245,207,141,227,207
49696 DATA 56,173,226,207,237,254,207
49704 DATA 141,193,207,173,227,207,237
49712 DATA 255,207,13,193,207,144,38
49720 DATA 56,173,226,207,237,254,207
49728 DATA 141,226,207,173,227,207,237
49736 DATA 255,207,141,227,207,24,173
49744 DATA 250,207,109,246,207,141,250
49752 DATA 207,173,251,207,109,247,207
49760 DATA 141,251,207,32,46,194,206
49768 DATA 252,207,173,252,207,201,255
49776 DATA 240,3,76,104,193,206,253
49784 DATA 207,76,104,193,96,173,251
49792 DATA 207,240,8,173,250,207,201
49800 DATA 65,144,1,96,173,248,207
49808 DATA 201,199,144,1,96,173,249
49816 DATA 207,240,1,96,173,250,207
49824 DATA 141,212,207,173,251,207,141
49832 DATA 213,207,173,248,207,141,214
49840 DATA 207,173,249,207,141,215,207
49848 DATA 173,215,207,74,141,217,207
49856 DATA 173,214,207,106,141,216,207
49864 DATA 173,217,207,74,141,217,207
49872 DATA 173,216,207,106,141,216,207
49880 DATA 173,217,207,74,141,217,207
49888 DATA 173,216,207,106,141,216,207
49896 DATA 173,213,207,74,141,219,207
49904 DATA 173,212,207,106,141,218,207
49912 DATA 173,219,207,74,141,219,207
49920 DATA 173,218,207,106,141,218,207
49928 DATA 173,219,207,74,141,219,207
49936 DATA 173,218,207,106,141,218,207
49944 DATA 173,214,207,41,7,141,220
49952 DATA 207,173,216,207,10,46,217
49960 DATA 207,10,46,217,207,10,141
49968 DATA 210,207,46,217,207,173,217
49976 DATA 207,141,211,207,173,210,207
49984 DATA 10,46,217,207,10,46,217
49992 DATA 207,109,210,207,141,216,207
50000 DATA 173,211,207,109,217,207,141
50008 DATA 217,207,173,216,207,10,46
50016 DATA 217,207,10,46,217,207,10
50024 DATA 46,217,207,141,216,207,173
50032 DATA 218,207,10,46,219,207,10
50040 DATA 46,219,207,10,46,219,207
50048 DATA 141,218,207,24,173,216,207
50056 DATA 109,218,207,141,208,207,173
50064 DATA 217,207,109,219,207,141,209
50072 DATA 207,24,173,220,207,109,208
50080 DATA 207,141,208,207,169,0,109
50088 DATA 209,207,141,209,207,24,169
50096 DATA 32,109,209,207,141,209,207
50104 DATA 173,208,207,133,251,173,209
50112 DATA 207,133,252,173,212,207,41
50120 DATA 7,141,225,207,56,169,7
50128 DATA 237,225,207,141,225,207,169
50136 DATA 0,141,206,207,56,173,225
50144 DATA 207,46,206,207,206,225,207
50152 DATA 16,245,160,0,177,251,13
50160 DATA 206,207,145,251,96,169,147
50168 DATA 32,210,255,169,0,162,0
50176 DATA 157,0,32,157,0,33,157
50184 DATA 0,34,157,0,35,157,0
50192 DATA 36,157,0,37,157,0,38
50200 DATA 157,0,39,157,0,40,157
50208 DATA 0,41,157,0,42,157,0
50216 DATA 43,157,0,44,157,0,45
50224 DATA 157,0,46,157,0,47,157
50232 DATA 0,48,157,0,49,157,0
50240 DATA 50,157,0,51,157,0,52
50248 DATA 157,0,53,157,0,54,157
50256 DATA 0,55,157,0,56,157,0
50264 DATA 57,157,0,58,157,0,59
50272 DATA 157,0,60,157,0,61,157
50280 DATA 0,62,157,0,63,232,208
50288 DATA 157,169,16,162,0,157,0
50296 DATA 4,157,0,5,157,0,6
50304 DATA 157,0,7,232,208,241,96,256
```

Program 6: Spiralizer – 64 Version

Translated by Gregg Peele, Editorial Programmer

```
10 POKE53281,1:PRINT"{CLR}{9 DOWN}
   {7 RIGHT}";
20 PRINT"{BLK}{2 SPACES}UCCCCCCCCCCCCCCCCI"
30 PRINT"{9 SPACES}B{15 SPACES}B"
40 PRINT"{9 SPACES}B{2 SPACES}SPIRALIZER
   {3 SPACES}B"
50 PRINT"{9 SPACES}B{15 SPACES}B"
60 PRINT"{9 SPACES}B{15 SPACES}B"
70 PRINT"{9 SPACES}JCCCCCCCCCCCCCCCCK"
80 PRINT"{7 DOWN}{12 RIGHT}PRESS SPACE";:
   POKE198,0:FORT=1TO300:NEXT
100 WAIT197,64,64:POKE53272,21:POKE53265,
    27:PRINT"{CLR}";
```



Complex designs are possible with "Spiralizer," 64 version.

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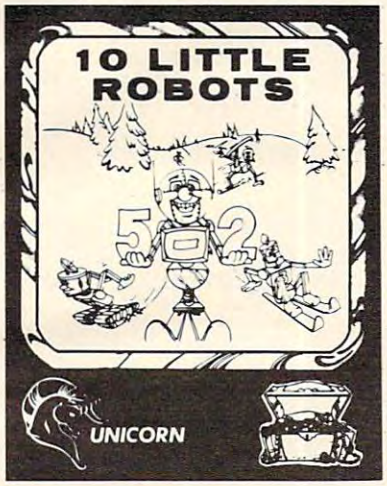

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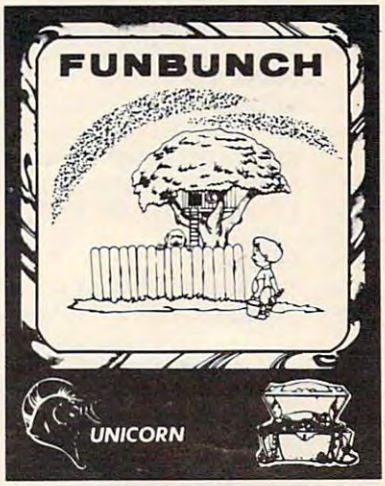

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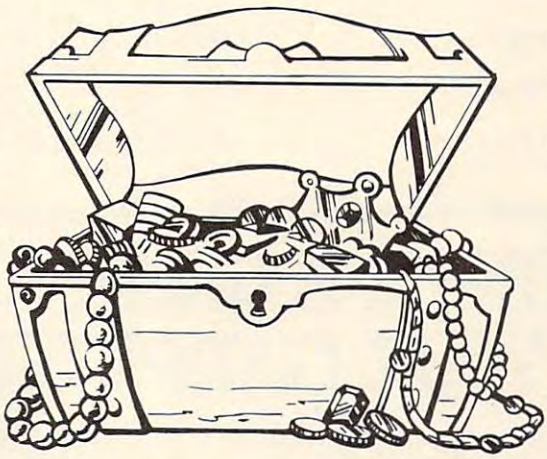

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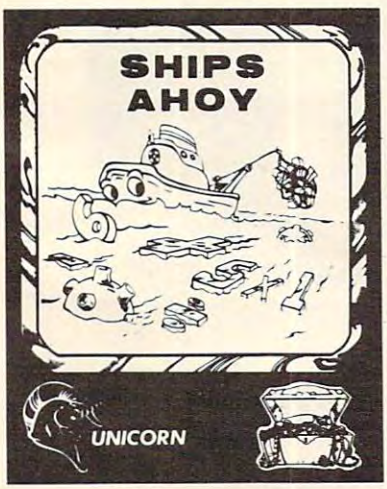

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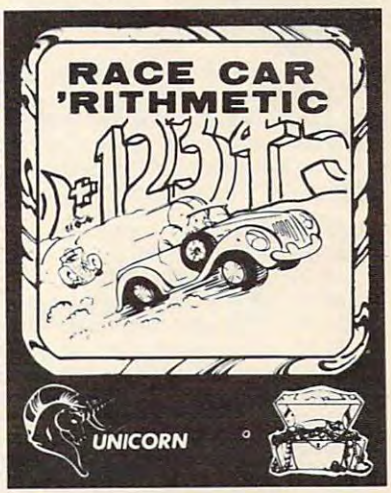

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```
110 Z=5 :PRINT"SPEED(-50 TO 50)? ";"
    {3 SPACES}{4 LEFT}";:GOSUB500:K=Z
115 IFZ<-50OR Z>50 THEN110
125 K=K-1
127 Z=35:PRINT"RADIUS (1 TO 60)? ";"
    {3 SPACES}{4 LEFT}";:GOSUB500:R=Z
130 IFZ<1ORZ>60THEN127
133 R=R+13:S=1
135 Z=1:PRINT"SPIN(1 TO 18)? ";"
    {3 SPACES}{4 LEFT}";:GOSUB500
137 IFZ<1ORZ>18 THEN135
140 A=1/Z:IFZ>1ANDZ<9THEN200
143 SM=1:M=2:PRINT"MOVEMENT OR DECREMENT
    {SPACE}(M/D)? ";"{3 SPACES}{4 LEFT}";
145 GETX$:IFX$=""THEN145
148 IF X$=CHR$(13)THEN M=0:SM=0:PRINT:PRI
    NT"{DOWN}NONE";:GOTO200
150 IFX$="M"THENSM=0:GOTO190
160 IF X$="D"THEN M=0:GOTO 190
170 GOTO145
190 PRINTX$
200 PRINT:PRINT"CLEAR (Y/N)?
201 GETT$:IFT$= ""THEN 201
203 IFT$<>"N"THENPRINT"YES":PRINT"{CLR}";
    :SYS50039
205 IF T$="N"THENPRINT"NO" :SYS50147
210 W=1:Z=139:IF M=2 THEN Z=80:IF A=1 THE
    N W=5:M=1:Z=122
215 IF SM-A=0THENW=5
220 IF A<1THEN K=K+A
230 C=0.001:IF A<1/9THENM=M/2:C=C/2
240 J=R:I=79-R
250 X0=Z+20 :Y0=30:REM:SYS49152
260 REM MAIN LOOP
270 FORT=0TO6.2831/A*WSTEP0.06283
280 IF SMTHENJ=R*S:I=79*S-J:S=S-C
290 X1=Z+T*M-SIN(T)*J+SIN(T*K)*I :X1=X1+2
    0
300 Y1=79-COS(T)*J-COS(T*K)*I:Y1=Y1+30
308 GOSUB1000:X0=X1:Y0=Y1
310 NEXT :GOTO100
500 L0=0:L1=1:B$=""
510 PRINTH$;
520 GETA$:IF A$=""THEN520
530 IF A$="-"AND L0=0THENPRINTA$;:B$=A$:L
    0=1:L1=2:GOTO510
540 IFA$= CHR$(13)AND L0>0THENZ=VAL(B$):P
    RINT:RETURN
550 IF A$=CHR$(13)THENPRINTZ:RETURN
560 IF A$=R$ANDL0>1THENPRINTA$;:B$=LEFT$(
    B$,LEN(B$)-1):L0=L0-1:GOTO510
570 IF A$=R$AND L0=1THENPRINTA$;:B$="":L0
    =0:GOTO510
580 IFL0>L1THEN510
590 IFA$<"0"ORA$>"9"THEN510
600 PRINTA$;:B$=B$+A$:L0=L0+1:GOTO510
900 POKE53272,21:POKE53265,27:PRINT"{CLR}
    ";:END
1000 POKE53272,PEEK(53272)OR8:POKE53265,P
     EEK(53265)OR32
1005 X0=INT(X0):IFX0<=255THEN POKE53220,X
     0:POKE53221,0
1010 IF X0>255THENPOKE53220,(X0-256):POKE
     53221,1
1030 POKE53222,Y0:POKE53223,0
1040 X1=INT(X1):IFX1<=255THEN POKE53224,X
     1:POKE53225,0
1050 IF X1>255THENPOKE53224,(X1-256):POKE
     53225,1
1060 POKE53226,Y1:POKE53227,0
1200 SYS49152 :RETURN
```

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