```
880 DATA 32,0,0,0,0,0,0,0,0
890 DATA 33,2,9,9,9,9,9,2,0
900 DATA 34,160,88,88,88,88,88,160,0
910 DATA 35,12,3,16,196,195,63,3,3
920 DATA 36,0,192,252,236,252,240,192,192
930 DATA 37,3,35,131,139,139,171,35,3
940 DATA 38,192,192,224,232,202,194,194,20
    0
950 DATA 39,64,80,84,85,85,85,85,85
960 DATA 40,1,5,21,85,85,85,85,85
970 DATA 41,0,102,219,36,126,137,66,60
980 DATA 42,0,15,0,51,63,15,15,3
990 DATA  288,0,0,0,0,0,0,0,0
1000 DATA 289,2,9,9,9,9,9,2,0
1010 DATA 290,160,88,88,88,88,88,160,0
1020 DATA 291,12,3,0,192,195,63,3,3
1030 DATA 292,0,192,252,204,252,240,192,192
1040 DATA 293,3,3,35,171,139,139,131,35
1050 DATA 294,192,200,194,194,202,232,224,1
     92
1060 DATA 295,64,80,84,85,85,85,85,85
1070 DATA 296,1,5,21,85,85,85,85,85
1080 DATA 297,129,102,90,36,126,82,36,24
1090 DATA 298,0,15,0,48,63,3,15,15
1100 DATA 43,153,219,231,255,90,24,36,66
1110 DATA 299,24,90,231,255,219,153,36,66
1120 DATA 44,217,219,231,75,2,24,36,66
1130 DATA 45,216,225,235,69,7,2,40,66
1140 DATA 46,192,192,145,3,67,1,72,130
1150 DATA 47,192,128,8,1,1,0,16,128
1160 DATA 300,217,219,247,99,22,24,36,68
1170 DATA 301,216,225,227,71,23,130,32,66
1180 DATA 302,192,200,129,3,131,1,64,130
1190 DATA 303,192,144,0,1,1,0,8,128
1200 DATA -1
2000 PRINT" {REV} {02 RIGHT} {02 RIGHT}  {0
    2 RIGHT} {03 RIGHT} {RIGHT} {02
    RIGHT} {RIGHT} {03 RIGHT} {RIGHT}
       {RIGHT} {03 RIGHT} "
2010 PRINT" {REV} {02 RIGHT} {RIGHT} {02
    RIGHT} {RIGHT} {03 RIGHT} {RIGHT}
     {RIGHT} {02 RIGHT}  {RIGHT}  {
    RIGHT} {03 RIGHT}  {02 RIGHT} "
2020 PRINT" {REV}     {RIGHT}     {RIGHT} {
    RIGHT} {RIGHT} {RIGHT}  {03 RIGHT
    RIGHT} {RIGHT} {RIGHT} {RIGHT}  {
    03 RIGHT} {RIGHT} {RIGHT} "
2030 PRINT" {REV} {02 RIGHT} {RIGHT} {02
    RIGHT} {RIGHT} {RIGHT} {RIGHT} {
    RIGHT} {RIGHT} {02 RIGHT} {03
    RIGHT} {RIGHT} {03 RIGHT} {02
    RIGHT}  "
2040 PRINT" {REV} {02 RIGHT} {RIGHT} {02
    RIGHT} {02 RIGHT} {RIGHT} {02
    RIGHT} {02 RIGHT} {RIGHT} {03
    RIGHT} {RIGHT}   {RIGHT} {03
    RIGHT} {03 DOWN}"
2060 PRINTSPC(15);"{REV})  _{02 RIGHT}   "
2070 PRINTSPC(15);"{REV}¯{02 RIGHT} {02
    RIGHT} "
2080 PRINTSPC(15);"{REV} {02 RIGHT} {02
    RIGHT}   "
2090 PRINTSPC(15);"{REV} {02 RIGHT} {02
    RIGHT} "
2100 PRINTSPC(15);"_{REV}  {OFF})  {REV} {0
    2 DOWN}"
2110 PRINT"   {REV}   {02 RIGHT}   {RIGHT}
    {03 RIGHT} {RIGHT}   {02 RIGHT}  ~
     {02 RIGHT}   {RIGHT} {03 RIGHT} ~
    "
2120 PRINT"   {REV} {02 RIGHT} {02 RIGHT} {
    03 RIGHT}  {02 R_GHT} {RIGHT} {02
     RIGHT} {RIGHT} {02 RIGHT} {02
    RIGHT} {02 RIGHT}  {02 RIGHT} "
2130 PRINT"   {REV} {02 RIGHT} {02 RIGHT} {
    03 RIGHT} {RIGHT} {RIGHT} {RIGHT}
     {02 RIGHT} {RIGHT}   {03 RIGHT} ~
    {02 RIGHT} {RIGHT} {RIGHT} "
2140 PRINT"   {REV} {02 RIGHT} {02 RIGHT} {
    03 RIGHT} {02 RIGHT}  {RIGHT} {02
     RIGHT} {RIGHT} {02 RIGHT} {02
    RIGHT} {02 RIGHT} {02 RIGHT}  "
2150 PRINT"   {REV}   {02 RIGHT}   {RIGHT} ~
    {03 RIGHT} {RIGHT}   {02 RIGHT} {
    03 RIGHT} {RIGHT}   {RIGHT} {03
    RIGHT} "
2160 RETURN
```

©

Bee Trap

Robert L. Lykins

You're a scout who leads worker bees – one at a time – from the bottom of the screen to the flower bed at the top. Beware the Venus Bee Traps along the way. Versions for VIC, Atari, and the TRS-80 Color Computer.

Spring has sprung. The air is clear and cool; a light northerly breeze carries the fresh scent of new flowers. A hum fills the air as seemingly lost bees from the southern colony, lured by the sweet winds, fly lazily toward the flower bed.

The Queen's Commission

Alas, all is not as rosy as it seems. As the midday sun warms the soil between the colony and the flowers, strangely beautiful, enticing blossoms appear throughout the field. Unknown to the lost worker bees, these are not gentle flowers. They are deadly Venus Bee Traps.

As Guide Bee, you must take the lost bees safely to the flower bed. You are credited only for the bees you take (one at a time), not those that find the flowers on their own. You lose credit for one bee if you enter the flower bed empty-handed. If 50 bees meet a fateful end or if you are caught by a Venus Bee Trap yourself, you lose your commission as Guide.

Multicolor Graphics

This program is a good example of the value of multicolor graphics on the VIC. By POKEing the character color location with a number ranging from 8 to 15 (instead of the usual 0 to 7), you get not only a different color but also a different character shape. The bees are really asterisks and the Venus Bee Traps are club symbols.

To illustrate this mode, first POKE in the screen and border color combination desired. This is important because these colors play a role in the color and apparent shape of the multicolor mode characters. Next, POKE 646 with a number from 8 to 15. Then type characters from the keyboard to see the resulting shape and color combinations. Beautiful designs may be drawn by repeating the same character many times. Make this easier by POKEing 650 with # 128. This makes all keys repeat.

Keyboard Play

For play without a joystick, add KB = 197 to line 10 and eliminate lines 3, 5, 7, 30, 32, 35, and 40. Change FIRE BUTTON to SPACE BAR in line 120 and line 3400. Eliminate line 312. Re-enter the following lines:

```
130 IFPEEK(KB)<>32THEN130
310 REM READ KEYS: Y (UP), B (DOWN), G (LEFT),
    H (RIGHT)
315 IFPEEK(KB)=11THEND1=D1 -22 :GOTO 335
320 IFPEEK(KB)=35THEND1=D1 -1 :GOTO 335
325 IFPEEK(KB)=19THEND1=D1 -1 :GOTO 335
330 IFPEEK(KB)=43THEND1=D1+1
3415 IFPEEK(KB)=32THEN150
```

Readers who would like a tape copy of this program may send $3 with a blank tape and a self-addressed, stamped mailer to:

Robert L. Lykins
P.O. Box 8140
Anchorage, AK 99508

Atari And TRS-80 Color Computer Version Notes For Bee Trap

To play these versions of Bee Trap you follow the same rules as the VIC version. A guide bee safely leads stray bees to the flower bed while avoiding the deadly Venus Bee Trap. The guide is controlled with the joystick. On the Atari, plug the joystick into controller jack #1; on the Color Computer, plug the joystick into the right port.

The game ends either when 50 lost bees have been taken by the Venus Bee Traps or when the guide bee collides with a Bee Trap. As the guide bee, be sure not to enter the flower bed without a lost bee. Terrible sounds will result, and you will be penalized one credit.

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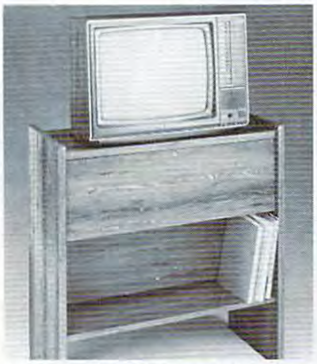

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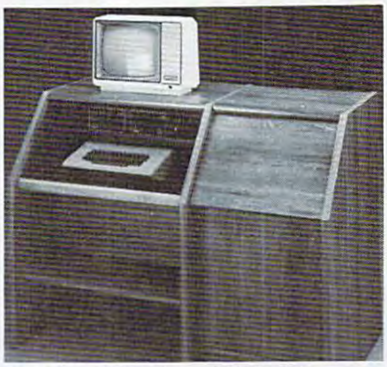

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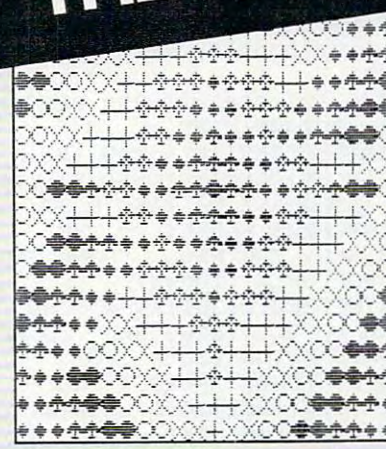
```
     History Book Report
       by Joe Grimes

Book  : I, Claudius
Author: Robert Graves

    Back in the old days of
Empire the cruel Emperor Ca
murdered and a new leader,
was chosen by the Praetoria
(The Romans had rather odd
order in those days.) The P
Guard thougt they had chose
simpleton and weakling who
easily manipulated to the G
purposes.
        Much to everyone's su
Claudius lasted for over a
and turned out to be a wise
moderate leader. Robert Gra
I, Claudius describes the E
life before he ascended the
```

Write and print my letters, homework—just about anything. With *Word Processor* software that comes with the printer.

Create my own custom computer games. The printer set includes the new *First Book of VIC:* it's full of great game ideas.

```
1 REM*VIC SQUIGGLE*
2 REM*FROM VIC 1001 USER'S
3 REM*TYPED AND DEBUGGED BY
7 C$="             "
9 PRINT""
10 DATA"|","─","┘","└","┌",
20 DATA1,0,5,6
30 DATA0,1,4,3
40 DATA3,6,2,0
50 DATA4,5,0,2
60 DIMA$(5),B(5,5)
70 FORI=0TO5
80 READA$(I)
90 NEXT
100 FORI=1TO4
110 FORJ=1TO4
120 READB(J,I)
130 NEXT
140 NEXT
190 T1=1
200 T2=1
210 X=20
```

Learn to write my own VIC 20 applications. With hard copy program listings that help me debug my programs.



Show off my computer graphics creations. Software includes *Kaleidoscope* and *Sketch Pad* graphics programs.

```
Recipe 334

CHEESE BERRY PIE

Ingredients

    2 Pks (3 oz. ea.) cream
    1/3 cup powdered sugar
    1/3 cup sour cream
    2 tsp grated orange pee
    Baked 9-inch pie shell
    2 - 3 cups whole fresh
    strawberries/raspberrie
    1/2 cup strawberry/rasp
    preserves, sieved

Procedure

  Soften cheese.  Beat in s
sour cream and orange peel.
in pie shell.  Top with ber
to glaze.  Chill.  If you l
```

Keep the family's favorite recipes on a VIC 20 cassette. Now Mom can't pretend that she lost the recipe for cheeseberry pie.

OFFICIALLY APPROVED BY COMMODORE

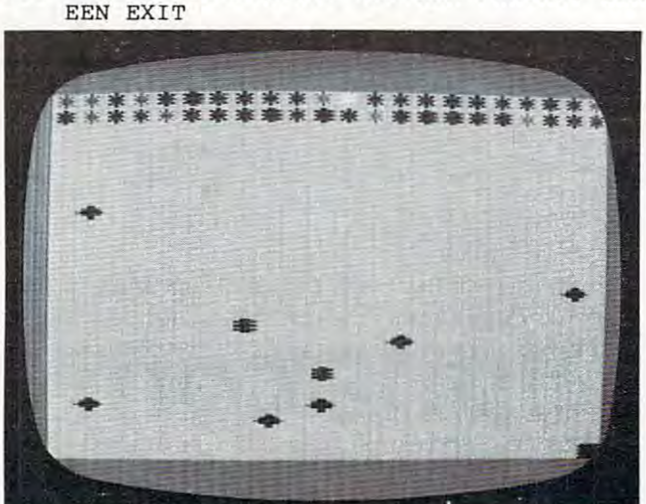
UL

Alphacom™

2323 South Bascom Avenue
Campbell, CA 95008

Program 1: VIC Version

```
3 GOTO 1Ø
5 J1=NOTPEEK(37151)AND6Ø-((PEEK(JS)AND12
   8)=Ø)
7 RETURN
1Ø Q=36879:J=37137:JS=37152
3Ø POKEQ,11Ø:PRINT"{CLEAR}{Ø6 DOWN}{Ø2
    RIGHT}{WHT}PLUG IN JOYSTICK","{Ø2
     DOWN}{Ø2 RIGHT}PRESS FIRE BUTTON

32 POKE 37154,127:REM ACTIVATE PORT B
35 GOSUB 5
4Ø IFJ1<>32THEN35
5Ø PRINT"{CLEAR}":POKEQ,93:FORL=1TO3:PRIN
    T"{Ø3 DOWN}{Ø5 RIGHT}B E E   T R ~
    A P{Ø2 DOWN}";:NEXT:FORL=1TO999:N
    EXT
6Ø POKEQ,127:FORL=1TO999:NEXT:POKEQ,42:FO
    RL=1TO2ØØØ:NEXT
8Ø PRINT"{CLEAR}{BLK}YOU ARE A GUIDE BEE ~
     {DOWN}COMMISSIONED BY THE   {DOWN}
     QUEEN BEE TO TAKE LOST
9Ø PRINT"BEES SAFELY TO THE    {DOWN}FLOW
    ER BED. YOU WILL  {DOWN}GET CREDI
    T FOR ONLY 1{DOWN}
1ØØ PRINT"BEE{RIGHT}AT A TIME. BEWARE{DOWN}
    THE LOVELY VENUS BEE  {DOWN}
    TRAPS WHICH BLOOM PRO-
11Ø PRINT"FUSELY ACROSS THE     {DOWN}FIEL
    D. {GRN}{REV}GOOD LUCK!?!{DOWN}
115 FORL=1TO2ØØ:NEXT
12Ø PRINT"{WHT}{REV}{RIGHT}(PRESS FIRE BUT
    TON){UP}
13Ø GOSUB 5:IFJ1<>32 THEN 13Ø
15Ø C=3Ø72Ø:P=768Ø:N=36877:V=36878:B=36875
    :K=8248:HH=36874
175 K1=7735:H=24Ø:SC=Ø:S=Ø:D1=Ø:D2=Ø:R=Ø
19Ø REM PRINT FLOWERS
2ØØ POKEQ,191:PRINT"{CLEAR}":FORL=ØTO43
225 POKEP+L,42
23Ø POKEP+L+C,INT(RND(1)*8):NEXT
3Ø5 POKEK1+D1,32:REM ERASE GUIDE BEE
31Ø REM READ JOYSTICK
312 J1=NOTPEEK(37151)AND6Ø-((PEEK(JS)AND12
    8)=Ø)
315 IFPEEK(JS)=119THEND1=D1+1:GOTO335
32Ø IFJ1=4THEND1=D1-22:GOTO 335
325 IFJ1=8THEND1=D1+22:GOTO 335
33Ø IFJ1=16THEND1=D1-1
335 IFK1+D1>8185THEND1=45Ø:REM PREVENT SCR
    EEN EXIT
```



Two bees evade Venus Beetraps in the VIC-20 version of "Bee Trap."

```
34Ø IFK1+D1<7724ANDS>ØTHEN2ØØØ:REM ENTER F
    LOWERS WITH BEE
345 IFK1+D1<7724THEND1=Ø:POKEQ,11Ø:FORL=1T
    O2ØØØ:NEXT:SC=SC-1:POKEQ,191:REM ~
    ENTER W/Ø BEE
35Ø IFD2<5ØANDX<2THENXX=INT(RND(1)*351)+44
    :POKEK1+C+XX,X+12:POKEK1+XX,88
351 REM RANDOM TRAP PLACEMENT
36Ø IFPEEK(K1+D1)=42THEND2=Ø:S=S+1:H=H-1Ø:
    REM CATCH LOST BEE
37Ø IFPEEK(K1+D1)=88THEN3ØØØ:REM GUIDE BEE
     IS ZAPPED
38Ø POKEK1+D1+C,8:POKEK1+D1,42:REM PRINT G
    UIDE BEE
425 REM BUZZING SOUNDS
44Ø IFH<13ØTHENH=24Ø
45Ø POKEV,6-X/6:POKEB,16Ø-X:POKEHH,H
5Ø5 POKEK-D2,32:REM ERASE LOST BEE
515 REM LOST BEE MOVEMENT
52Ø X=INT(RND(1)*(H/5-22))
53Ø IFX<3THEND2=D2+22
54Ø IFX=3ORX=4THEND2=D2+1
55Ø IFX=5THEND2=D2-1
56Ø IFK-D2<7724THEND2=Ø:REM BEE FINDS FLOW
    ERS WITHOUT GUIDE
57Ø IFPEEK(K-D2)=42ANDD2>62THEND2=Ø:S=S+1:
    H=H-1Ø:REM LOST BEE FINDS GUIDE B
    EE
58Ø IFPEEK(K-D2)=88THEN1ØØØ:REM LOST BEE I
    S ZAPPED
59Ø POKEK-D2+C,14:POKEK-D2,42:REM PRINT LO
    ST BEE
6ØØ GOTO3Ø5
1ØØØ POKEQ,42:FORL=1TO1ØSTEP.1:POKEV,1Ø-L:P
    OKEN,2ØØ-L*5:NEXT:POKEN,Ø:D2=Ø
1Ø5Ø R=R+1:IFR=5ØTHEN3ØØØ
1Ø75 IFR>4ØTHENPOKEQ,249:GOTO3Ø5
11ØØ POKEQ,191:GOTO3Ø5
2ØØØ POKEQ,127:SC=SC+1:PRINT"{HOME}{Ø2
    DOWN}{Ø4 RIGHT}{RED}CREDIT"SC;
21ØØ IFSC=1THENPRINT"BEE":GOTO23ØØ
22ØØ PRINT"BEES
23ØØ FORL=1TO75STEP.3:POKEB,175+L:NEXT:PRIN
    T"{UP}                   ":S=Ø:
    D1=Ø:GOTO11ØØ
3ØØØ POKEQ,1Ø:FORL=1TO1ØSTEP.1:POKEV,15-L:P
    OKEB,2ØØ-L*5:NEXT:POKEB,Ø:POKEHH,
    Ø
31ØØ PRINT"{HOME}{Ø2 DOWN}{RIGHT}{CYN}FINAL
     CREDIT"SC;
32ØØ IFSC=1THENPRINT"BEE":GOTO34ØØ
33ØØ PRINT"BEES
34ØØ PRINT"{DOWN} HIT {REV}S{OFF} TO STOP, ~
    PRESS  FIREBUTTON TO REPLAY"
34Ø3 GET A$
341Ø IF A$="S" THEN 35ØØ
3415 GOSUB 5:IF J1=32 THEN 15Ø
342Ø GOTO 34Ø3
35ØØ POKE 37154,255:POKE Q,27:PRINT"{CLEAR}
    {BLU}":END
```

Program 2: Atari Version

```
1Ø5 DL=PEEK(56Ø)+256*PEEK(561)+4
11Ø SCREEN=PEEK(88)+256*PEEK(89)
12Ø GRAPHICS 2:SETCOLOR 2,Ø,Ø
125 POKE 752,1
13Ø SETCOLOR Ø,7,1Ø:POSITION 3,4:PRI
    NT #6;"B E E{3 SPACES}T R A P"
135 FOR I=1 TO 3:SOUND Ø,Ø,Ø,Ø:SOUND
     1,Ø,Ø,Ø:SOUND 1,14Ø,12,4:SOUND
    1,45,12,4:FOR K=1 TO 2ØØ:NEXT K:
    NEXT I
```

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1

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2

The Tax Handler makes April 15th just another day. This is the perfect complement to our Color Accountant. The Tax Handler will help prepare your tax returns and probably save you money. Included are:

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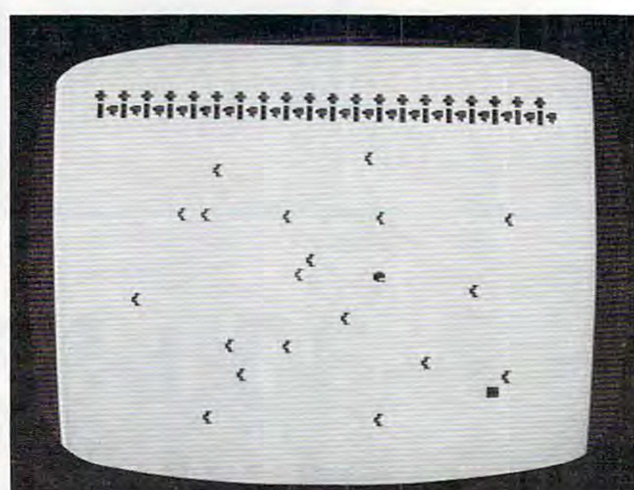
```
140 PRINT "{3 SPACES}- PLUG JOYSTICK
     INTO JACK #1 -":FOR I=1 TO 950:
    NEXT I:SOUND Ø,Ø,Ø,Ø:SOUND 1,Ø,Ø
    ,Ø:GRAPHICS Ø
150 PRINT :? :PRINT "{4 SPACES}YOU A
    RE A GUIDE BEE COMMISSIONED":?
160 PRINT "BY THE QUEEN BEE TO TAKE
    LOST BEES":?
170 PRINT "SAFELY TO THE FLOWER BED.
     YOU WILL":?
180 PRINT "GET CREDIT FOR ONLY 1 BEE
     AT A TIME.":?
190 ? "BEWARE THE VICIOUS VENUS BEE
    TRAPS":?
200 PRINT "WHICH BLOOM PROFUSELY ACR
    OSS THE"
210 ? :PRINT "FIELD!"
220 POSITION 14,17:PRINT "GOOD LUCK!
    !!!"
225 POKE 752,1
230 POSITION 2,20:PRINT "  PRESS THE
     FIRE BUTTON TO START"
240 IF STRIG(Ø)<>Ø THEN 240
245 K=SCREEN+1074:K1=SCREEN+1ØØ:H=24
    Ø:SC=Ø:S=Ø:D1=Ø:D2=Ø:R=Ø
248 GRAPHICS Ø:SETCOLOR 4,1,12:SETCO
    LOR 2,2,11
250 POKE 752,1:POSITION Ø,Ø:FOR I=1
    TO 2Ø:PRINT CHR$(123);CHR$(32);:
    NEXT I
255 FOR I=2 TO 24:POKE DL+I,4:NEXT I
    :POKE DL-1,4+64
260 POSITION Ø,1:FOR J=1 TO 2Ø:PRINT
     CHR$(124);CHR$(Ø);:NEXT J:REM P
    RINT FLOWER BED
305 POKE K1+D1,Ø:REM ERASE GUIDE BEE
310 REM READ JOYSTICK
312 IF STICK(Ø)<>15 THEN POKE 77,Ø
315 IF STICK(Ø)=7 THEN D1=D1+1:GOTO
    335
320 IF STICK(Ø)=14 THEN D1=D1-4Ø:GOT
    O 335
325 IF STICK(Ø)=13 THEN D1=D1+4Ø:GOT
    O 335
330 IF STICK(Ø)=11 THEN D1=D1-1
335 IF K1+D1>SCREEN+959 THEN D1=D1-4
    Ø:REM PREVENT SCREEN EXIT
340 IF K1+D1<SCREEN+8Ø AND S>Ø THEN
    2ØØØ:REM ENTERS FLOWERS W/ BEE
345 IF K1+D1<SCREEN+8Ø THEN D1=Ø:SET
    COLOR 4,9,12:FOR I=1 TO 3ØØ:NEXT
     I:SC=SC-1:SETCOLOR 4,1,12:REM E
    NTER W/O BEE
350 IF D2<9Ø AND X<2 THEN XX=INT(RND
    (1)*68Ø)+8Ø:POKE K1+XX,28:REM RA
    NDOM TRAP PLACEMENT
360 IF PEEK(K1+D1)=3 THEN D2=Ø:S=S+1
    :H=H-1Ø:REM CATCH LOST BEE
370 IF PEEK(K1+D1)=28 THEN 29ØØ:REM
    GUIDE BEE IS ZAPPED
380 POKE K1+D1,32:REM PRINT GUIDE BE
    E
425 REM BUZZING SOUNDS
440 IF H<13Ø THEN H=24Ø
450 SOUND Ø,14Ø,12,4:SOUND 1,H,12,4:
    SOUND 2,45,12,2
505 POKE K-D2,Ø:REM ERASE LOST BEE
515 REM LOST BEE MOVEMENT
520 X=INT(RND(1)*(H/5-22))
530 IF X<3 THEN D2=D2+4Ø
540 IF X=3 OR X=4 THEN D2=D2+1
550 IF X=5 THEN D2=D2-1
560 IF K-D2<SCREEN+8Ø THEN D2=Ø:REM
    BEE FINDS FLOWERS W/O GUIDE
570 IF PEEK(K-D2)=3 AND D2>12Ø THEN
    D2=Ø:S=S+1:H=H-1Ø:REM LOST BEE F
    INDS GUIDE BEE
580 IF PEEK(K-D2)=28 THEN 1ØØØ:REM L
    OST BEE IS ZAPPED
590 POKE K-D2,3:REM PRINT LOST BEE
600 GOTO 3Ø5
1000 SETCOLOR 4,4,12:FOR I=5Ø TO 15Ø
     :SOUND 3,I,1Ø,4:NEXT I:SOUND 3,
     Ø,Ø,Ø
1050 D2=Ø:R=R+1:IF R=5Ø THEN 29ØØ
1060 FOR I=1 TO 2ØØ:NEXT I
1100 SETCOLOR 4,1,12:GOTO 3Ø5
2000 SETCOLOR 4,4,12:SETCOLOR 2,2,6:
     SC=SC+1:POKE DL+3,2
2050 FOR I=Ø TO 7Ø:SOUND 1,I,1Ø,4:NE
     XT I:FOR I=Ø TO 3Ø:NEXT I:SOUND
      1,Ø,Ø,Ø
2100 POSITION 12,2:PRINT " CREDIT ";
     SC;:IF SC=1 THEN PRINT " BEE ":
     GOTO 23ØØ
2200 PRINT " BEES "
2300 FOR L=1 TO 5ØØ:NEXT L:FOR L=5 T
     O 27:POSITION L,2:PRINT " ":NEX
     T L:POKE DL+3,4
2310 S=Ø:D1=Ø:SETCOLOR 2,2,1Ø:GOTO 1
     1ØØ:REM SCORE SOUND
2900 SOUND Ø,Ø,Ø,Ø:SOUND 1,Ø,Ø,Ø:SOU
     ND 2,Ø,Ø,Ø
3000 SETCOLOR 4,7,12:SETCOLOR 2,2,8:
     FOR I=1ØØ TO 255:SOUND 1,I,1Ø,4
     :NEXT I:SOUND 1,25,2,4:FOR I=Ø
     TO 3Ø:NEXT I
3100 SOUND 1,Ø,Ø,Ø:FOR I=3 TO 4:POKE
      DL+I,2:NEXT I
3200 POSITION 9,2:PRINT " FINAL CRED
     IT ";SC;:IF SC=1 THEN PRINT " B
     EE ":GOTO 34ØØ
3300 PRINT " BEES "
3400 POKE 764,255:PRINT " HIT Q TO S
     TOP/FIREBUTTON TO REPLAY"
3420 IF STRIG(Ø)=Ø THEN 245
3425 IF PEEK(764)=47 THEN POKE 764,2
     55:GRAPHICS Ø:END
3430 GOTO 342Ø
```



The Atari version of "Bee Trap" uses multicolored characters for the flowers (top), bees (center and lower right), and the bee traps.

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By Westmoreland & Gilman from Adventure

Underwater adventure is yours as you command a nuclear sub armed with deadly missiles and torpedoes. Guide it carefully through sea mines and underwater mountains; watch out for depth charges being fired by overhead ships ... and don't run out of air! Scrolling sea bottom for added excitement.

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By Neil Larimer from Adventure Int.

A space battle between your cruiser and wave-after-wave of enemy ships. You can destroy them with your energy darts or you can ram them—as long as your shields are intact. The action takes place on a continuous horizontal landscape. You control the altitude and speed of your craft as you pursue the enemy. Skill level 1 is exciting, and there are four more levels available.

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By Cindy and Andrew Bartorillo from Acorn

Learn the basics of a foreign language. LANGUAGE TEACHER offers hundreds of word combinations, verb conjugations and phrases. There is an option for having multiple-choice answers and for being retested on missed items. Full printer capability and a great deal of "human engineering" further enhance the programs. Teachers will appreciate the ample documentation and the ability to get printouts of quizzes. Currently available languages are: French, Spanish, Italian and German.

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By Sparky Starks
From Adventure International

This is one game that will bug you! Wacky arcade-style machine language game for one or two players. Your garden has fallen into a Florida sinkhole where weird forces have mutated a bevy of bugs into a contingent of killers. Control the seven types of bugs using DDT on the pesky pests! You'll enjoy these bugs in your computer! Graphics oriented, real-time action with great sound.

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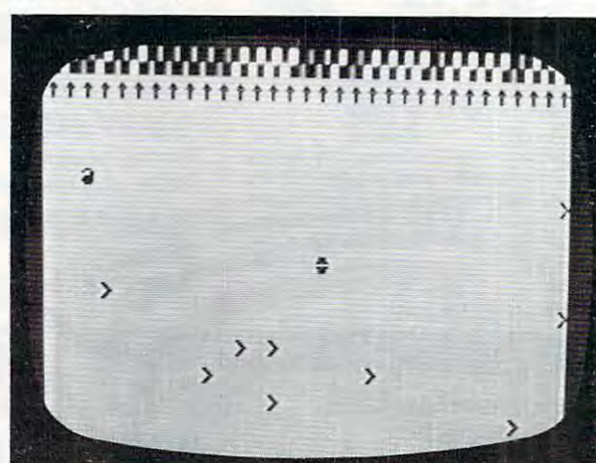
Program 3: Color Computer Version

```
100 CLS
110 PRINT@232,"E E E{3 SPACES}T R E
    E"
120 PRINT@389,"PLUG IN RIGHT JOYSTI
    CK"
130 SOUND 1,30:FOR I=1 TO 500
140 NEXTI
150 CLS
160 PRINT:PRINT"{3 SPACES}YOU ARE A
     GUIDE BEE COMMIS-"
170 PRINT"SIONED BY THE QUEEN BEE T
    O TAKE"
180 PRINT"LOST BEES SAFELY TO THE F
    LOWER"
190 PRINT"BED. YOU WILL GET CREDIT
    FOR"
200 PRINT"ONLY ONE BEE AT A TIME. B
    EWARE"
210 PRINT"THE VICIOUS VENUS BEE TRA
    PS"
220 PRINT"WHICH BLOOM PROFUSELY ACR
    OSS"
230 PRINT"THE FIELD."
240 PRINT@362,"GOOD LUCK!!!"
250 FOR I=1 TO 300:NEXT I
260 PRINT@451,"PRESS FIRE BUTTON TO
     BEGIN"
270 GOSUB 600:IF FIRE=0 THEN 270
280 CLS:E=0
290 K1=1104:P=1024:SC=0:S=0:D1=0:D2
    =0:R=0:H=240:K=1503+RND(32)
300 REM PRINT FLOWERS
310 FOR I=1 TO 32:C=128+16*RND(7)+6
    :PRINT CHR$(C);:NEXT I
320 FOR I=1 TO 32:PRINT"^";:NEXT I
330 E=E+1:POKE K1+D1,96:REM ERASE G
    UIDE BEE
340 H1=JOYSTK(0):V=JOYSTK(1):REM RE
    AD RIGHT JOYSTICK
350 IF H1=OH AND V=OV THEN 370
360 SOUND 1,1
370 IF H1=0 THEN D1=D1-1:GOTO 410
380 IF H1=63 THEN D1=D1+1:GOTO 410
390 IF V=0 THEN D1=D1-32:GOTO 410
400 IF V=63 THEN D1=D1+32
410 OH=H1:OV=V:IF K1+D1>1535 THEN D
    1=D1-32:REM PREVENT SCREEN EXIT
420 IF K1+D1<1088 AND S>0 THEN 680:
    REM ENTER FLOWERS WITH BEE
430 IF K1+D1<1088 THEN D1=0:SC=SC-1
    :SOUND 50,3:REM ENTER W/O BEE
440 IF D2<70 AND X<2 THEN XX=RND(30
    4)+64:POKE K1+XX,126:REM RANDOM
     TRAP PLACEMENT
450 IFPEEK(K1+D1)=64THEN D2=0:S=S+1
    :H=H-10:E=-30:REM CATCH LOST BE
    E
460 IF PEEK(K1+D1)=126 THEN 760:REM
     GUIDE BEE IS ZAPPED
470 POKE K1+D1,99:REM PRINT GUIDE B
    EE
480 IF H<130 THEN H=240
490 POKE K-D2,96:REM ERASE LOST BEE
500 REM LOST BEE MOVEMENT
510 X=RND(H/5-23)
520 IF X<3 AND E>5 THEN D2=D2+32
530 IF X=3 OR X=4 THEN D2=D2+1
540 IF X=5 THEN D2=D2-1
550 IFK-D2<1088 THEN D2=0:K=RND(32)
    +1503:REM BEE FINDS FLOWERS W/O
    UT GUIDE
560 IF PEEK(K-D2)=99 AND D2>90 THEN
     D2=0:S=S+1:H=H-10:E=-35:REM LO
    ST BEE FINDS GUIDE BEE
570 IF PEEK(K-D2)=126 THEN 630:REM
    LOST BEE IS ZAPPED
580 IF E>5 AND S=0 THEN POKE K-D2,6
    4:REM PRINT LOST BEE
590 GOTO 330
600 REM JOYSTICK FIRE BUTTON ROUTIN
    E
610 Z=PEEK(65280):FIRE=(Z=126)OR(Z=
    254)
620 RETURN
630 REM LOST BEE ZAPPED
640 D2=0:E=-5
650 R=R+1:IF R=50 THEN 760
660 SOUND 50,5:K=1503+RND(32)
670 GOTO 330
680 REM GUIDE SUCCESSFULLY CARRIES
    LOST BEE INTO FLOWER BED
690 SC=SC+1:E=-2
700 FOR I=130 TO 190 STEP 5:SOUND I
    ,1:NEXT I
710 PRINT@72,"CREDIT ";SC;
720 IF SC=1 THEN PRINT" BEE":GOTO 7
    40
730 PRINT" BEES"
740 FOR I=1 TO 500:NEXTI:PRINT@70,"
    {24 SPACES}"
750 S=0:D1=0:D2=0:K=1503+RND(32):GO
    TO 330
760 FOR I=190 TO 110 STEP -5:SOUND
    I,1:NEXT I
770 PRINT@68," FINAL CREDIT ";SC;
780 IF SC=1 THEN PRINT" BEE":GOTO 8
    10
790 PRINT" BEES"
800 FOR I=1 TO 200:NEXT I
810 PRINT@101,"PLAY AGAIN (Y OR N)"
    ;
820 INPUT A$:IF A$="Y" THEN 280
830 CLS:END
```



"Bee Trap," TRS-80 Color Computer version. ©

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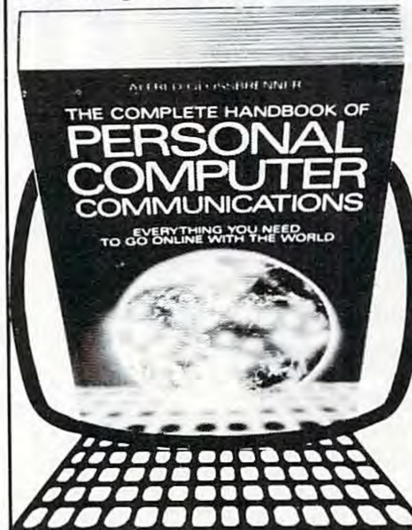

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Memory Trainer

Harvey B. Herman, Associate Editor

For 64, VIC, PET/CBM, Atari, TI, and Apple – this program might help you improve your memory skills. Some people, training in a similar fashion, have been able to quickly memorize random 80-digit numbers.

A provocative article, entitled "Exceptional Memory," appeared recently in *American Scientist* (vol. 70, no. 6, p. 607, 1982). The authors described experiments in which a person with a normal memory was trained to recall a sequence of over 80 random digits. How?

When most people read a random sequence once, they can remember only five to nine digits, the apparent limit of short-term memory (STM).

One might call this prodigious feat of memory (recalling 80 digits) *exceptional*, but the authors said that this skill may not be uncommon. Diligent practice, in one case 230 hours over 20 months, resulted in improvement in the ability to rapidly transfer information into long term memory (LTM). A "normal" memory could thereby be transformed into an "exceptional" one.

How easy it would be to automate the task of memory training by using a computer. Consequently, after reading the article, I sat down at my Commodore 8032 and wrote "Memory Trainer." Random digits are flashed on the screen at a specified rate, rather than being read to the subject. If the sequence is repeated correctly, the next sequence of digits is increased by one. When an error is made, the length of the sequence decreases by one. The subject can stop the experiment at any point, whereupon the maximum number length achieved is displayed.

Program 1: 80-Column CBM Version

```
100 REM MEMORY TRAINING PROGRAM
110 REM PATTERNED AFTER TECHNIQUE IN:
120 REM    "EXCEPTIONAL MEMORY" BY
130 REM    K.A. ERICSSON    AND
140 REM    W.G. CHASE
150 REM    AMERICAN SCIENTIST
160 REM    VOL 70, NO 6, PG 607, 1982.
170 REM
180 REM PROGRAM BY HARVEY B. HERMAN
190 REM
200 REM MAX 76 DIGITS
210 DIM N(76)
220 MA=0:REM MA=MAX CORRECT SCAN
230 PRINT "{CLEAR}{REV}MEMORY TRAINING PRO
    GRAM"
240 PRINT
250 INPUT "DIGIT RATE (SEC/DIG)  1{03
    LEFT}";DR
260 IF DR<.5 THEN DR=.5
270 PRINT
280 INPUT "INITIAL SEQUENCE LENGTH  5{03
    LEFT}";SL
290 IF SL<2 THEN SL=2
300 IF SL>76 THEN SL=76
310 REM MIN DIGIT RATE .5 SEC/DIG
320 REM SEQ LEN - MIN 2:MAX 76
330 PRINT:PRINT"{REV}CURRENT DIGIT SPAN{
    OFF}";SL;"{LEFT} "
340 REM FLASH GET SET AND DIGITS
350 PRINT:PRINT "{REV}GET SET{OFF}";:FOR I
    =1 TO 300:NEXT I
360 PRINT "{07 LEFT}GET SET";CHR$(7):PRINT
     "*":PRINT "{UP}";:FOR I=1 TO 1250:
     NEXT I:PRINT
370 FOR I=1 TO SL
380 N(I)=INT(RND(1)*10)
390 T=TI
400 PRINT "{UP}{REV}";N(I);"{OFF}";:FOR J=
    1 TO 100:NEXT J
410 PRINT "{03 LEFT}";N(I)
420 IF TI<T+DR*60 THEN 420
430 NEXT I
440 PRINT "{UP}  ";
450 PRINT:PRINT "INPUT DIGITS":FL=0
460 PRINT "
          ";
470 PRINT "
          ":INPUT "{02 UP}  *{03
    LEFT}";A$
480 IF LEN(A$)<>SL THEN FL=1:GOTO 540
490 FOR I=1 TO SL
500 IF VAL(MID$(A$,I,1)) <> N(I) THEN FL=1
    :I=SL
510 NEXT I
520 REM FL=0 - CORRECT   - INCREASES SEQ L
    EN BY ONE
530 REM FL=1 - INCORRECT - DECREASES SEQ L
    EN BY ONE
540 PRINT:IF FL=1 THEN PRINT "{REV}INCORRE
    CT{OFF} - TRY A SHORTER SPAN NEXT
    ":SL=SL-1
550 IF FL=1 THEN PRINT "
                      ";
560 IF FL=1 THEN PRINT "
                      ":PRINT "{ UP}";
570 IF FL=1 THEN FOR J=1 TO SL+1:PRINT RIG
    HT$(STR$(N(J)),1);:NEXTJ:GOTO620
580 PRINT "{REV}CORRECT{OFF} -   TRY A LON
    GER SPAN NEXT ":SL=SL+1
590 IF MA<SL-1 THEN MA=SL-1
600 PRINT "
          ";
610 PRINT "
          ":PRINT "{UP}";
620 PRINT:PRINT:INPUT "AGAIN   Y{03 LEFT}"
    ;N$:IF SL<1 THEN SL=1
```

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```
630 IF SL>76 THEN SL=76
640 IF LEFT$(N$,1)="Y" THEN PRINT"{HOME}{0
    5 DOWN}";:GOTO 330
650 PRINT:PRINT "HOPE YOU IMPROVED YOUR DI
    GIT SPAN":PRINT
660 PRINT "{REV}HIGHEST CORRECT DIGIT SPAN
    {OFF}";MA;"{UP}"
```

Program 2: 40-Column PET/CBM And 64 Version

Substitute the following lines in Program 1 to run on a 40-column PET/CBM or the Commodore 64.

```
470 PRINT "
          ":INPUT "{03 UP}  *{03
    LEFT}";A$
560 IF FL=1 THEN PRINT "
                        ":PRINT "{02
     UP}";
610 PRINT "
          ":PRINT "{02 UP}";
```

Program 3: VIC Version

Substitute the following lines in Program 1 to run Memory Trainer on the VIC-20.

```
40 GOTO 100
50 POKE 36878,8:POKE 36875,225:FOR I=1 TO
    30:NEXT I:POKE 36875,0:RETURN
230 PRINT "{CLEAR}    {REV}MEMORY TRAINER"

250 INPUT "DIG RATE(SEC/DIG)  1{03 LEFT}";
    DR
270 REM DELETE THIS LINE FROM PROGRAM 1
280 INPUT "INIT SEQ LENGTH  5{03 LEFT}";SL

360 PRINT "{07 LEFT}GET SET":GOSUB 50:PRIN
    T "*":PRINT "{UP}";:FOR I=1 TO 12
    50:NEXT I:PRINT
470 PRINT "
          ":INPUT "{04 UP}  *{03
    LEFT}";A$
540 PRINT:IF FL=1 THEN PRINT "{REV}INCORRE
    CT{OFF}-TRY LESS":SL=SL-1
560 IF FL=1 THEN PRINT "
                        ":PRINT "{04
    UP}";
580 PRINT "{REV}CORRECT{OFF}-TRY MORE  ":S
    L=SL+1
610 PRINT "
          ":PRINT "{04 UP}";
640 IF LEFT$(N$,1)="Y" THEN PRINT"{HOME}{0
    4 DOWN}";:GOTO 330
650 PRINT"{CLEAR}{DOWN}":PRINT "HOPE YOU I
    MPROVED YOURDIGIT SPAN!":PRINT
```

Program 4: Atari Version

```
200 REM MAX 95 DIGITS
210 DIM N(95),A$(95),N$(3)
220 MA=0:REM MA=MAX CORRECT SPAN
230 GRAPHICS 0:PRINT "{8 SPACES}MEMO
    RY TRAINING PROGRAM":PRINT
240 PRINT "DIGIT RATE (SEC/DIG)   1
    {2 LEFT}";:INPUT DR
250 IF DR<0.5 THEN DR=0.5
260 PRINT
280 PRINT "INITIAL SEQUENCE LENGTH
    5{2 LEFT}";:INPUT SL
290 IF SL<2 THEN SL=2
300 IF SL>95 THEN SL=95
310 REM MIN DIGIT RATE .5 SEC/DIG
320 REM SEQ LEN - MIN 2:MAX 95
330 PRINT :PRINT "CURRENT DIGIT SPAN
    ";SL
340 REM FLASH GET SET AND DIGITS
350 POKE 752,1:PRINT :PRINT "GET SET
    ";:FOR I=1 TO 300:NEXT I
360 PRINT "{7 LEFT}GET SET";CHR$(253
    ):PRINT "*":PRINT "{UP}";:FOR I=
    1 TO 500:NEXT I:PRINT
370 FOR I=1 TO SL
380 N(I)=INT(RND(1)*10)
390 POKE 20,0:POKE 19,0
400 PRINT "{UP}";CHR$(N(I)+176);:FOR
     J=1 TO 100:NEXT J
410 PRINT "{LEFT}";N(I)
420 IF (PEEK(19)*256+PEEK(20))/60<DR
     THEN 420
430 NEXT I
440 PRINT "{UP}  ";
450 PRINT :PRINT "INPUT DIGITS":FL=0
460 PRINT "{96 SPACES}"
470 POKE 752,0:PRINT "{3 UP} *
    {2 LEFT}";:INPUT A$
480 IF LEN(A$)<>SL THEN FL=1:GOTO 54
    0
490 FOR I=1 TO SL
500 IF VAL(A$(I,I))<>N(I) THEN FL=1:
    I=SL
510 NEXT I
520 REM FL=0 - CORRECT - INCREASES S
    EQ LEN BY ONE
530 REM FL=1 - INCORRECT - DECREASES
     SEQ LEN BY ONE
540 PRINT :IF FL=1 THEN POSITION 2,1
    4:? "INCORRECT - TRY A SHORTER S
    PAN NEXT":SL=SL-1
550 IF FL=1 THEN PRINT "{80 SPACES}";
560 IF FL=1 THEN PRINT "{20 SPACES}":
    PRINT "{3 UP}";
570 IF FL=1 THEN FOR J=1 TO SL+1:PRI
    NT N(J);:NEXT J:GOTO 620
580 POSITION 2,14:? "CORRECT - TRY A
     LONGER SPAN NEXT{3 SPACES}":SL=
    SL+1
590 IF MA<SL-1 THEN MA=SL-1
600 PRINT "{38 SPACES}";
610 PRINT "{56 SPACES}"
620 POSITION 2,18:? "AGAIN
    {3 SPACES}Y{2 LEFT}";:INPUT N$:I
    F SL<1 THEN SL=1
630 IF SL>95 THEN SL=95
640 IF N$(1,1)="Y" THEN POSITION 2,5
    :GOTO 330
650 PRINT "{UP}HOPE YOU IMPROVED YOU
    R DIGIT SPAN!"
660 PRINT :PRINT "HIGHEST CORRECT DI
    GIT SPAN ";MA
```

Program 5: Apple Version

```
200  REM  MAX 76 DIGITS
210  DIM N(76)
220 MA = 0: REM  MA=MAX CORRECT SPAN
230  TEXT : HOME : INVERSE : PRINT "MEM
     ORY TRAINING PROGRAM": NORMAL
240  PRINT
250  INPUT "DIGIT RATE (1-10) ? ";DR
260  IF DR < 1 OR DR > 10 THEN 230
270  PRINT
280  INPUT "INITIAL SEQUENCE LENGTH ? "
     ;SL
```

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```
290  IF SL < 2 THEN SL = 2
300  IF SL > 76 THEN SL = 76
320  REM  SEQ LEN - MIN 2:MAX 76
330  PRINT : INVERSE : PRINT "CURRENT D
     IGIT SPAN";: NORMAL : PRINT " ";SL
340  REM  FLASH GET SET AND DIGITS
350  PRINT : FLASH : PRINT "GET SET";: FOR
     I = 1 TO 300: NEXT I: NORMAL : HTAB
     1: PRINT "GET SET";
360  PRINT  CHR$ (7): PRINT "*";: FOR I
      = 1 TO 1250: NEXT I
370  FOR I = 1 TO SL
380 N(I) =  INT ( RND (1) * 10)
400  HTAB 1: INVERSE : PRINT N(I);: FOR
     J = 1 TO 100: NEXT J: NORMAL
410  HTAB 1: PRINT N(I);: IF I = SL THEN
      HTAB 1: PRINT " ";
420  FOR K = 1 TO DR * 100: NEXT K
430  NEXT I
450  PRINT : PRINT : PRINT "INPUT DIGIT
     S":FL = 0
460  PRINT "
                   ";
470  PRINT "
                ": VTAB 13: PRINT "*";: HTAB
     1: INPUT "";A$
480  IF  LEN (A$) <  > SL THEN FL = 1: GOTO
     540
490  FOR I = 1 TO SL
500  IF  VAL ( MID$ (A$,I,1)) <  > N(I)
      THEN FL = 1:I = SL
510  NEXT I
520  REM  FL=0 - CORRECT - INCREASES SE
     Q LEN BY ONE
530  REM  FL=1 - INCORRECT - DECREASES
     SEQ LEN BY ONE
540  IF FL = 1 THEN  INVERSE : VTAB 15:
      PRINT "INCORRECT";: NORMAL : PRINT
     " - TRY A SHORTER SPAN NEXT ":SL =
     SL - 1
550  IF FL = 1 THEN  PRINT "
                                 ";
560  IF FL = 1 THEN  PRINT "
                             ": VTAB 1
     6
570  IF FL = 1 THEN  FOR J = 1 TO SL +
     1: PRINT  RIGHT$ ( STR$ (N(J)),1);
     : NEXT J: GOTO 620
580  VTAB 15: INVERSE : PRINT "CORRECT"
     ;: NORMAL : PRINT " - TRY A LONGER
      SPAN NEXT     ":SL = SL + 1
590  IF MA < SL - 1 THEN MA = SL - 1
600  PRINT "
                   ";
610  PRINT "
                   ": VTAB 18
620  HTAB 1: VTAB 19: INPUT "AGAIN (Y O
     R N) ? ";N$: VTAB 19: HTAB 18: PRINT
     "    ": IF SL < 1 THEN SL = 1
630  IF SL > 76 THEN SL = 76
640  IF  LEFT$ (N$,1) = "Y" THEN  VTAB
     6: GOTO 330
650  PRINT : HTAB 7: PRINT "HOPE YOU IM
     PROVED YOUR SPAN!": PRINT
660  HTAB 7: INVERSE : PRINT "HIGHEST C
     ORRECT DIGIT SPAN";: NORMAL : PRINT
     " ";MA: VTAB 23
```

Program 6: TI-99/4A Version

```
100 RANDOMIZE
110 REM MAX 90 DIGITS
120 DIM N(90)
130 MA=0
140 CALL CLEAR
150 CALL SCREEN(12)
160 FOR I=5 TO 8
170 CALL COLOR(I,14,16)
180 NEXT I
190 PRINT "{6 SPACES}MEMORY TRAINER
    "
200 FOR I=1 TO 3
210 PRINT
220 NEXT I
230 INPUT "DIGIT RATE (1-10) ? ":DR
240 IF DR<1 OR DR>10 THEN 140
250 PRINT
260 INPUT "INITIAL SEQUENCE LENGTH
    ? ":SL
270 IF SL<2 THEN SL=2
280 IF SL>90 THEN SL=90
290 PRINT
300 PRINT
310 PRINT
320 PRINT "CURRENT DIGIT SPAN "&STR
    $(SL)
330 PRINT
340 PRINT
350 IF H$<>"Y" THEN 390
360 FOR I=1 TO 6
370 PRINT
380 NEXT I
390 PRINT "get set"
400 PRINT "*"
410 FOR I=9 TO 11
420 CALL COLOR(I,10,7)
430 NEXT I
440 FOR I=1 TO 200
450 NEXT I
460 FOR I=9 TO 11
470 CALL COLOR(I,2,1)
480 NEXT I
490 CALL SOUND(150,300,10)
500 FOR I=1 TO 200
510 NEXT I
520 FOR I=1 TO SL
530 N(I)=INT(RND*10)
540 CALL HCHAR(23,3,N(I)+48)
550 FOR J=1 TO DR*20
560 NEXT J
570 CALL HCHAR(23,3,32)
580 FOR K=1 TO 10
590 NEXT K
600 NEXT I
610 CALL HCHAR(23,3,32)
620 FL=0
630 PRINT
640 PRINT
650 IF H$<>"Y" THEN 690
660 FOR I=1 TO 4
670 PRINT
680 NEXT I
690 PRINT "INPUT DIGITS"
700 INPUT "*":A$
710 PRINT
720 PRINT
730 FOR I=1 TO 200
740 NEXT I
750 IF LEN(A$)=SL THEN 780
760 FL=1
770 GOTO 850
780 FOR I=1 TO SL
790 IF VAL(SEG$(A$,I,1))=N(I)THEN 8
    20
800 I=SL
810 FL=1
```

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```
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830 REM FL=0 -CORRECT- INCREASE SEQ
     LEN BY ONE
840 REM FL=1 -INCORRECT-
850 CALL CLEAR
860 IF FL=0 THEN 980
870 PRINT "INCORRECT-TRY A SHORTER
    SPAN"
880 PRINT
890 SL=SL-1
900 PRINT "YOUR RESPONSE=";A$
910 H$=""
920 FOR I=1 TO SL+1
930 H$=H$&STR$(N(I))
940 NEXT I
950 PRINT
960 PRINT "ACTUAL SEQUENCE=";H$
970 GOTO 1020
980 PRINT " CORRECT-TRY A LONGER SP
    AN"
990 SL=SL+1
1000 IF MA>=SL-1 THEN 1020
1010 MA=SL-1
1020 FOR I=1 TO 10
1030 PRINT
1040 NEXT I
1050 PRINT "{6 SPACES}AGAIN (Y OR N
     ) ? "
1060 CALL KEY(0,F,STATUS)
1070 IF STATUS=0 THEN 1060
1080 H$=CHR$(F)
1090 CALL CLEAR
1100 IF H$="N" THEN 1120
1110 GOTO 320
1120 PRINT "HOPE YOU IMPROVED YOUR
     SPAN!"
1130 FOR I=1 TO 10
1140 PRINT
1150 NEXT I
1160 FOR I=3 TO 4
1170 CALL COLOR(I,13,12)
1180 NEXT I
1190 PRINT "-HIGHEST CORRECT DIGIT
     SPAN-"
1200 PRINT
1210 PRINT
1220 PRINT "{11 SPACES}(";MA;")"
1230 FOR I=1 TO 500
1240 NEXT I
1250 END
```

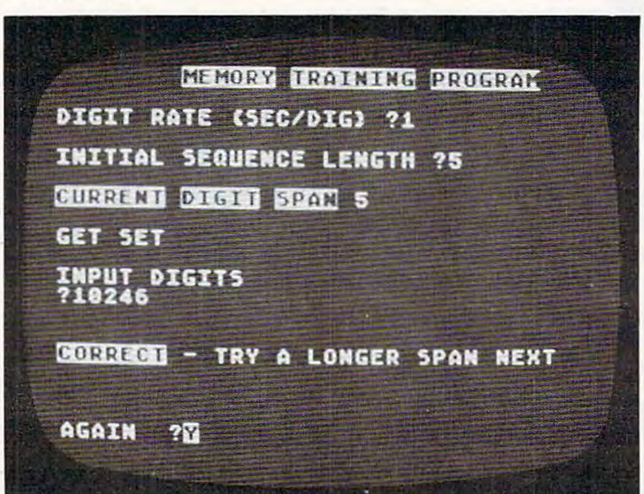

"Memory Trainer," Atari version. (Other versions similar.)

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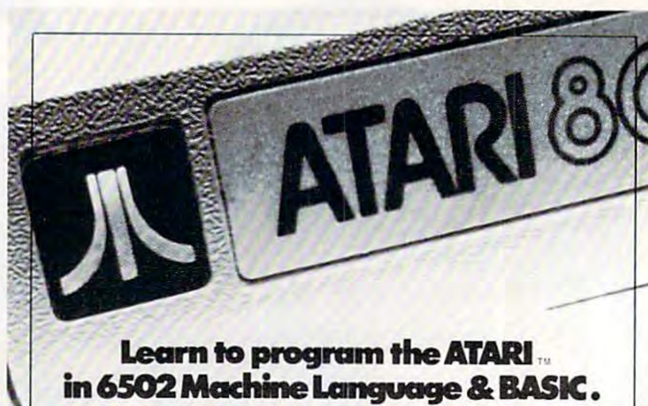
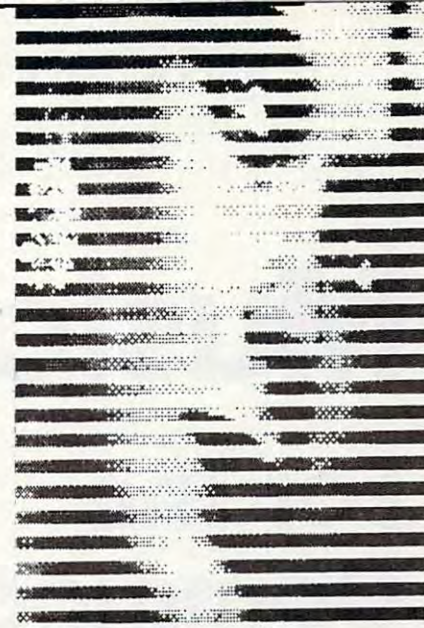


Will This Happen to You?



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MusicMaster

For The Commodore 64

Chris Metcalf and Marc Sugiyama

This excellent program simulates a realtime, full-function, synthesizer control panel for Commodore 64 sound and music. Your keyboard becomes the connection between you and the sounds you hear. The screen displays a double piano keyboard and the status of the other elements of the sounds you are creating.

MusicMaster's functions include: slide, one-key access to all the primary chords, timbre, envelope, duration, octave, maintain, polyphony, waveform, and others. All available immediately and automatically from the keyboard.

The power and versatility of the 64's "music synthesizer on a chip" offer the programmer-musician extraordinary control over sound: its shape, color, even interactions between sounds (modulation). There is much freedom, but this also means that there are many aspects of each sound for the programmer to control. MusicMaster automates this control: for example, you can play chords as easily as single notes. Above all, you'll learn the meaning of the various sound registers – because you'll hear the effect as you change the registers. Now you can begin to fully explore the amazing sounds of the 64.

Enter the MusicMaster program into your Commodore 64 as you would enter any other BASIC program. MusicMaster includes two short machine language subroutines in DATA statements, so be certain that all those numbers are entered correctly. After you have entered and saved the program, run it. Be sure that the volume of your television or audio output device is turned up enough so that you can hear the computer.

Shortly before the message "PLEASE STAND BY" has left the screen, the computer will display the instructions. Across the top of the screen, you will find a row of indicators. The first item on this row is the OCTAVE, which has a range from one to eight. This is followed by the VOICE number, which indicates the particular *timbre* of your output. After this is a series of letters which indicate the current mode of operation. These modes will be described below. The last indicator is the VOLUME, with a range of 0 to 15.

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Under the indicator line are the two musical keyboards. They indicate where on the computer's keyboard the musical keyboards can be found.

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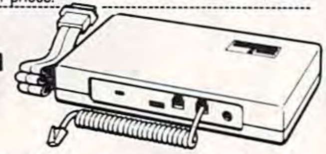

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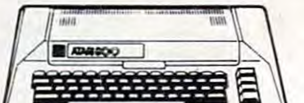

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NEW Version with TURTLE GRAPHICS

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standard size screens (16 lines by 64 characters).
150 screens per diskette on 4040, 480 screens on 8050.
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For writing text, Page-Mate has a definable keyboard for operator flexibility. Shift lock on letters only, or use keyboard shift lock. All keys repeat.

Page-Mate text editing includes floating cursor, scroll up or down, page forward or back, and repeating insert and delete keys. Text block handling includes transfer, delete, append, save, load, and insert.

All formatting commands are imbedded in text for complete control. Commands include margin control and release, column adjust, 9 tab settings, variable line spacing, justify text, center text, and auto print form letter (variable block). Files can be linked so that one command prints an entire manuscript. Auto page, page headers, page numbers, pause at end of page, and hyphenation pauses are included.

Unlike most word processors, CBM graphics as well as text can be used. Page-Mate can send any ASCII code over any secondary address to any printer.

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The lower keyboard is a continuation of the upper keyboard; thus the lower set of keys plays the higher notes.

Below the keyboards is a description of the functions assigned to the programmable function keys. The left column describes the unshifted function keys, and the right column describes the shifted function keys.

F1 and **F3**: These keys allow you to change the volume of the music. Pressing F1 will increase the volume one step, and pressing F3 will decrease the volume one step. Notice how the VOLUME indicator changes as you press either one of these keys. Remember that the volume ranges from 0 to 15; 0 is completely silent, and 15 is the maximum volume.

F4: Pressing F4 will change the status of the Maintain mode, indicated by the "M" in the indicator row. When this mode is in operation, the "M" will be in reverse field. When this mode is activated, the computer does not release the tones after the keys have been pressed. Instead, the tones continue until other keys are pressed. To silence all the voices, press the space bar.

F6: This key changes the status of the Multivoice mode. This mode is indicated by the "V" in the indicator row. A reverse field "V" indicates that the mode is in operation. The Multivoice mode enables more than one voice to be played at the same time. The program "powers on" with this mode activated. If this mode is not activated, then one tone follows the next on the same voice, and chords cannot be played. This has some disadvantages, but it is useful in conjunction with the Slide mode. With this mode, you can have up to three simultaneous voices.

F7 and **F5**: Pressing these keys changes the status of the Slide and Chord modes. They will be described below.

F2: This key allows you to define your own waveforms.

Making Music

Once the program is ready, press the following key sequence: QWERTYUI. You should hear a C major scale. If you do not, check the program for typing errors. Now try this key sequence: IOP@*(up arrow)(RUN/STOP)Z. This time you should hear the same scale, but one octave higher.

Pressing the sequence ZXCVBNM, produces another scale one octave higher than the last. Now try pressing the keys QET all at once to get a C-major chord. Each note of this chord is assigned one voice. Since there are only three voices, the computer can accept only three keys at one time as input.

If you want to change octaves, press the control key and a number from one to eight, one being the lowest octave and eight the highest. Some of the voices do not work well in very low octaves. Pressing the Commodore key and a number will change the VOICE number. This, too, has a range of one to eight.

The Slide mode is very interesting. A reverse-field "S" on the status row indicates that the Slide mode is active. The Slide mode will work regardless of the Multivoice and Maintain modes. When in this mode, the computer steps smoothly through the tones rather than moving by half tones as a piano would. This can produce an intriguing, eerie effect with the Maintain mode activated. For example, enter the Slide mode, make sure that the Maintain and Multivoice modes are activated, and press the following key sequence: QETIP*ZCB, . As always, you can silence the voices by pressing the space bar.

Forming Chords

Another mode of operation is the Chord mode. This allows for *single key* control over different types of chords and their inversions. Once you activate the Chord mode, a second indicator row appears. On the left is the chord name, and on the right is the chord position – root, first inversion, or second inversion.

The root chord is a chord in which the lowest note is also the key of the chord. For example, the C major triad is formed using the notes C, E, and G. When the notes are in that order, CEG, the chord is a root chord. If the notes of the chord start on a different note than C, then we have the inversions of the chord. For example, E and G, with high C, is the first inversion, and G, with high C and E, is the second inversion.

To change the chord type, press the shift-key and a number from one to nine. The chords which are available correspond to the following numbers: (1) Major; (2) Minor; (3) Diminished; (4) Augmented; (5) Major Seventh; (6) Minor Seventh; (7) Dominant Seventh; (8) Major Sixth; (9) Minor Sixth.

The inversions are selected by pressing the shift key and the plus sign for root, the minus sign for the first inversion, and the pound sign for the second inversion.

In order to play a chord, you must first select the chord type and inversion that you want, and then press the note on the keyboard which corresponds to the lowest note of your chord. For example, if you want to play a D flat minor second inversion chord, enter the Chord mode, select the minor chord and the second inversion (by pressing shift-2 and shift-pound-sign) and press "R", which corresponds to the note F on the musical keyboard. The chord that you will hear is comprised of the following notes: F, B flat, and high D flat. (Since the Slide mode can slide only one

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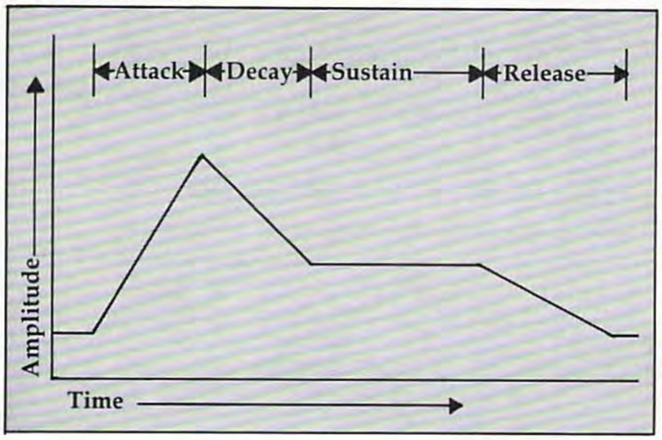
voice at a time, the Chord and Slide modes are incompatible, so turning on one automatically turns off the other.)

Attack, Decay, Sustain, Release

To define your own waveform, press F2. Once you are in this mode, the computer asks a series of questions that apply to the construction of a new waveform. The first question is which waveform you wish to change. Pressing RETURN with no other input returns program control to the play mode. After this question, the computer displays the current Attack, Decay, Sustain, and Release values, and asks for new values. Pressing RETURN with no other input or giving a bad input returns you to the first question.

The Envelope



The attack rate is the time that it takes the sound to reach its highest volume level. The larger the number, the more time it takes. Decay is the time it takes the sound to drop to the Sustain volume level. Sustain is the volume level at which the sound remains until the Release is initiated. The Release rate is the time that it takes the sound to soften from the sustain level to silence (see the figure).

After these questions, the computer asks for the waveform type. You must enter the first letter of the type of waveform desired. If the Pulse waveform is selected, then the pulse rate must be entered. The authors of the Commodore 64 manual have written the pulse value as two numbers, the LOW pulse and the HIGH pulse. To obtain a single value for the pulse rate, take the HIGH pulse times 256 and add it to the LOW pulse. Once these questions have been answered, the computer returns to the playing mode with the voice set to the one you have just modified.

Program Structure

The mechanics are fairly simple since most of the program is written in BASIC. The REMs identify the major sections of the program (see the table for a description of variables). However, some programming tricks are used. The POKE214,X command moves the cursor to line X on the screen. But a PRINT with no statement must follow this POKE or the cursor will not move to its new location. A POKE 788,53 disables the RUN/STOP key,

Variables

A	miscellaneous
A$	miscellaneous
AD	attack/decay for define waveform routine
AD()	table of attack/decay values
BF	constant pointer to buffer (198)
C$()	table of chord names
C()	table of chord note offsets
C1	chord number
C2	chord inversion
CH	chord mode flag
ER	INPUT routine error flag
ET	constant pointer for multikey input routine
FF	constant 255
FH()	table of high bytes of frequencies
FL()	table of low bytes of frequencies
HB	256 constant
I	miscellaneous
IK	constant for "inkey" or keyboard matrix value
IN	value for input from INPUT routine
IN$	input string from INPUT routine
J	miscellaneous
K()	conversion table for ASCII values
LL	polyphonic flag
LN$	constant line
MN	multivoice flag
NH	constant high byte location 901
NL	constant low byte location 900
NM$()	"root," "first," or "second" (for chord inversion display
OC	number of half steps offset (octave)
P	maintain mode flag
PH()	table of pulse high bytes
PL()	table of pulse low bytes
PU	pulse rate for define waveform routine
R	frequency number and miscellaneous
RA	slide mode register start pointer
RB	slide mode register end pointer
S	constant 54272
S1	constant 49152 (for multikey GET routine)
S2	constant 49403 (for music loader routine)
SL	slide mode flag
SP$	constant 39 spaces (for blanking)
SR	sustain/release value for define waveform routine
SR()	table of sustain/release values
T	current base address of SID
T()	table of last used base locations
V	computer voice number
VL	volume
VN	constant voice number location for music loader (251)
WF	waveform holder for define waveform routine
WV	current waveform
WV()	table of waveform values

All variables beginning with "Z" are low numeric constants.

but this can be annoying when listing programs. To re-enable the RUN/STOP key, POKE 788,49. WAIT is also employed when waiting for input (WAIT 198,255).

The SYSS1 (to 49152) is a full keyboard scan routine for the Commodore 64. This routine is very useful because it allows the user to enter more than one key at a time.

The machine language routine returns the ASCII values of the keys being pressed to addresses 830, 831, and 832. (Due to a hardware problem involving the way the keyboard is wired, certain combinations of keys yield incorrect values.) The number of keys being pressed is stored in location 829. This routine could be used by games in which a multiple input is required. It could also be adapted to work on other Commodore computers, such as the VIC-20 and the PET/CBM series.

A second machine language subroutine simply loads the values from 900-906 into the appropriate voice in the sound chip. Select the increment for voices 0, 1, and 2 (0, 7, or 14), POKE 251 with this value, then SYS(49408). The subroutine does not start the note, but leaves it to BASIC, via a POKE to the sound chip (SID), for the corresponding voice.

If you find any problems in this program, or can offer any improvements or comments, please write to either of us at the addresses listed below. If you do not want to enter the program yourself, please send a standard (1541) floppy disk or a cassette tape, a self-addressed stamped mailer and $3 to either of the addresses listed below.

Chris Metcalf
123 Ardmore Rd.
Kennsington, CA 94707

Marc Sugiyama
5969 Chabolyn Terr.
Oakland, CA 94618

Note: This program contains a number of characters which are not currently part of the listing conventions. To obtain any of the characters in the left column, type the keys indicated in the right column. ("Logo" indicates the Commodore logo key at the lower left of the keyboard.) For any underlined characters in the listing, see the table in "How To Type **COMPUTE!**'s Programs."

{ORG}	LOGO & 1	{LTG}	LOGO & 6
{BRN}	LOGO & 2	{LTB}	LOGO & 7
{LTR}	LOGO & 3	{GY3}	LOGO & 8
{GY1}	LOGO & 4	{C}	CTRL & C
{GY2}	LOGO & 5	{X}	CTRL & X

MusicMaster

```
200 GOTO46Ø
21Ø :
22Ø :
23Ø REM SLIDE SUBROUTINE
24Ø IFRA<ØTHENRA=R
25Ø RB=R:T=S+V*Z7:POKEVN,V*Z7:POKENL,FL(RA
    ):POKENH,FH(RA):SYSS2:POKET+Z4,WV
    +Z1
26Ø FORI=RATORBSTEPSGN(RB-RA)/2:POKET,FL(I
    ):POKET+1,FH(I):NEXT
27Ø IFPEEK(IK)=JANDPEEK(IK)-64THEN27Ø
28Ø RA=RB:POKET+Z4,WV+P:V=V+MN*(Z1+Z3*(V=Z
    2)):RETURN
29Ø :
3ØØ REM CHORD SUBROUTINE
31Ø POKEBF,ZØ:FORI=ZØTOZ2:A=R+C(C1,C2,I):P
    OKEVN,I*Z7:POKENL,FL(A)
32Ø POKENH,FH(A):SYSS2:NEXT:POKES+Z4,WV+Z1
    :POKES+11,WV+Z1:POKES+18,WV+Z1
33Ø IFPEEK(IK)=JANDPEEK(IK)-64THEN33Ø
34Ø POKES+Z4,WV+P:POKES+11,WV+P:POKES+18,W
    V+P:RETURN
35Ø :
36Ø REM POLYPHONIC SUBROUTINE
37Ø A=PEEK(IK):SYSS1:J=PEEK(ET):IFJ=ZØORA=
    ZSTHENRETURN
38Ø FORI=Z1TOJ:R=K(PEEK(ET+I))+OC:IFR=OCTH
    ENNEXT:RETURN
39Ø T(I)=V*Z7:POKEVN,T(I):POKENL,FL(R):POK
    ENH,FH(R):SYSS2
4ØØ IFMNTHENV=V+Z1:IFV=Z3THENV=ZØ
41Ø NEXT:FORI=Z1TOJ:POKES+T(I)+Z4,WV+Z1:NE
    XT
42Ø SYSS1:IFJ=PEEK(ET)ANDA=PEEK(IK)THEN42Ø
43Ø FORI=Z1TOJ:POKES+T(I)+Z4,WV+P:NEXT:GOT
    O37Ø
44Ø :
45Ø :
46Ø REM INITIALIZE VARIABLES
47Ø PRINT"{CLEAR}"CHR$(142);CHR$(8);:POKE5
    328Ø,Ø:POKE53281,Ø:POKE788,52:REM
     IGNORE RUN/STOP
48Ø FORI=1TO39:SP$=SP$+" ":LN$=LN$+"#":NEX
    T
49Ø PRINT"{WHT}OCTAVE=5  VOICE=1 :C:S:M:{
    REV}V{OFF}:{REV}P{OFF}: VOLUME=1Ø
    {RIGHT}"LN$
5ØØ POKE214,23:PRINT:PRINTTAB(15)"MUSICMAS
    TER{HOME}{Ø2 DOWN}
51Ø A$="PLEASE STAND BY{WHT}":POKE214,21:P
    RINT:PRINTTAB(13)"{GRN}"A$:S=5427
    2:GOSUB158Ø
52Ø DIMFL(134),FH(134),K(255),C(8,2,2):OC=
    48:VL=1Ø:MN=1:LL=1:RA=-1
53Ø Z1=1:Z2=2:Z3=3:Z4=4:Z7=7:ZS=64:FF=255:
    HB=256
54Ø IK=197:BF=198:VN=251:NL=9ØØ:NH=9Ø1:ET=
    829:S1=49152:S2=494Ø8:FORI=Z1TO41
55Ø K(ASC(MID$("Q2W3ER5T6Y7UI9OØP@-*£↑{
    HOME}{C}ZSXDCVGBHNJM,L.:/",I)))=I:NEXT
56Ø PRINTTAB(13)"{CYN}{UP}"A$:R=5.8:A=1Ø78
    7.4138:J=Z2↑(-Z1/12)
57Ø FORI=94TOØSTEP-1:FH(I)=INT(A*R/HB):FL(
    I)=A*R-HB*FH(I):A=A*J:NEXT
58Ø PRINTTAB(13)"{UP}"A$:GOSUB131Ø
59Ø :
6ØØ REM READ ALL DATA
61Ø FORI=ZØTO8:FORJ=ZØTOZ2:READC(I,J,Ø),C(
    I,J,1),C(I,J,2):NEXT:READC$(I):NEXT
62Ø READNM$(Ø),NM$(1),NM$(2):FORI=1TO8:REA
```

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```
    DAD(I),SR(I),WV(I),PL(I),PH(I):NEXT
630 FORR=1TO2:READI,J:FORA=ITOJ:READIN:POK
    EA,IN:NEXT:NEXT
640 PRINTTAB(9)"{DOWN}(USE CONTROL-X TO EX
    IT)":I=1:GOSUB860
650 :
660 :
670 REM NUCLEUS
680 WAITBF,FF:J=PEEK(IK):GETA$:R=K(ASC(A$)
    )+OC:IFR=OCTHENGOSUB800:GOTO680
690 IFSLTHENGOSUB240:GOTO680
700 IFCHTHENGOSUB310:GOTO680
710 IFLLTHENGOSUB370:GOTO680
720 T=S+V*Z7:POKEVN,V*Z7:POKENL,FL(R):POKE
    NH,FH(R):SYSS2:POKET+Z4,WV+Z1
730 IFMNTHENV=V+Z1:IFV=Z3THENV=Z0
740 IFPEEK(IK)=JANDPEEK(IK)-64THEN740
750 POKET+Z4,WV+P:WAITBF,FF:GETA$:J=PEEK(I
    K):R=K(ASC(A$))+OC:IFR-OCTHEN720
760 GOSUB800:GOTO680
770 :
780 :
790 REM PARAMETER FUNCTIONS
800 IFCH=0THEN830
810 FORI=0TO2:IFA$=MID$("[])",I+1,1)THENC2
    =I:PRINT"{HOME}{DOWN}"TAB(23)NM$(
    I):RETURN
820 NEXT:A=ASC(A$):IFA>32ANDA<42THENC1=A-3
    3:PRINT"{HOME}{DOWN}"TAB(11)C$(C1
    ):RETURN
830 FORI=1TO8:IFA$<>MID$("{BLK}{WHT}{RED}{
    CYN}{PUR}{GRN}{BLU}{YEL}",I,1)THE
    NNEXT:GOTO850
840 OC=12*(I-Z1):PRINT"{HOME}"TAB(7)MID$(S
    TR$(I),2):RETURN
850 FORI=1TO8:IFA$<>MID$("{ORG}{BRN}{LTR}{
    GY1}{GY2}{LTG}{LTB}{GY3}",I,1)THEN
    NEXT:GOTO880
860 POKE902,PL(I):POKE903,PH(I):WV=WV(I):P
    OKE904,WV:POKE905,AD(I):POKE906,S
    R(I)
870 PRINT"{HOME}"TAB(16)MID$(STR$(I),2):RE
    TURN
880 IFA$<>"{F1}"ANDA$<>"{F3}"THEN930
890 VL=VL-(VL<15ANDA$="{F1}")+(VL>0ANDA$="
    {F3}"):POKES+24,VL
900 PRINT"{HOME}"TAB(37)RIGHT$("0"+MID$(ST
    R$(VL),2),2):RETURN
910 :
920 REM STYLE FUNCTIONS
930 IFA$="{F4}"THENP=1-P:POKE1047,13+128*P
    :GOTO1580
940 IFA$="{F6}"THENMN=1-MN:POKE1049,22+128
    *MN:GOTO1580
950 IFA$="{F8}"THENLL=1-LL:POKE1051,16+128
    *LL:RETURN
960 IFA$="{F7}"THENSL=1-SL:RA=-1:POKE1045,
    19+128*SL:CH=1:GOTO990
970 IFA$<>"{F5}"THEN1010
980 POKE1045,19:SL=0
990 CH=1-CH:POKE1043,3+128*CH:IFCH=0THENPR
    INT"{HOME}{DOWN}"LN$:PRINTSP$:RET
    URN
1000 PRINT"{HOME}{DOWN}"SP$"{RIGHT}{UP}CHOR
     D TYPE:"C$(C1)TAB(23)NM$(C2)" INV
     ERSION{RIGHT}"LN$:RETURN
1010 IFA$=" "THENGOSUB1580:RA=-1:POKEBF,Z0:
     RETURN
1020 IFA$="{X}"THENGOSUB1580:PRINT"{CLEAR}"
     ;:POKE788,49:END
1030 IFA$<>"{F2}"THENRETURN
1040 :
1050 :
1060 REM DISPLAY WAVEFORM PARAMETERS
1070 GOSUB1470:POKE214,13:PRINT
1080 PRINT"VOICE TO BE DEFINED (1-8)";:J=1:
     GOSUB1500
1090 IFIN<1ORIN>8THENGOSUB1470:GOTO1400
1100 I=IN:PRINTTAB(31)"ATT:"MID$(STR$(INT(A
     D(I)/16)),2)
1110 PRINTTAB(31)"DEC:"MID$(STR$(AD(I)AND15
     ),2)
1120 PRINTTAB(31)"SUS:"MID$(STR$(INT(SR(I)/
     16)),2)
1130 PRINTTAB(31)"REL:"MID$(STR$(SR(I)AND15
     ),2)
1140 PRINTTAB(31)"WVF:{CYN}"MID$("SAWTRIPUL
     NSE",3*LOG(WV(I))/LOG(2)-11,3)"{WHT}
1150 IFWV(I)=64THENPRINTTAB(31)"PLS:"MID$(S
     TR$(PH(I)*HB+PL(I)),2)
1160 :
1170 REM DEFINE A NEW WAVEFORM
1180 POKE214,14:PRINT:PRINT"ATTACK RATE (0-
     15)";:J=2:GOSUB1500:IFERTHEN1070
1190 AD=IN:PRINT"DECAY RATE (0-15)";:GOSUB1
     500:IFERTHEN1070
1200 AD=AD*16ORIN:PRINT"SUSTAIN LEVEL (0-15
     )";:GOSUB1500:IFERTHEN1070
1210 SR=IN:PRINT"RELEASE RATE (0-15)";:GOSU
     B1500:IFERTHEN1070
1220 SR=SR*16ORIN:PRINT"{CYN}S{WHT}AW {CYN}
     T{WHT}RIANGLE {CYN}P{WHT}ULSE {
     CYN}N{WHT}OISE";:J=1:GOSUB1500
1230 FORJ=1TO4:IFIN$<>MID$("STPN",J,1)THENN
     EXT:GOTO1070
1240 WF=2↑(J+3):IFWF<>64THEN1260
1250 PRINT"PULSE RATE (0-4095)";:J=4:GOSUB1
     500:PU=IN:IFIN<0ORIN>4095THEN1070
1260 WV(I)=WF:PL(I)=PU-HB*INT(PU/HB):PH(I)=
     INT(PU/HB):AD(I)=AD:SR(I)=SR
1270 GOSUB1470:GOSUB1410:GOTO860
1280 :
1290 :
1300 REM DISPLAY KEYBOARDS
1310 POKES+24,VL:PRINT"{HOME}{03 DOWN}"TAB(
     9)"'{REV} {RIGHT} {RIGHT} ] {
     RIGHT} {RIGHT} {RIGHT} ] {RIGHT} ~
     {RIGHT} ] {RIGHT} {RIGHT} {RIGHT}
      "
1320 PRINT"  LOW     '{REV} {OFF}2{REV} {
     OFF}3{REV} ] {OFF}5{REV} {OFF}6{
     REV} {OFF}7{REV} ] {OFF}9{REV} {
     OFF}0{REV} ] {OFF}-{REV} {OFF}£{
     REV} S "
1330 PRINT"KEYBOARD '{REV} ] ] ] ] ] ] ] ]
     ] ] ] ] ] "
1340 PRINTTAB(9)"'{REV}Q]W]E]R]T]Y]U]I]O]P]
     @]*]↑] "
1350 PRINTTAB(13)"{DOWN}*{REV} {RIGHT} {
     RIGHT} ] {RIGHT} {RIGHT} {RIGHT} ~
     ] {RIGHT} {RIGHT} {OFF}4"
1360 PRINT"  HIGH        *{REV} {OFF}S{REV}
     {OFF}D{REV} ] {OFF}G{REV} {OFF}H{
     REV} {OFF}J{REV} ] {OFF}L{REV} {
     OFF}:{REV} {OFF}4"
1370 PRINT"KEYBOARD      '{REV} ] ] ] ] ] ]
     ] ] ] {OFF}4"
1380 PRINTTAB(13)"*{REV}Z]X]C]V]B]N]M],].]/
     {OFF}4"
1390 :
1400 REM DISPLAY FUNCTION MENU
1410 POKE214,13:PRINT:PRINT"F1 -- LOUDER
       F2 -- DEFINE WAVEFORM
1420 PRINT"{DOWN}F3 -- SOFTER      F4 -- {
```

```
    CYN}MAINTAIN{WHT}
1430 PRINT"{DOWN}F5 -- {CYN}CHORDS{WHT}
     F6 -- {CYN}MULTIVOICE{WHT}
1440 PRINT"{DOWN}F7 -- {CYN}SLIDES{WHT}
     F8 -- {CYN}POLYPHONIC{WHT}":RETURN
1450 :
1460 REM CLEAR DISPLAY AREA
1470 POKE214,12:PRINT:FORJ=1TO11:PRINTSP$:N
    EXT:RETURN
1480 :
1490 REM INPUT SUBROUTINE
1500 IN$="":PRINT"? ";
1510 PRINT"{REV} {OFF}{LEFT}";:WAITBF,FF:
    GETA$:IFA$="{X}"THEN1020
1520 A=ASC(A$):IFA=13THENPRINT" ":IN=VAL(IN
    $):ER=(IN<ØORIN>15)ORIN$="":RETURN
1530 IFA=20ANDLEN(IN$)THENPRINT" {02 LEFT}
    {LEFT}";:IN$=LEFT$(IN$,LEN(IN$)-1)
1540 IF(AAND127)<35ORLEN(IN$)=JTHEN1510
1550 PRINTA$;:IN$=IN$+A$:GOTO1510
1560 :
1570 REM CLEAR MUSIC CHIP
1580 FORI=4TO18STEP7:POKES+I,Ø:NEXT:FORI=ØT
    O23:POKES+I,Ø:NEXT:RETURN
1590 :
1600 :
1610 REM CHORD DATA
1620 DATA,4,7,,3,8,,5,9,"MAJOR      ",,3,7,,
    4,9,,5,8,"MINOR      "
1630 DATA,3,6,,3,9,,6,9,"DIMINISHED",,4,8,,
    4,8,,4,8,"AUGMENTED "
1640 DATA,4,11,,4,11,,4,11,"MAJOR 7TH ",,3,
    10,,3,10,,3,10,"MINOR 7TH "
1650 DATA,4,10,,4,10,,4,10,"DOMIN 7TH",4,7,
    9,4,7,9,4,7,9,"MAJOR 6TH "
1660 DATA3,7,9,3,7,9,3,7,9,"MINOR 6TH","   R
    OOT"," FIRST",SECOND
1670 :
1680 REM WAVEFORM PARAMETER DATA
1690 DATA,249,16,,,,249,32,,,,249,64,160,15
    ,,249,128,,,,240,16,,,204,204,16,,
1700 DATA,252,64,200,,192,240,32,,
1710 :
1720 REM MULTI-INPUT ASSEMBLY CODE
1730 DATA49152,49294,120,169,,141,61,3,170,
    169,254,133,252,165,252,141,,220,173
1740 DATA1,220,157,143,192,232,56,38,252,17
    6,239,162,,160,,189,143,192,42,176
1750 DATA29,72,132,253,138,10,10,10,5,253,1
    68,185,79,192,238,61,3,172,61,3,153
1760 DATA61,3,104,192,3,240,12,164,253,200,
    192,8,208,219,232,224,8,208,209,88
1770 DATA96,17,135,134,133,136,29,13,20,0,6
    9,83,90,52,65,87,51,88,84,70,67,54
1780 DATA68,82,53,86,85,72,66,56,71,89,55,7
    8,79,75,77,48,74,73,57,44,64,58,46
1790 DATA45,76,80,43,47,94,61,1,19,59,42,92
    ,3,81,2,32,50,4,95,49
1800 :
1810 REM MUSICLOADER ASSEMBLY CODE
1820 DATA49408,49454,169,212,133,252,169,,1
    60,6,145,251,136,145,251,170,169,8
1830 DATA136,145,251,138,145,251,136,192,1,
    208,249,188,41,193,185,132,3,145,
    251
1840 DATA232,224,6,208,243,96,2,3,,1,6,5
```

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REVIEWS

Commodore 64 Programmer's Reference Guide

Anu M. Gupta

This book is Commodore's answer to the many questions of Commodore 64 owners. The manual included with the 64 can get you started, but the serious programmer will probably find much in this book of great value.

Thorough Coverage

The 486-page guide is thorough in its documentation of the 64's features. It begins by covering the rules governing programming in BASIC. There are examples showing how to set up expressions and the hierarchy of mathematical operations. A section on programming techniques shows the main ways to input information into the computer, and methods for conserving memory.

The second chapter is a BASIC "dictionary," with complete information and examples of what each command does. It's an excellent reference when encountering new commands. The short tutorial on using the keyboard and screen editor should put newcomers to the 64 at ease.

The next chapter is an in-depth discussion on using the screen graphics of the 64. The material includes the vital memory locations for video display, display modes, programmable characters, bit-mapping, smooth scrolling, and sprites. The guide devotes more than 50 pages of the graphics chapter to programming sprites and contains sample programs with explanations. This section alone may be worth the price of the book.

The chapter on sound also combines sample programs with explanatory text to show how the programmer can make use of the 64's sound capabilities. It deals with volume, multiple voices, waveforms, envelopes, filtering, and modulation to help you create the sounds you are after.

Machine language. These two words cause some BASIC programmers to pause and catch their breath. Chapter 5 uses a relatively simple vocabulary to introduce some aspects of machine language programming. It covers several topics, including the kernal, instruction sets, and addressing modes, to name a few. A complete memory map of the 64 is featured at the end of this chapter.

An input/output guide constitutes the last chapter, with information on output to such devices as modems and printers. It also illustrates how to make full use of the RS-232 interface, user port, serial bus, and expansion port. There is also a section on using paddles, joysticks, and light pens.

100 Pages of Reference Tables

Following the last chapter are more than 100 pages of reference tables, including BASIC abbreviations, screen display codes, ASCII codes, note values for music, pinouts of all the major chips, error messages, chip specifications, and a quick reference card. The last page is perhaps the biggest surprise of all, a full fold-out schematic diagram of the 64 for hardware enthusiasts.

Commodore has done a solid job with this book. It provides 64 users with important assistance in increasing their understanding of their computer. While the book makes no attempt to teach programming as such, it is a fine reference book.

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The Printographer Graphics Printer Package For The Apple

Richard Cornelius

The Printographer, by Stephen Billard, is a utility program which processes high-resolution images on the Apple II computer and sends them to a printer. You can perform cropping operations on the high-resolution screen and determine the format in which the image will appear on the printer. The package comes with one disk including instructions on how to make backup copies and a 27-page manual.

Operates With Any Printer

The first question that many people will ask about *The Printographer* is, "Will it work with my printer?" The answer is yes, indeed, if your printer has any graphics capability. A powerful feature of the program is the ease with which it can be configured to operate with just about any combination of printer and interface.

If you have one of more than a dozen common printers, you do not need to know any technical details of its operation. From a menu, you can identify your printer and, if applicable, the particular interface card that you have. This menu automatically appears the first time you boot the disk. The printer specifications that you select are then saved to the disk so that on subsequent runs you are moved directly into the main program without having to identify your particular printer again.

The manual explains how to rerun the printer-selection program should you wish to run *The Printographer* with a different printer. If your printer is not one of those on the menu, then you explain how your printer processes information, but the program on the disk still does most of the work.

The Printographer performs its various cropping operations on the high-resolution screen quickly and smoothly. Pictures can be cropped from the top, bottom, or either side, or in a diamond or oval shape within the boundaries you specify. Starting over again is accomplished by a single keystroke, and the mechanics of operating the program are easy to understand.

However, I did encounter a problem. The cropping instructions are given on the text page and include, logically enough, the use of the question mark to return the instructions to the screen. The first time through the instructions, I paid little attention to them except to remember the use of the question mark.

Unfortunately, once I was on the high-resolution page for cropping, the question mark generated only a beep from the computer; I saw no instructions. Eventually I found that a CTRL-C would send the program to a point from which I could return to the instructions, but the first time through I had to reboot the disk just to see the instructions again.

Easy To Use

Most of the program is very easy to use. The general format employs the ESC key to move a highlighting identifier through the menu and the RETURN key to actually select the item that is highlighted. I was impressed with how easy it was to select a high-resolution picture from among a mixture of Applesoft, text, and binary files on one of my own disks. *The Printographer* gave me a menu of only the high-resolution images on my disk. It even ignored other binary files that were not high-resolution pictures.

The printing routines seem to work exactly as specified. Pictures can be printed in normal or inverse mode, vertically or horizontally on the page, magnified up to nine times, and tabbed over on the page. Routines for doing this printing from your own programs are available (not copy-protected) on the disk with instructions in the documentation on how to use them. Images can also be saved on a disk in one of three forms: a regular binary file, a compressed version that saves space, or a printer image. If you have the right printer setup, this last form allows printer spooling so that the computer is not tied up while the graphics are being printed.

The documentation is clear and complete. It is not packaged in a fancy (and expensive) padded binder, but it contains all of the information that I would want to know about the software. The primary part of the documentation is written so that no technical knowledge of the Apple or printers is required. The appendices, however, contain technical details such as writing your own printer driver and memory management so you can use some of the *Printographer* routines within your own programs.

The backup procedure seems to work well. Parts of the disk are copy-protected. The disk, however, comes with its own copying program which, according to the documentation, will make a total of three backup copies of the disk. This copy program uses a single drive, supposedly for assuring maximum reliability during the copying process. The copy program works essentially like *COPYA* on the Apple System

Master Disk.

All in all, *The Printographer* is a useful utility which is relatively easy to use. It comes with complete documentation. The program is not without faults, but technical support is easy to obtain. The price seems in line with the capabilities of the program. Its strongest feature is the manner in which it can easily be configured to work with whichever graphics printer you might happen to have.

The Printographer
Southwestern Data Systems
10761-E Woodside Avenue
Santee, CA 92071
$49.95 ©

Marathon For Atari

Mike Kinnamon

More Than A Math Drill

Marathon departs somewhat from typical math drill programs. It makes use of the Atari's graphics and sound capabilities. The object is to advance your marathon runner from the starting line at the left of the screen to the finish line at the right. This is accomplished by giving the correct answer to the math problem presented before your opponent does or before the timer runs out.

When the game is loaded from disk or cassette, an option allows one or two players. You may then select which mathematical operation the game will focus on – addition, subtraction, multiplication, or division. You may opt for a mixture of these operations by selecting the general category instead.

Four Levels Of Difficulty

There are four levels of difficulty: walker, jogger, sprinter, and olympian. Each successively higher level decreases the amount of time allowed to correctly answer the math problems. Pressing START begins the game.

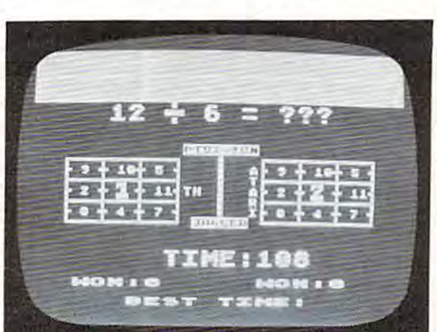
A math problem, nothing larger than two-digit numbers, will appear near the middle of the screen. Two matrices (one for each player) containing eight answers from which to choose appear on each side of the screen.

Once a player has located the correct answer on the matrix, he or she uses the joystick to position the cursor over the appropriate cell and presses the red button to indicate the answer. The player who gets the right answer first is rewarded with the advancement of his or her marathon runner at the top of the screen.

The game continues in this manner until one of the player's marathon runners crosses the finish line. On every fifth problem, the players are asked to identify the multiple of a given number. At the game's conclusion, the winning player will be ranked from "Walker-Team Six" to "Olympian-Team One." These rankings are derived from a combination of correct answers, advancements due to the opponent's incorrect responses, and the number of times that the timer expired.

Good Graphics

Geoff Brown, the author of *Marathon*, employs effective mixed screen modes and color schemes. The flow of the program is smooth and bug-free.



Runners are locked in a tie at the top of the screen while the program awaits the answer to a math problem in Marathon.

I have used this program in my fourth- through sixth-grade classes and found it helpful in motivating students who need remediation. Ten to 15 minutes seemed to be the attention span for the majority of the students. *Marathon* can be put to good use in the classroom.

Marathon
Educational Software Inc.
4565 Cherryvale Avenue
Soquel, CA 95073
Requires 16K RAM Cassette
24K RAM Disk
$19.95

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***Disk Data Manager* For VIC And 64**

Cal Hunter

After acquiring my first computer, a Commodore VIC-20, I found that my most pressing need was for a data processing program that would enable me to maintain customer profile information and to search out, sort, and print mailing lists and different categories of information for marketing programs.

After browsing the magazine advertisements, I chose *Disk Data Manager* by MicroSpec. It requires a minimum of 8K expansion for a VIC (to handle up to 600 records). With even greater expansion, up to 1200 records can be maintained.

Novices should have no difficulty handling the program. The instruction manual is well-written and thorough, and program prompts are self-explanatory. It's worth the time, however, to carefully read the instruction manual before loading and running the program.

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ADVENTURE WRITING/DEATHSHIP by Rodger Olsen — This is a data sheet showing how we do it. It is about 14 pages of detailed instructions how to write your own adventures. It contains the entire text of Deathship. Data sheet - $3.95. NOTE: Owners of TI99, TRS-80, TRS-80 Color, and Vic 20 computers can also get Deathship on tape for an additional $5.00.

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ADVENTURES — Adventures are a unique form of computer game. They let you spend 30 to 70 hours exploring and conquering a world you have never seen before. There is little or no luck in Adventuring. The rewards are for creative thinking, courage, and wise gambling — not fast reflexes.

In Adventuring, the computer speaks and listens to plain English. No prior knowledge of computers, special controls, or games is required so everyone enjoys them—even people who do not like computers.

Except for Quest, itself unique among Adventure games, Adventures are non-graphic. Adventures are more like a novel than a comic book or arcade game. It is like reading a particular exciting book where you are the main character.

All of the Adventures in this ad are in Basic. They are full featured, fully plotted adventures that will take a minimum of thirty hours (in several sittings) to play.

Adventuring requires 16k on Sinclair, TRS-80, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Sinclair requires extended BASIC. Now available for TI99.

TREK ADVENTURE by Bob Retelle — This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one — The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to build some that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.

Dungeons of Death — Just for the 16k TRS-80 COLOR, this is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. At the normal price for an Adventure ($14.95 tape, $19.95 disk), this is a giveaway.

PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple—playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.

QUEST by Bob Retelle and Rodger Olsen — THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alesia. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

32K TRS 80 COLOR Version $24.95.

Adds a second level with dungeons and more Questing.

PRICE AND AVAILABILITY:

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Please specify system on all orders

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screen displays. When the program is loaded and run, a menu appears:

CReate a File
ADd a Record
DElete a Record
CHange a Record
BRowse thru the File
SEarch the File
PRint the File
EXit the File

Entering the first two characters executes the desired function. The first time you run the program, the only valid options will be to CReate a File or EXit the File. A data base description file is required to perform the other options.

One word of caution: It is imperative that you *always* exit the program with the EXit option. This procedure closes and updates all file records. Failure to do so can result in all newly entered data being erased.

To create a file format, enter the CReate option. You will be queried on the number of fields per record. Any number up to nine may be selected. You will then be prompted to name each field.

My prospect file required seven fields:

Field #1	**Name**
Field #2	**Address**
Field #3	**Phone**
Field #4	**Sex**
Field #5	**Age**
Field #6	**Rating**
Field #7	**Comments**

The *Disk Data Manager* permits me to add new prospects, delete a record when it is no longer needed, or change a record when new information is obtained. It's efficient. At any time, I can browse through my prospects or even search for a particular record. If I wish, I can print out a complete listing of the desired information in any category.

The PRint option offers several functions. You may print your entire file in record number sequence, or you may specify a field to sort on. If you select a field to sort on, you will be asked to specify the low and high limits. For instance, in the above prospect file, if you elected to sort on field #5, you could elect a low of 35 and a high of 50. The report would then be printed listing only persons in the file between 35 and 50 years of age.

Commodore 64 Version

When I recently traded in my VIC for a Commodore 64, I ordered the *64 Data Manager*, a somewhat more elaborate version of the same program.

The menu is the same. The add, delete, and change options are still basically the same, but the browse function permits you to examine the next record forward or backward.

The SEarch and PRint options offer some very useful changes. Instead of the sort by low and high parameters, you may now become more specific by entering selection criteria. The message line will prompt: "field# (eq, ne, gt, lt, ge, le) Argument." You may select one of the two-character equivalency parameters. They stand for equal, not equal, greater than, less than, greater than equal to, and less than equal to. Argument stands for the value you wish the field compared against. An example might illustrate this concept best:

Field #	Field ID
1	Name
2	Age
3	Sex
4	Salary

We wish to select persons over 30 years old who are male and earn $20,000 or less. We would then enter the following criteria:

2gt30
3eqmale
4le20000

Disk Data Manager is quite a flexible, valuable tool.

Disk Data Manager
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Plano, TX 75075
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©

Ghost Encounters For Atari

Tina Halcomb

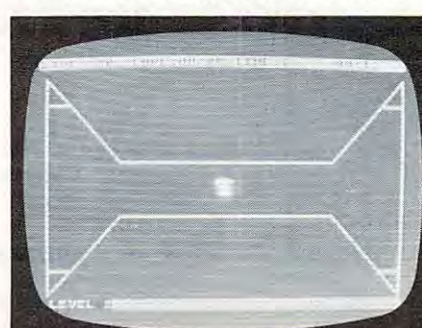
Ghost Encounters, by J. V. Software, is a realtime graphic adventure game. It requires an Atari 400 or 800, at least 16K of memory, and one joystick. *Ghost Encounters* is available on diskette and cassette.

You begin your quest in a base room which contains the doors leading to each additional room (for that particular level). As you complete each task, or exit a room for whatever reason, you are returned to the base room from which you can decide your next challenge. Upon entering a room which contains a treasure, you hear four bell tones. What you must do is tag the prize and exit the room without being destroyed.

Agile Monsters

You can be destroyed in a couple of ways – by monsters or by the timer. Several different monsters will hunt you. Being touched by one of them will cost you one life, and you are promptly returned to the base room for whatever level you are playing. The various monsters seem to be much more agile than you (the ghost). You can move north, south, east, west and four diagonal directions, but you are limited – you can't move through walls.

The enemy *can* go through walls and in most cases moves



The ghost begins its treasure hunt in Ghost Encounters.

much faster than the ghost. Dodging these creatures can be very risky. You can run from them, or you can shoot at them. If you are a real marksman you can do both, but you had better be quick. In order to shoot at an object, you must move in the direction of that object, because the bullets are aimed in the direction you were moving immediately prior to releasing the fire button. so, to shoot at something that is chasing you, you must stop running and fire before your enemy closes in on you.

Puzzles

Not all rooms have monsters in them. In some, you must solve a puzzle to gain passage to your prize. The ghost can transform into eight different shapes which assist in solving the puzzles.

No matter what your opposition in each room, you must beat the timer. The countdown rate is different from room to room. Each time the timer counts to zero, you lose one life. You may restore the timer any time by passing through a door.

Treasure Hunt

The object of the game is to collect as many prizes as you can before you lose your ten lives. Once you capture all the prizes for any level, you are automatically promoted to the next level, and the game continues. The faster you capture the prizes, the better your score will be.

The game responds a bit slowly to the constantly changing joystick position. Also a feature which would allow the game to be saved would be resumed at another time would be nice.

This game has qualities that are similar to those of the arcade games and other characteristics in common with adventure games. All in all, it's very entertaining.

Ghost Encounters
J. V. Software, Inc.
3090 Mark Avenue
Santa Clara, CA 95051
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SOFTWARE

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BOOKS	LIST	SALE
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A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in **COMPUTE!** are written in a computer language called BASIC. BASIC is easy to learn and is built into most computers (on some computers, you have to purchase an optional BASIC cartridge).

BASIC Programs

Each month, **COMPUTE!** publishes programs for many machines. To start out, type in only programs written for your machine, e.g., "TI Version" if you have a TI-99/4. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from one computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as "O" for the numeral "0", a lowercase "l" for the numeral "1", or an uppercase "B" for the numeral "8". Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to the appropriate key for your computer. For example, if you have an Atari, refer to the "Atari" section in "How to Type COMPUTE!'s Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard, break key, and RESET (or STOP) keys may all seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, so always SAVE a copy of your program before you RUN it. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1) Type in the program a line at a time, in order. Press RETURN or ENTER at the end of each line. Use backspace or the back arrow to correct mistakes.

2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type COMPUTE!'s Programs" elsewhere in the magazine.)

We regret that we are no longer able to respond to individual inquiries about programs, products, or services appearing in **COMPUTE!** *due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear on the CAPUTE! page, usually within eight weeks. If you have specific questions about items or programs which you've seen in* **COMPUTE!**, *please send them to Readers Feedback, P.O. Box 5406, Greensboro, NC 27403.*

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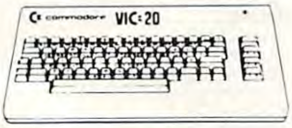

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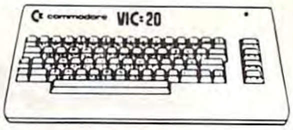

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Ten Little Robots (ATARI) $12.95
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How To Type COMPUTE!'s Programs

Many of the programs which are listed in **COMPUTE!** contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to tell exactly what to type when entering one of these programs into your computer, we have established the following listing conventions. There is a separate key for each computer. Refer to the appropriate tables when you come across an unusual symbol in a program listing. If you are unsure how to actually enter a control character, consult your computer's manuals.

Atari 400/800

Characters in inverse video will appear like: INVERSE VIDEO
Enter these characters with the Atari logo key, {⅄}.

When you see	Type	See	
(CLEAR)	ESC SHIFT <	↖	Clear Screen
(UP)	ESC CTRL -	↑	Cursor Up
(DOWN)	ESC CTRL =	↓	Cursor Down
(LEFT)	ESC CTRL +	←	Cursor Left
(RIGHT)	ESC CTRL *	→	Cursor Right
(BACK S)	ESC DELETE	◂	Backspace
(DELETE)	ESC CTRL DELETE		Delete character
(INSERT)	ESC CTRL INSERT		Insert character
(DEL LINE)	ESC SHIFT DELETE		Delete line
(INS LINE)	ESC SHIFT INSERT		Insert line
(TAB)	ESC TAB	▸	TAB key
(CLR TAB)	ESC CTRL TAB		Clear tab
(SET TAB)	ESC SHIFT TAB		Set tab stop
(BELL)	ESC CTRL 2		Ring buzzer
(ESC)	ESC ESC		ESCape key

Graphics characters, such as CTRL-T, the ball character ● will appear as the "normal" letter enclosed in braces, e.g. {T .

A series of identical control characters, such as 10 spaces, three cursor-lefts, or 20 CTRL-R's, will appear as {10 SPACES}, {3 LEFT}, {20 R}, etc. If the character in braces is in inverse video, that character or characters should be entered with the Atari logo key. For example, {♥} means to enter a reverse-field heart with CTRL-comma, {5U} means to enter five inverse-video CTRL-U's.

Commodore PET/CBM/VIC

Generally, any PET/CBM/VIC program listings will contain bracketed words which spell out any special characters: {DOWN} would mean to press the cursor-down key; {3DOWN} would mean to press the cursor-down key three times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listing. For example, S would mean to type the S key while holding the shift key. This would result in the "heart" graphics symbol appearing on your screen. Some graphics characters are inaccessible from the keyboard on CBM Business models (32N, 8032).

Sometimes in a program listing, especially within quoted text when a line runs over into the next line, it is difficult to tell where the first line ends. How many times should you type the SPACE bar? In our convention, when a line breaks in this way, the ~ symbol shows exactly where it broke. For example:

```
100 PRINT "TO START THE GAME  ~
    YOU MAY HIT ANY OF THE KEYS
    ON YOUR KEYBOARD."
```

shows that the program's author intended for you to type two spaces after the word *GAME*.

All Commodore Machines

Clear Screen	{CLEAR}	Cursor Left	{LEFT}
Home Cursor	{HOME}	Insert Character	{INST}
Cursor Up	{UP}	Delete Character	{DEL}
Cursor Down	{DOWN}	Reverse Field On	{RVS}
Cursor Right	{RIGHT}	Reverse Field Off	{OFF}

VIC/CBM 64 Conventions

Set Color To Black	{BLK}	Function Two	{F2}
Set Color To White	{WHT}	Function Three	{F3}
Set Color To Red	{RED}	Function Four	{F4}
Set Color To Cyan	{CYN}	Function Five	{F5}
Set Color To Purple	{PUR}	Function Six	{F6}
Set Color To Green	{GRN}	Function Seven	{F7}
Set Color To Blue	{BLU}	Function Eight	{F8}
Set Color To Yellow	{YEL}	Any Non-implemented Function	{NIM}
Function One	{F1}		

To enter any color code, hold down CTRL and press the appropriate color key. Use CTRL-9 for RVS on and CTRL-0 for RVS off.

8032/Fat 40 Conventions

Set Window Top	{SET TOP}	Erase To Beginning	{ERASE BEG}
Set Window Bottom	{SET BOT}	Erase To End	{ERASE END}
Scroll Up	{SCR UP}	Toggle Tab	{TGL TAB}
Scroll Down	{SCR DOWN}	Tab	{TAB}
Insert Line	{INST LINE}	Escape Key	{ESC}
Delete Line	{DEL LINE}		

When you see an underlined character in a PET/CBM/VIC program listing, you need to hold down SHIFT as you enter it. Since the VIC-20 and Commodore 64 have fewer keys than the PET/CBM, some graphics are grouped with other keys and have to be entered by holding down the Commodore key. If you see any of the symbols in the left column underlined in a listing, hold down the Commodore key and enter the symbol in the right column. Just use SHIFT to enter all other underlined characters.

!	K	←	*	1	E
"	I	↑	PI	2	R
#	T	.	S	3	W
$	@	–	Z	4	H
%	G	=	X	5	J
'	M	<	C	6	L
&	+	>	V	7	Y
\	–	,	D	8	U
;	F	/	P	9	I
?	B	*	N	@	SHIFT*
(	£	+	Q	[	SHIFT+
)	SHIFT-£	0	A	]	SHIFT–

Apple II / Apple II Plus

All programs are in Applesoft BASIC, unless otherwise stated. Control characters are printed as the "normal" character enclosed in brackets, such as {D} for CTRL-D. Hold down CTRL while pressing the control key. You will not see the special character on the screen.

TRS-80 Color Computer

No special characters are used, other than lowercase. When you see letters printed in inverse video (white on black), press SHIFT-0 to enter the characters, and then press SHIFT-0 again to return to normal uppercase typing.

Texas Instruments 99/4

No special control characters are used. Enter all programs with the ALPHA lock on (in the down position). Release the ALPHA lock to enter lowercase text.

Timex TS-1000, Sinclair ZX-81

Study your computer manual carefully to see how to enter programs. Do not type in the letters for each command, since your machine features single-keystroke entry of BASIC commands. You may want to switch to the FAST mode (where the screen blanks) while entering programs, since there will be less delay between lines. (If the blanking screen bothers you, switch to the SLOW mode.)

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Radar Rat Race	29.95	23.96	3.00
GORF	39.95	31.96	4.00
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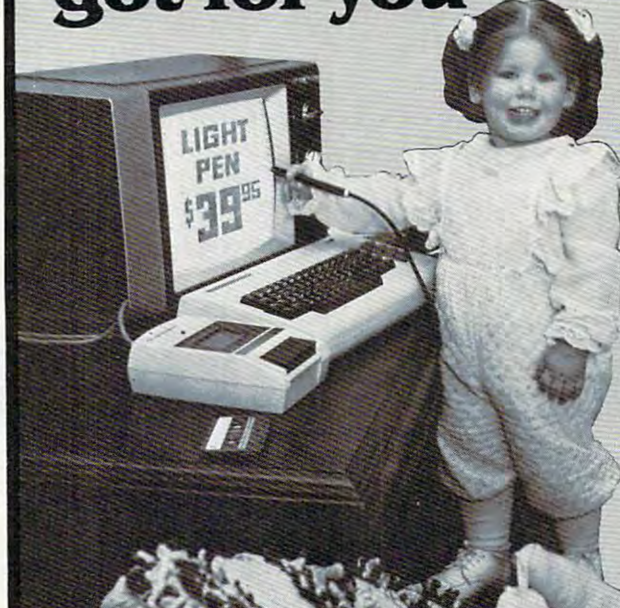

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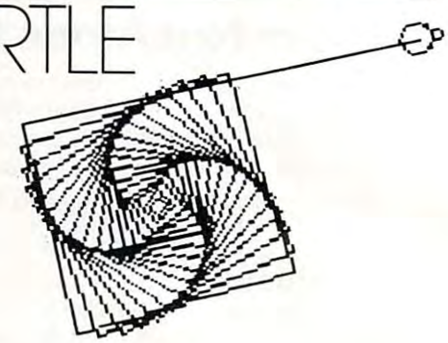

David D. Thornburg, Associate Editor

HES Turtle Graphics II

I visited with the people from HES at their booth at the Las Vegas Consumer Electronics Show this January. At that time I was given a glimpse of Turtle Graphics II, a graphics language they developed for the Commodore 64. I was pleased by what I saw, and even more pleased when a preliminary copy of the language was sent for me to review.

HES Turtle Graphics II supports two kinds of display screens – the LORES, or text, screen, and the HIRES, or 320 x 200 pixel, color graphics screen. Furthermore, this language also supports the Commodore 64 sprite graphics.

The software package contains:

1. A program editor
2. A sprite shape editor
3. An I/O handler for disk, tape or printer, and
4. A trace mode

While Turtle Graphics II does not have a mode for the immediate execution of commands, the program editor is so easy to use that this is not a great drawback.

Syntactically, Turtle Graphics II is a cross between Atari PILOT and the turtle graphics portion of TI Logo. To illustrate this, I have created the listings below in Turtle Graphics II, Atari PILOT, and TI Logo. The listing is for a procedure that generates a squiral pattern similar to that used in the Friends of the Turtle emblem. To make the listings easier to compare, I have numbered all the lines and made sure that similar lines have similar numbers.

Before analyzing the Turtle Graphics II syntax in detail, you should compare the three listings. You can see that the HES language is intermediate between TI Logo and Atari PILOT. When you examine the syntax chosen for the HES sprite graphics, the relation to TI Logo is even more evident (for example, to start or stop sprite movement, you type FREEZE or THAW).

This is not to suggest that HES Turtle Graphics II is in any way a replacement for Logo. Logo has many features that just aren't available on other languages. But, if you want to explore turtle graphics on the Commodore 64, this language is a fine starting point.

HES Turtle Graphics II

```
 1 LABEL SQUIRAL
 2 HIRES
 3 PEN UP
 4 MOVE TO 100-160
 5 SETHEADING TO 90
 6 PEN DOWN
 7 CALCULATE Y=0
 8 LABEL ADD 2
 9 CALCULATE Y=Y+2
10 FORWARD Y
11 ROTATE RIGHT 89
12 TEST IF (Y>180)
13 IF FALSE JUMP ADD 2
14 ROUTINE END
```

Atari PILOT

```
 1 *SQUIRAL
 2 GR: CLEAR
 3 GR: PEN UP
 4 GR: GOTO 0,0
 5 GR: TURNTO 0
 6 GR: PEN YELLOW
 7 C: #Y=0
 8 *ADD2
 9 C: #Y=#Y+2
10 GR: DRAW #Y
11 GR: TURN 89
12
13 J (#Y<181): *ADD2
14 E:
```

TI Logo

```
 1 TO SQUIRAL
 2 TELL TURTLE CLEARSCREEN
 3 PEN UP
 4 SXY 0 0
 5 SETHEADING 0
 6 PEN DOWN
 7 MAKE "Y 0
 8 ADD2:
 9 MAKE "Y :Y +2
10 FORWARD :Y
11 RIGHT 89
12 TEST Y > 180
13 IFF GO "ADD2
14 END
```

Nonstandard Features

Before leaving the listings, there are a few nonstandard "features" that need to be mentioned. First, the HES turtle does not start in the middle of the screen; it starts in the upper left corner. Also, the MOVE TO command accepts the Y-axis (measured from 0 at the top) first, followed by the X-axis. I know of no other language that accepts coordinates in this sequence.

Two other nonstandard turtle characteristics involve the SETHEADING TO command. A heading of 0 degrees faces the turtle to the right (instead of straight up), and turning angles for this command increase in a counterclockwise (instead of clockwise) direction. The starting angle and starting position for the turtle make sense if you recall that the original turtle graphics package from these people used only the text display.

None of these characteristics is a showstopper – as long as each is understood from the beginning.

There are many features of HES Turtle Graphics II that I find delightful. The sprite editor lets you easily create shapes, change their color and magnification, and save them on tape or disk for later use. The sprite editor contains eight predefined shapes that can be changed to anything you wish. The shapes provided include a boat, rocket, truck, ball, space shuttle, house, man, and woman. Sprites can be made to wrap around the screen if so desired (this causes them to appear at the opposite edge of the screen if they are moved off one end). You can also set the speed and visibility of any sprite, and can even control a sprite's position directly with a joystick.

The program editor lets you enter two-letter abbreviations for all commands (for example, you can enter IT instead of IF TRUE JUMP). And yet, when the program is listed, all abbreviated words are fully expanded to their English counterparts.

While I am primarily interested in the high resolution graphics turtle, the low resolution (character-based) turtle graphics has some interesting features. One of the more powerful is the CHECK FOR command that looks for the existence of a chosen character directly ahead of the turtle. This command allows Turtle Graphics II users to create maze-solving programs.

Turtle Graphics II is a language worth considering if you are interested in turtle graphics, but don't need the rest of the power found in Logo.

Next Time

In the last few weeks, several people have asked me for a side-by-side comparison of PILOT and Logo. The result of such a comparison includes some surprises, as you will see next month. ©

Turning Logo Upside Down

Fred D'Ignazio, Associate Editor

In my February 1983 **COMPUTE!** column I put out a call for new computer languages for kids. I related my experiences with my own children (ages three and seven), trying to teach them to program. Frankly, I admitted that my efforts had failed. Neither child seemed to have the least inclination to learn how to program.

You readers responded to the column in a big way. You told me about your own thoughts about kids and programming, and you passed on news about programming projects and languages that you had learned about. I want to thank you for all this information. I will be printing excerpts from your letters in the coming months. Also, I am anxious to hear from even more of you. I believe kids' computer languages are the cutting edge of the revolution in computer learning. They deserve all the attention and debate we can muster up.

Enter *Delta Drawing*

Shortly after I wrote my February column, I received a copy of Spinnaker Software Company's *Delta Drawing* program for the Apple II Plus. (Versions for other computers are expected soon.) At first, I thought *Delta Drawing* was just another new "paint" program or simplified "turtle graphics" program. Then I dug further.

Now, my family and I have spent a dozen hours playing with *Delta Drawing*, and I am convinced that it is something more. I now believe that it is a first, but significant, step toward a powerful new computer language for kids.

Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. His books include Katie and the Computer *(Creative Computing),* Chip Mitchell: The Case of the Stolen Computer Brains *(Dutton/Lodestar),* The Star Wars Question and Answer Book About Computers *(Random House), and* How To Get Intimate With Your Computer (A 10-Step Plan To Conquer Computer Anxiety) *(McGraw-Hill).*

As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device. His column appears monthly in **COMPUTE!**.

I Want To Play Mystery House!

This is how my seven-year-old daughter, Catie, and I were first introduced to *Delta Drawing*:

I took the plastic off the *Delta Drawing* case and handed the disk to Catie. Catie put the disk in the Apple computer's disk drive and booted up the program.

We answered a couple of quick questions (did we have a color monitor? ‹Yes – a must›; did we have a printer? ‹No›). Then a little upside-down "V" appeared on the center of the screen. Under the V was a blinking dot. Around the edge of the screen was a blue box.

The manual calls the upside-down V the "Delta Drawing cursor." But Catie knew better. "That's a turtle," she said. "The blinking dot is her tail." Catie named the turtle DeeDee (for "DD" – Delta Drawing).

I thought things were going pretty well. That's when Catie got bored. (Catie gets bored easily.)

"I'm tired of this game," she said.

"But we haven't even started," I replied.

"I don't care. I want to play Mystery House."

Mystery House (from On-Line Systems) is one of Catie's favorite adventure games (along with *Cranston Manor*, also from On-Line, and *Copts and Robbers*, from Sirius).

Did I respond to Catie's obstinance with tact and gentle persuasion? Of course not. I did what any normal parent would do. I yelled at her.

Naturally, she responded by crying and I felt guilty. You really botched it, Fred, I thought to myself.

Catie started banging on the Apple keyboard. All of a sudden, DeeDee came to life and drew a small straight line toward the top of the screen. She made a cute little "blink" or "clink" sound. Catie stopped crying and stared.

"Can I make my own pictures?" she asked.

Encouraged, I pulled out the "Fast Start" cards that accompany the *Delta Drawing* manual. Catie and I both avoided the manual. At 80 pages of fairly tiny print, it looked too intimidating, both for daughter and daddy.

But the Fast Start cards were different. Each one is made of shiny, plastic-coated, heavy-stock paper. Each one has a picture at the top and a few commands to show you how the picture was made. The cards are two-sided, numbered (with big numbers!) from one to fourteen.

One card tells you on one side how to load *Delta Drawing*, and on the back gives you all of the *Delta Drawing* commands. I discovered that Catie had pressed the Apple's "D" key and caused DeeDee to *draw*.

Catie and I looked at the pictures on the Fast Start cards. We grew excited. It looked like we could get DeeDee to draw all the standard stuff: circles, squares, triangles, and the like. We could also get DeeDee to draw three-dimensional cubes and "paint" the sides; play a game of Tic-Tac-Toe, and draw a colorful scene with an orange house, green grass, a blue sky, and an orange sun.

But how?

I did the adult thing and turned to card #1 and began trying to decipher the command beneath the picture. Meanwhile, Catie did the kid thing and began punching buttons. A couple of minutes later, I was still on card #1, but Catie had discovered that the "R" button made DeeDee turn right 30 degrees and the "L" button made her turn left 30 degrees. Catie showed me how she could press the "U" button and make DeeDee do a fancy U turn; and the "M" button to get DeeDee to scoot across the screen with her pen up – that is, she moved without drawing.

Catie squealed. "DeeDee didn't obey me," she said. "She went up and I wanted her to go down." We looked at the card with the command summary. We discovered that by pressing the "E" button we could make DeeDee backtrack and erase her last step.

I threw the Fast Start cards on the table. From that point on, we began improvising. Occasionally, we picked up the cards and borrowed commands off them, when we needed to make DeeDee do something we wanted her to do.

It sounds really impressive when I say that "Catie and I improvised." Actually, I advised Catie what to do, and she ignored me. This seemed to be a very successful strategy to learn *Delta Drawing*.

After a while, I gave up and let Catie take the lead.

Catie's approach was to do things with commands she already knew. For example, the first thing she did was hit the D (Draw) key until DeeDee drew herself off the top of the screen and popped back onto the bottom of the screen.

Catie wondered why DeeDee could "tunnel" off the screen, like Ms. Pac Man. Why didn't DeeDee bump her nose on the blue wall at the edge of the screen?

We looked at the Fast Start card with the command summary and found that there is a "B" command that makes DeeDee "bounce" instead of tunnel. When we pressed the B key, the wall turned green. To get DeeDee back into tunnelling mode, we had to press a "W" (wraparound) key.

Watching Catie at work was like watching a baby learn to speak for the first time – only in fast motion. She was learning a new language, and the moment she learned a new word in the language, she used it to express herself.

In fact, the reason she learned new words was to be able to express herself. She was motivated to master the language's vocabulary so she could do what she set out to do. And when she learned each new word, she automatically incorporated it into all the other words she knew. She was associating each word and developing word sequences – her own personal "grammar" in the new language.

Catie's experimental approach was efficient, but it also led us occasionally into dead ends and surprises. For example, Catie got DeeDee to draw a house out of a square and a triangle. She filled the house with purple, by pressing "C" to choose the color, then by holding the CTRL button down and typing "F" (Fill). Then she tried to color the grass green. She pressed "C" and picked green. She typed CTRL-F, and green started washing like a wave across the screen. Then the green went out of control. It slipped through a tiny hole in the line that separated the grass and the sky, and it filled the sky, too. It ended up filling the entire picture, except for the purple house.

Catie howled!

A Sun Not A Circle

One thing that I immediately liked about *Delta Drawing* was the quick way Catie could make a picture. Also, I liked the precise, geometric way she constructed pictures. I have a problem with "paint" programs that use joysticks because my fine motor skills never passed the "klutz" stage. But, looking at Catie create pictures in *Delta Drawing*, I had hopes that even I might be able to make something pretty.

That is, if Catie would ever give me a turn.

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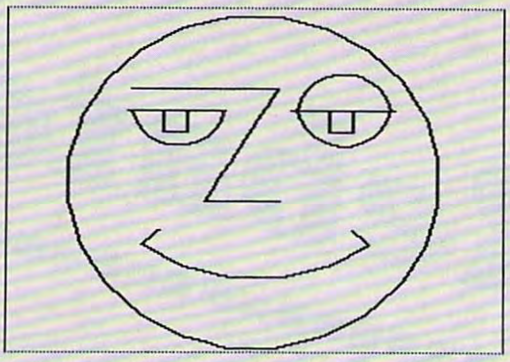

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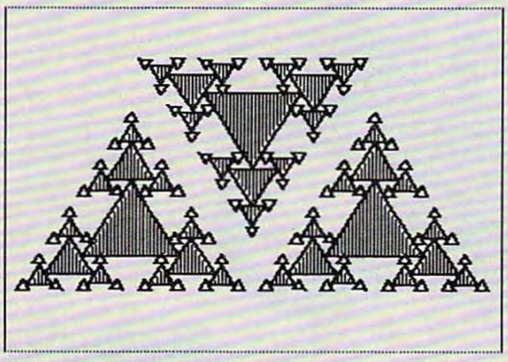

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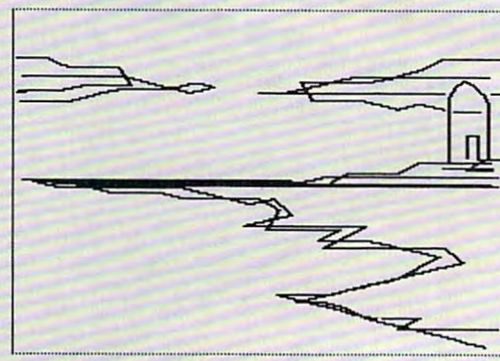

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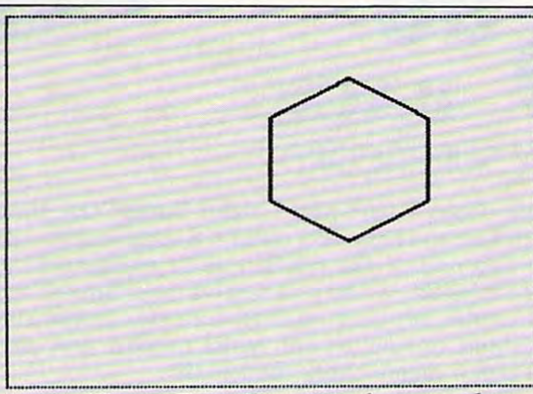
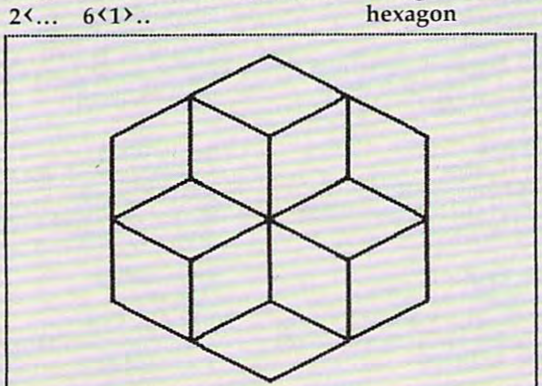


1<... 3D .. >D .. 2R .....>1 hexagon element
2<... 6<1>.. hexagon



1<... 3D .. <D .. 2R .....>1
2<... 6<1>.. 2R .....>2
3<... 6<2>.. hexagon with 60 degree turn
6 hexagons (motif #1)

Another thing that pleased me about *Delta Drawing* is that when children are using shapes like triangles, squares, and circles – they are not dealing with them in an abstract, adult sense. After all, shapes by themselves are boring. But shapes that resemble real-world objects like hats, planets, boxes, mountains, etc., are interesting. And shapes that can be combined into "building blocks" to make a new world are even more interesting. With *Delta Drawing*, Catie not only combined the shapes, she created new shapes to act as the proper building blocks for the world she was trying to create.

The Catie Robot Makes A Circle

With both Catie and Eric (three years old), I had tried the classic Logo experiment where you get the child to play "turtle" and figure out how to walk in a circle around the floor. I had often tried, but I had always failed.

The easy part was getting Catie and Eric to play turtle and figure out how to draw a circle. They took a baby step forward then made a small turn to the right. Then they repeated two steps over and over until they made a circle.

Fine. But then came the hard part – entering a program into the computer to make the turtle do what Catie and Eric had discovered so easily.

This is where I hit a brick wall. Catie and Eric had no interest in creating a "circle" procedure (program) in Logo. In fact, they never got past the first command – FORWARD or FD.

For Catie and Eric, it was too much effort for too little reward. And they didn't want to wait for the computer to learn the procedure. Why couldn't the computer obey them and make the circle immediately?

With Logo it couldn't, but with *Delta Drawing* it could. To make a circle, Catie typed D (Draw) and R (Right), then D and R, then D and R again. As she typed, DeeDee responded and drew the circle. It was easy to type D and R, and Catie got immediate results. After drawing the circle for the first time, she colored it orange with just a single command – CTRL-F. Then, on her own, she figured out how to make DeeDee move around the edge of the circle and make rays. She had turned her circle into a sun.

Our First *Delta Drawing* Program

Catie and I were doing great – until I accidentally bumped the "1" button on the keyboard and Catie's beautiful picture disappeared.

I thought she was going to kill me.

Quickly, I scanned the card with the command summary, looking for an "Unerase" button. "Why did that happen?" I grumbled. "Stupid program!"

I didn't find an unerase command on the card, but I did discover the "T" (text) command. I pushed the T button. DeeDee vanished. The screen filled with words.

There was Catie's program! It was still there.

I flipped through the big manual. A moment later I realized what I had done. By accident, when I pressed the "1" button, I had saved Catie's picture as a *program* – program #1. To get the picture back, I had to call the program. Doing that was unbelievably easy. I just had to push the "1" button again.

We switched back to DeeDee by pressing the "G" (Graphics) button. Then Catie pushed the "1" button, and, superfast, DeeDee drew and painted her picture. It was good as new.

Automatic Pictures

That's when Catie and I discovered the "A" button. The A button executes the Automatic command. The Automatic command automatically calls the last saved program and obeys it – over and over until you punch the ESC (escape) button.

I had a brainstorm. I had Catie type in a CTRL-D (a half-draw) and a CTRL-R (a half-turn right). DeeDee did her stuff.

Then I told Catie to press the "1" button. She did. Now we had a program that, when we pressed "T", looked like this:

1‹ ... ^D .. ^R ... ›1

The program looked puny and not very exciting. What was it good for? To find out, I asked Catie how we could make DeeDee automatically obey program #1 – over and over. With just a moment's thought, Catie pressed the "A" button.

A couple of seconds later, we had a circle!

To get DeeDee to stop drawing, Catie pressed the ESC button. Catie and I were excited: using program #1 as a building block, we had created a "circle" program – program #2. We saved program #2 by pressing the "2" button.

We drew circles all over the picture screen and got DeeDee to paint them different colors. Then we tried something simpler – and neater.

We erased all our current commands by typing CTRL-E. We pressed the "T" button. Our first two programs were still intact.

We pressed 2 and got a quick circle. Then we pressed the "L" button. DeeDee turned 30 degrees to the left. We saved these two commands as program #3. The first three programs looked like this:

Program #1 1‹ ... ^D .. ^R ... ›1
Program #2 2‹ ... 25‹1› ... ›2
This came from pressing the A button.
Program #3 3‹ ... ‹2› .. L ... ›3

When you see a number inside brackets, like ‹2›, it means you are calling a program – this time program #2. The 25‹1› means you are calling program #1 25 times. We got the computer to do this just by pressing the A button – once! – and the ESC button to stop DeeDee.

Next Catie typed the A button. DeeDee drew a circle, turned left 30 degrees, drew another circle, turned left 30 degrees, drew another circle, and so on. In about a minute she had rotated her way around the picture screen. She had drawn a three-dimensional figure: a doughnut! Catie, on her own, moved DeeDee and had her paint the doughnut's center orange and the background violet. *After the doughnut was drawn* (not before), Catie and I pressed "T" to see what the program looked like. Here it is:

Program #4 4‹ ... 44‹3› .. 2L .. M .. C:2
.. ^F .. 8M .. C:5 .. ^F ..

Remember: the most formidable command – 44 "calls" of program #3 was achieved by pressing the A button *once*.

Catie and I saved our doughnut in just a few seconds. We pressed CTRL-S, and the computer asked if we wanted to save or recall (load) something. We pressed "S" for save. Then the computer asked us if we wanted to save the program ("T" – text) or the picture ("G" – graphics). We typed "T." The computer told us to load in our own disk. We did, and it asked us to name our *Delta Drawing* file – we called it DONUT. Then the computer saved it.

Nested Building Blocks

Delta Drawing's real power comes from its ability to save pictures as building blocks; from its ability to combine simple building blocks into blocks that are more and more elaborate and complex. And you can gain access to all these building blocks just by pressing the CTRL-A buttons. When you press CTRL-A, the computer asks you which building block (program) you want. You can choose any number, from 1 to 9.

By pushing just a few buttons, Catie and I created our doughnut. We built the doughnut from a draw and turn program, a circle program, and a circle and turn program. Just as easily, we could have created "house" programs, "people" programs, "tree" programs, and so on. We could have formed a picture by positioning DeeDee on the screen and calling the program we wanted.

A Kid's Language

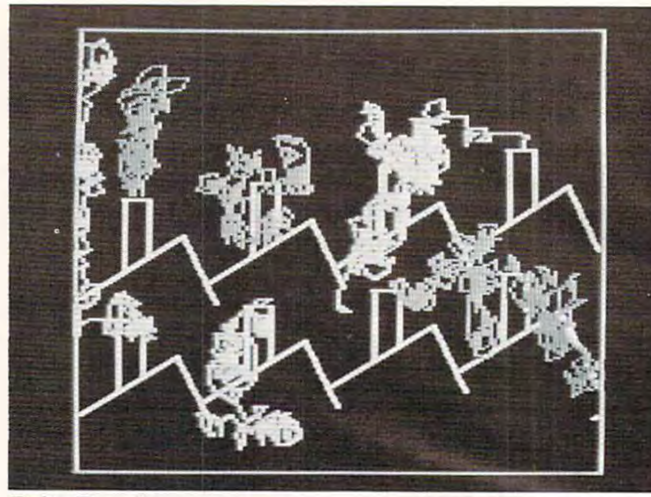
Delta Drawing represents, I hope, one of the early representatives of a new generation of children's software that combines simplicity with great power. Also, it is open-ended. It is a language. Once the child learns the language, she can do whatever she wants. And she can do a lot *even as she is learning the language*.

This simplicity, power, and freedom are what made the program a hit with Catie. And when her brother showed up, and learned a few buttons, they made a big hit with him, too. All of a sudden programming becomes an activity with immediate results that are meaningful to the child, controlled by the child, and that challenge and stimulate the child to be original and inventive.

This is certainly a good start toward a kids' language of the future. And it's not a bad adult's language, either. My wife Janet and I have had a ball creating pictures with *Delta Drawing*. Here is a piece of software that is equally fascinating and easy to use for a three-year-old, a first grader, and two jaded adults. The generation gap between the different members of the family disappears when we use *Delta Drawing*. We are all equally caught up in exploring its possibilities. And no single member of the family seems to have an edge. This is a very nice feature of the program.

Upside Down Logo

Why did I claim that *Delta Drawing* is like Logo turned on its head? Because with Logo (and most other languages), you have to type in the commands in your program before you can run the program and create a picture. With *Delta Drawing* you make the picture first, and in making the



Delta Drawing

picture you create a program. It's just the opposite. It's Logo upside down!

Delta Drawing costs $59.95 and runs on the Apple II+. By spring, a new version will be available on the IBM PC. By next fall you can look for it on the Atari 800, the VIC, the Commodore 64, and possibly on other low-priced computers.

To inquire about *Delta Drawing*, write:

Spinnaker Software Corporation
215 First Street
Cambridge, MA 02142
617-868-4700

New Resources

Since my last column I've received two interesting new books.

The Computer Camp Book

The Computer Camp Book is published by The Yellow Springs Computer Camp, Inc. It has 224 pages and costs $12.95. To order the book, write:

The Computer Camp Book
1424 Glen View Drive
Yellow Springs, OH 45387

or call 513-767-7717.

The book is a wealth of information about computer camps, including:

- How to start and run your own computer camp
- Ideas and materials for teaching and learning
- Computer literacy activities
- A look at different computer camps
- A nationwide guide to computer camps, courses, and workshops
- A guide to computing resources (including a five-page guide to computing resources for handicapped people)

Parent's Guide to Computers in Education

The *Parent's Guide* was written by David Moursund. It is a real buy – 80 pages for only $3.50. To get the *Guide*, write:

Parent's Guide
Dept. of Computer & Information Science
University of Oregon
Eugene, OR 97403

or call 583-686-4429.

The book covers a lot of ground in a clear, simple style. Some of the subjects covered include: the school of the future, introduction to computers, hardware and software, computers in education, "What You Can Do," a buyer's plan, a glossary, and a list of resources.

A unique feature of the book is that it is really two books in one. A second book, entitled "Here Comes the Dawn (If Only I Can Find the Switch)," written by Merle Marsh, appears in little italicized text boxes at the foot of every few pages. It begins, on page 3: "I tried to enter the Computer Age by quietly sneaking up on the new technology …."

©

Learning With Computers

Glenn M. Kleiman

In the March 1982 *Learning with Computers* column, we explored several projects which demonstrated the potential of word processing as an educational tool. This month, let's take another look at word processing for classrooms and homes – some of the practical difficulties. We'll also review a word processing program suitable for children.

Writing requires both the mental process of composing sentences to express the intended meanings and the physical process of putting words onto paper. Many children find the physical process to be slow and tedious, leading them to dislike writing and to be unwilling to edit and revise what they have written.

The advantage of computerized word processing is that it makes the physical process easier, so it becomes simple to create and alter written text. Each time changes are made, the computer can print a new copy, so the writer doesn't have the tedious chore of rewriting or retyping the entire text just to make a few changes. This ease of revision encourages students to write more, edit more, produce better essays, and take greater pride in their written work.

Word Processing In Schools

However, the use of word processing in schools has been limited for several reasons: children's lack of typing ability; the lack of word processing programs suitable for children; and an insufficient number of computers available.

The first problem can be overcome by some instruction and practice in typing. Typing is a valuable skill and is becoming even more valuable as computers become more prevalent. The time and effort spent mastering typing is worthwhile at any grade level.

Computers can be used to help children learn to type. In March we looked at the benefits of computer-directed typing drill and practice. A variety of typing-teacher programs are available. With some practice, most children are able to type as quickly as they write, and typing with a word processor means errors can be corrected easily and the writing always looks neat. Typing is particularly advantageous for those children who have difficulties with the fine motor control required to write neatly.

The second problem, lack of suitable software, may come as a surprise to those of you who are aware of the large number of word processing programs available for small computers. It is true – there are some excellent programs. But these programs are designed for business and professional applications, not for classrooms and homes.

Professional word processing programs contain many features beyond the fundamental insert, delete, rearrange, and print capabilities. There may be options for arranging numbers in columns, producing form letters, creating indexes, and other advanced functions. There may also be different ways of performing similar functions; so, for example, three different procedures may be used to delete single words, sentences, and paragraphs. This can be most efficient for an experienced user who writes a great deal. But the time required to learn the system, the complexity of using it, and the cost of the programs make most professional word processors poorly suited for classroom and home applications.

Giving a child a professional word processing program to write a 500 word essay is like giving someone a sledgehammer to tack a poster to the wall. Fortunately, word processing programs designed specifically for different users and uses are becoming available. One new program, called the *Bank Street Writer*, is advertised as "the first word processor for the entire family."

Bank Street Writer

The *Bank Street Writer* is an easy-to-learn and easy-to-use word processor that is sufficiently powerful for most of the writing done in homes and schools. Its designers, intending the program to be used by children, have kept the number of commands down to the minimum necessary. They also provide clear prompts on the computer screen for each step in entering, erasing, rearranging, or printing text. The children are protected from accidentally erasing or losing their writing – a real problem with some sophisticated word processors.

The *Bank Street Writer* divides the screen into two areas, a text area and a prompt area. The text area shows what you have written. The prompt area displays all the commands, so you don't have to remember them.

The program has three modes: *write, edit,*

and *transfer*. Entering text in the write mode is similar to using a typewriter with an erase key which makes it easier to correct typing mistakes. From write mode, you can press ESC to enter edit mode.

Edit mode is for altering the text. The prompt area tells you which four keys move the cursor. To insert text, you simply move the cursor to where you want the text to appear and then press ESC to go back to write mode. Then, as you type, the words in the existing text move over to make space for the new ones.

Word processing is potentially one of the most valuable educational uses of computers. It puts children in charge of the computer and provides them with a powerful tool they can appreciate.

The prompt area in edit mode also contains a menu with *erase, move, find, unerase, move-back, replace*, and *transfer menu* options. You select an option by moving a marker on the menu. The prompt area then tells you exactly how to proceed. For example, if you select *erase*, the computer tells you to move the cursor to the beginning of the text to be erased. When you press the RETURN key to signal that this has been done, you are prompted to move the cursor to the end of the text to be erased. As you do so, the words to be erased are highlighted. Next you are asked whether you are sure you want to erase the highlighted words. If you type Y, the words disappear, and the remaining words close up the space. If you type N, the words remain, and the program goes back to the edit mode menu.

The unerase and move-back options can be used after an erase or move operation. The erased or moved words reappear, and you are then asked if they should, in fact, be put back into their original position. These options are valuable for two reasons. First, they allow children to recover easily from mistakes. Nothing is more frustrating than accidentally erasing or misarranging your essay just because you pressed the RETURN key by accident.

Second, these options encourage children to try different arrangements of words and sentences and to evaluate which is best. The facility for testing different ways of expressing their ideas encourages children to improve their writing. It is also excellent for children working together – they can actually see how each other's suggestions will look without having to do a great deal of rewriting.

Transfer mode, which can be selected from edit mode, is used to save the writing on a disk, retrieve prior writing from disk, merge two files into one, and get the computer to print copies. Before printing, you are prompted to enter (or accept the default settings for) the number of characters per line and the amount of spacing between lines, and to indicate whether pages should be numbered and whether you want a heading on each page. You can also specify to have a file printed as a continuation of the previous file, so that long documents can be divided into individual files and then printed contiguously.

There is also a utility program which lets you set the word processor for different hardware configurations and set the defaults for spacing, page size, and so on. And a tutorial program is on the back of the disk to help you learn to use the word processor.

The *Bank Street Writer* does have certain limitations. You cannot change the spacing within a file – once you have chosen double-spaced printing, the entire file must be double-spaced. It has centering capability, but lacks underlining. The erase and move commands are limited to 15 lines of text (530 characters) at a time. To erase or move more, you have to repeat the command. Find and replace are limited to a maximum of 29 characters in a string. Also, if you divide a single document into separate files, you will have to apply the replace command to each one separately. These limitations make the *Bank Street Writer* unsuitable for large amounts of text. It is designed for such things as letters and school essays, not books or extensive business correspondence.

The *Bank Street Writer* is the best word processing program I have seen for children. I am delighted that it is available because I regard word processing as potentially one of the most valuable educational uses of computers. Word processing puts children in charge of the computer and provides them with a powerful tool they can appreciate. It encourages them to write and helps them improve their writing – something that is sometimes neglected in the classroom. Of course, word processing is also a valuable tool for teachers, and the *Bank Street Writer* is suitable for them.

The *Bank Street Writer* is available for Apple II and Atari computers, and a Commodore 64 version is being prepared. Two packages are available. The home package, available from Brøderbund Software (1938 Fourth Street, San Rafael, CA 94901), includes two copies of the program/tutorial disk and a written manual. The school package, available from Scholastic Inc. (730 Broadway, New York, NY 10003), contains three copies of the program/tutorial disk, a student's manual, and a teacher's guide. The home package sells for about $70, the school package for about $95.

The Need For Many Computers

This brings us to the final problem in using word processing in classrooms: it is an equipment-intensive activity, and most schools do not have a sufficient number of computers. Writing requires time, and to take full advantage of word processing, much of that time has to be spent in front of a computer. There have been attempts to solve this traffic problem, including having children write the first draft of their essays on paper and then having adults type the text into the computer. The children mark their changes on paper and then edit their essays on the computer. This at least exposes children to word processing, and may be the best alternative, given inadequate computer time for each child.

However, it does not let the children experience actually composing text on the computer, and this is what encourages them to analyze, evaluate, edit, and improve their writing. The simple fact is that taking full advantage of the potential of word processing requires more computers than are currently available in most schools. Still, whatever introduction to word processing can be provided is valuable, and with the continuing drop in hardware and software prices, computers and word processing may soon become more accessible.

Word Puzzle Programs

There are several excellent word puzzle programs available for teachers and children who do have access to one or two computers in their school for a few hours a week. These programs show children some of the potential of computers and require minimal computer time and children enjoy them. My favorite is *Crossword Magic*. This program has students enter their words and clues, and it creates a crossword puzzle for them. There are also programs which create word search and anagram puzzles from lists of words students enter. Here are some sources for word puzzle programs, each of which is easy to use and performs its intended function very well.

Crossword Magic, for Apple II and Atari computers, is from L & S Computerware, 1589 Fraser Drive, Sunnyvale, CA 94087. This program requires a graphics printer, such as the Epson MX-80 with Graftrax or the C. Itoh Prowriter.

Word search and anagram programs for the Apple II are available from Hi Tech, 126 Lighthouse Ave., Santa Cruz, CA 95060.

A word search program for the PET is available on *Cursor #14* from The Code Works, Box 550, Goleta, CA 93017. ©

Susan Semancik & C. Marshall Curtis

Developing A Communications Program

Making selections from a complicated menu can be made easier and faster in a number of ways. This is Part 5 in a series on developing a communications program for the handicapped. The programs, for the PET and VIC, demonstrate various methods of active and passive entry selection. These programs are easily adapted to any computer using Microsoft BASIC.

Once a menu is displayed, procedures must be considered for selecting an entry of the menu. This can be done passively, where the computer controls positioning and the user controls selecting, or actively, where the user controls both positioning and selecting. In a passive approach, the computer points to each menu entry individually, pausing for a predetermined amount of time based on the user's ability to respond. If no response is made during the pause, then the computer continues to scan the menu sequentially.

Passive interaction is good for persons with severe motor impairment, since a single movement can indicate the user's response. But, depending on the size of the menu, the computer can take time to point to a desired menu entry. Different types of scanning techniques can speed up a passive selection process.

In an active selection procedure, the user indicates the position of the menu entry. This is the way we've selected a menu entry in our program examples so far, by having the user type the entry's row and column numbers to make a selection. Another method for this procedure is to use an alternative input device, such as a joystick, to control a pointer on the screen. When the pointer has been moved opposite the desired menu entry, the joystick's button could be used to indicate that a selection is desired.

Program 1 is a passive selection algorithm that can replace lines 300-360 in any of the previous examples (April 1983) that allowed selection of a menu entry. Hitting any key during the pause time will select the indicated menu entry and place it in the message area of the screen. The format we're displaying has two top screen lines reserved for input functions (to be discussed in a later article), middle lines for the menu, and sufficient bottom lines for a message of 160 characters. Review part two of this series (June 1982) if a different menu setup is desired.

Program 1 shows how an arrow can be used on the PET computer to indicate that a menu entry is being scanned. Since the entries in a column have various lengths less than or equal to the column's width, it is necessary to calculate each entry's length for proper spacing in the message area. This is accomplished in lines 312 and 314 by the variable E. Line 530 embeds a space after each word entry placed in the message area. When we consider other user input options, we will provide a means of eliminating spaces between words and adding punctuation marks for those that need correspondence quality messages.

To make the message more readable on the screen, line 505 insures that no words will be split at the right-hand edge of the screen. So far, our routine works well if your menu is composed only of columns of individual words. But, if any column has rows of characters (as in our DAILY menu), our selection process will not recognize the individual characters, but will put the entire row into the message area. It will be easier to adjust for the selection of individual characters if we agree that all character columns will appear on the right-hand side of the screen.

If the number of such columns is to vary from menu to menu, then we will need to add another menu parameter, CC, which will give the number of character columns in the menu. For our DAILY menu, CC=1, and for our TIME menu, CC=0. In

Program 1 (April, p. 135) CC should be appropriately added to lines 20 and 330; and in Programs 2 and 3 (April, p. 135), to line 216.

Scanning Display Indicators

We will change the selection process in Program 1 so that if a selection of a character row is made, then a secondary scanning will be done within that row. We can do this easily for highlighting and flashing, but only with at least one blank line between menu rows when using the arrow indicator. Notice that neither the automatic embedding of spaces nor the prevention of word-splitting is used with character selections. If you always have a space as one of the characters in your column of characters, and if you plan ahead, these omissions should not be a problem.

When forming a word from a column of characters, you usually need multiple letter selections. This can be accomplished by scanning the character column until no more selections are made from it. Otherwise, in a sequential scanning procedure, there could be a considerable time delay between the selection of consecutive characters. After a character selection is made, you could continue the scan from the same character selected, from the start of the selected character's row, or from the start of the selected character's column. The last option gives the greatest flexibility, especially if the characters are arranged according to frequency of use. To achieve the first option, change line 465 to GOTO 444; for the second option, change line 465 to GOTO 442; and for the third option, change line 465 to K=1:RETURN, and add the following line:

```
318 IF K THEN K=0:R=1:GOTO 310
```

The improvements discussed for Program 1 have been incorporated in the following example. Program 2 employs an active user response procedure on a VIC computer, where a joystick is used to control the movement of a pointer and the joystick's button is used for selecting. A delay may be helpful; otherwise, multiple selections may unexpectedly result.

Try an arrow delay at line 465, a button delay at 470, and/or a character selection delay at 478, using FOR DE=1 TO 100:NEXT DE preceding the contents of the line(s) indicated. Notice that the original menu was shortened so the arrow could fit to the right of each column of the menu. Also, since the joystick routine can interfere with normal keyboard operation, be sure to push the RUN and RESTORE keys together to reset normal operations if the program is stopped in line 400.

Program 1:
PET Computer Using Arrow Indicator

```
299 REM DE=DELAY FOR PAUSE, PM=# OF POSITI
    ONS IN MESSAGE AREA, J=CURRENT POS.
300 DE=100:SP=32768:HA=159:J=0:PM=200:REM
    HA=SCREEN VALUE FOR HORIZONTAL ARROW
303 SM=SP+W*25-PM:VA=158:REM SCREEN VALUE
    FOR VERTICAL ARROW
305 FOR C=1 TO CM: FOR R=1 TO RM
310 PA=SP+(SR-1)*W+(R-1)*W+(R-1)*BR*W+S(C)
    -1+L(C):REM PA=SCREEN POS. OF ARROW
312 P1=PA-L(C):P2=PA-1:E=P2:FORI=P2TOP1STE
    P-1:IFPEEK(I)<>32THENE=I:I=P1
314 NEXTI
315 POKE PA,HA:GOSUB400:POKEPA,32
320 NEXT R,C
325 GOTO305
399 REM USER RESPONSE ROUTINE
400 X=0: P=0
410 GET A$: IF A$<>""THEN 500
420 P=P+1: IF P<DE THEN 410
430 RETURN
499 REM PUT SELECTION INTO MESSAGE AREA
500 P1=PA-L(C): P2=PA-1:REM P1=START OF EN
    TRY, P2=END OF ENTRY
505 Y=W-(J-W*INT(J/W)+1):IFE-P1>=YTHENJ=J+
    Y+1:IFJ>=PMTHENJ=0
510 FOR I=P1 TO E:POKE SM+J,PEEK(I)
520 J=J+1:IF J=PM THEN J=0
530 NEXTI:POKESM+J,32:J=J+1:IF J=PM THEN J=0
540 RETURN
```

Program 2:
For The Unexpanded VIC Computer

Note: This program uses a joystick in an active selection process with an arrow indicator, character selection, and different colors for the menu and message.

```
8 REM HIT RUN/RESTORE WHEN PROGRAM IS ST
  OPPED
9 REM DELETE REMARKS TO FIT PROGRAM ON U
  NEXPANDED VIC
10 PRINT CHR$(147);: REM CLEAR TEXT SCREE
20 W=22:RM=6:BR=1:CM=4:BC=1:RI=2:SR=3:SC=
   1:CC=1:REM CC=# OF CHARACTER COLUMNS
25 DIM S(CM),L(CM):S(1)=SC
30 DATA 3,3,5,7:REM COLUMN WIDTHS/LAST ON
   E SHORTENED TO FIT POINTER ON SCREEN
35 IF C=1 THEN 50
38 REM CALCULATE STARTING POSITION FOR EA
   CH COLUMN
40 FOR I=2 TO CM:READ L(I-1):S(I)=S(I-1)+
   L(I-1)+BC:NEXT I:READ L(CM)
50 IF SR=1 THEN 70
60 FOR X=1 TO SR-1:PRINT:NEXT X:REM POSIT
   ION CURSOR TO FIRST ROW OF MENU
65 LP=S(CM)+L(CM)-1:IF LP>W THEN 200
70 TP=0:FOR R=1 TO RM:FOR C=1 TO CM:READ
   M$
75 P=S(C)-1+TP
80 PRINT TAB(P);M$;:NEXT C
90 IF S(CM)+LEN(M$)-1<W THEN PRINT:GOTO 1
   00:REM WRAPAROUND ADVANCES A LINE
95 IF BR=0 THEN TP=TP+W:IF TP>87 THEN TP=
   0:REM UPDATE TAB IF LINE ENDS W/NO LF
100 IF BR=0 THEN 120
110 FOR B=1 TO BR:PRINT:NEXT B:REM SKIP BL
    ANK ROWS BETWN COLUMN ENTRIES
120 NEXT R
130 GOTO 300
140 DATA DR.,IS,COLD,INGEDS1
145 DATA I,AM,WHEN," AOTFR3"
150 DATA YOU,ARE,DRINK,.ULHCP5
155 DATA MOM,EAT,WANT,?MYWKB7
160 DATA DAD,NO,TIME,",VJQZX9"
165 DATA HOT,YES,SLEEP,";$02468"
200 PRINT "MENU SIZE ERROR!":END
```

```
290 REM SP=STARTING MEMORY AREA FOR SCREEN
    /CP=COLOR MAP FOR SCREEN
292 REM CL=MENU COLOR/HA=HORIZONTAL ARROW/
    VA=VERTICAL ARROW
294 REM J=# OF POSITIONS USED IN MESSAGE A
    REA
300 SP=7680:CL=PEEK(646):CP=38400-SP:HA=15
    9:J=0:PM=110
301 XD=37154:XR=37152:XL=37151:POKE37139,0
    :REM JOYSTICK REGISTERS
302 REM SM=STARTING POSITION FOR MESSAGE A
    REA/PM=# OF POSITIONS IN MESSAGE AREA
303 SM=SP+W*23-PM:VA=158:MC=2:IF CL=2 THEN
    CL=6:REM MC=RED MESSAGE COLOR
305 C=1:R=1:REM C=MENU COLUMN #/R=MENU ROW#
310 PA=SP+(SR-1)*W+(R-1)*W+(R-1)*BR*W+S(C)
    -1+L(C)
311 REM P1=STARTING POSITION, P2=END OF CO
    LUMN POSITION FOR MENU ENTRY
312 P1=PA-L(C):P2=PA-1:E=P2:FOR I=P2 TO P1
     STEP-1:IF PEEK(I)<>32 THEN E=I:I=P1
313 REM E=ENDING POSITION FOR MENU ENTRY/P
    A=SCREEN POSITION FOR HOR. ARROW
314 NEXT I
315 POKE PA,HA:POKE PA+CP,MC
320 GOSUB 400
330 IF Z=5 THEN 470
340 IF Z=4 THEN R=R+1
350 IF Z=3 THEN R=R-1
360 IF Z=2 THEN C=C+1
370 IF Z=1 THEN C=C-1
375 IF C<1 THEN C=1
377 IF R<1 THEN R=1
380 IF C>CM THEN C=CM
385 IF R>RM THEN R=RM
390 POKE PA,32:GOTO 310
399 REM WAIT FOR JOYSTICK MOVE OR BUTTON
400 Z=0:POKE XD,127:XV=PEEK(XR)AND128:POKE
     XD,255:IF XV=0 THEN Z=2:GOTO 460
410 XV=PEEK(XL):IF (XVAND63)=63 THEN 460
420 IF (XVAND4)=0 THEN Z=3
430 IF (XVAND8)=0 THEN Z=4
440 IF (XVAND16)=0 THEN Z=1
450 IF (XVAND32)=0 THEN Z=5
460 IF Z=0 THEN 400
465 RETURN
469 REM CHARACTER SELECTION
470 IF C<CM-CC+1 THEN GOSUB500:GOTO 320
472 I=P1:POKE PA,32
474 POKE I+W,VA:POKE I+W+CP,MC
476 GOSUB 400
478 IF Z<>5 THEN 484
480 Z=0:POKE SM+J,PEEK(I):POKE SM+J+CP,MC:
    J=J+1:IF J=PM THEN J=0
482 GOTO 476
484 POKE I+W,32:IF Z=4ORZ=3 THEN 340
486 IF Z=2 THEN I=I+1:IF I>E THEN 340
488 IF Z=1 THEN I=I-1:IF I<P1 THEN 340
490 GOTO 474
499 REM ADD SELECTION TO MESSAGE
500 P1=PA-L(C):P2=PA-1
504 REM NO WORD SPLITTING AT RIGHT EDGE OF
     SCREEN
505 Y=W-(J-W*INT(J/W)+1):IF E-P1>=Y THEN J
    =J+Y+1:IF J>=PM THEN J=0
510 FOR I=P1 TO E:POKE SM+J,PEEK(I):POKE S
    M+J+CP,MC
520 J=J+1:IF J=PM THEN J=0
525 REM EMBED SPACE AFTER NON-CHARACTER SE
    LECTIONS
530 NEXT I:POKE SM+J,32:POKE SM+J+CP,MC:J=
    J+1:IF J=PM THEN J=0
540 Z=0:RETURN
```

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Data Searcher

Jerry Sturdivant

Programmers are always looking for ways to make their programs more "friendly," easier to use.

This special search routine will accept all kinds of wrong input and still come up with the right match. For VIC, PET, and 64.

Have you ever searched through a file for something but just couldn't find it? You know it's in there, but your spelling may be off by one letter and the strings just won't match?

Or you know the city of Albuquerque is in the program, but you can't spell it? Or you don't know if you're supposed to add the state? And if you *do* need to type the state, should you use the two-letter abbreviation? Is New Mexico supposed to be NE or NM?

In short, if a program has to search for a string match, you can solve all these problems by adding a Truncating Search Routine.

Let's look at the example program. Here a user enters the name of a city, and the program gives the elevation. If no match is found for the user's request, rather than having line 120 report "CITY NOT FOUND": GOTO 70, the program performs a *truncating search* (lines 160 to 210).

The routine searches only that first part of each City string equal to the length of the Request string. If there is no match, it shortens the end of the Request string by one letter and searches the shorter portion of each City string. It will continue to shorten and search until it finds a match or runs down to two letters. It will print all matches found for that length Request string.

Suppose the user gets the two-letter abbreviation of Maine wrong. If the user requests PORTLAND MA rather than ME or types out the complete word "MAINE", it will still find PORTLAND ME. If the user requests just PORTLAND, the search will print both PORTLANDs. As for our Albuquerque problem, the word can be badly misspelled and still be found. A user who understands the Truncating Search would just enter ALBU. It's a very handy and user-friendly routine, especially for poor spellers.

Data Searcher Demonstration Program

```
10 REM PICK CITY - PRINT CITY AND ELEVATI
   ON
20 NUMBER OF CITIES=5
30 DIM CITY$(NUMBER OF CITIES),ELEV$(NUMB
   ER OF CITIES)
40 FOR I=1 TO NUMBER OF CITIES
50 READ CITY$(I),ELEV$(I)
60 NEXT
70 T=0:PRINT"ENTER CITY NAME"
80 INPUT REQUEST$
90 FOR I=1 TO NUMBER OF CITIES
100 IF REQUEST$=CITY$(I) THEN PRINT CITY$(
    I),ELEV$(I):GOTO 70
110 NEXT
120 REM       NOTHING FOUND
130 REM  SEARCH SIMILAR SPELLING
140 REM ========================
150 PRINT"SEARCHING FOR SOMETHING SIMILAR
    "
160 FOR Z=LEN(REQUEST$) TO 2 STEP -1
170 FOR I=1 TO NUMBER OF CITIES
180 IF LEFT$(REQUEST$,Z)=LEFT$(CITY$(I),Z)
     THEN PRINT CITY$(I),ELEV$(I):T=1
190 NEXT I
200 IF T THEN 70
210 NEXT Z
220 PRINT"CITY NOT FOUND":GOTO 70
230 REM           DATA
240 REM        8888888888
250 DATA ALBUQUERQUE NM,4500
260 DATA BISHOP CA,4100
270 DATA PORTLAND MA,45
280 DATA PORTLAND OR,37
290 DATA THE DALLES OR,85
```

©

Apple Shape Generator

J. F. Johnson

The Apple computer allows shapes to be manipulated from within a BASIC program. Although shapes are very useful in two-dimensional dynamic graphics, the process of creating shapes and entering them into a shape table is tedious, and errors are exceedingly difficult to correct. This program simplifies the process of defining a shape. All required binary to hexadecimal conversions require no user intervention and a shape table is automatically constructed, with each new shape added to the current table.

Many of the shape-drawing routines currently available for the Apple allow a shape to be created within a rectangular drawing area, with a bit map of this entire area, then stored as the shape. This technique is fine for creating relatively small shapes. However, as the size of the shape increases (so that the rectangular area the size of either hi-res page is required to enclose the shape), the amount of wasted space (i.e., bytes which are "off" and represent only the background) becomes considerable. A bit map of a shape requiring a rectangular area of this size would require 7-8 K.

This program creates shapes in the manner explained in the Applesoft manual (Chapter 9). The head-to-tail vector method is used to initially define the shape. These vectors are then "unwrapped" and sequentially combined in pairs for conversion from their individual binary codes into equivalent hexadecimal code. Each hexadecimal byte represents one byte in the shape definition. The shape is then added to the table in memory with the table's index also updated. Shapes which would have required up to 8K in a table have been reduced to less than 1K using this program.

Capabilities Of Key Shape Maker

The following can be accomplished with Key Shape Maker:

1) Construct a shape table comprised of 1-255 shapes.
2) Create a table with a maximum length of 6K.
3) Alter any shape after it has been entered into the table. Also, add "buffer bytes" at the end of each shape definition so that any shape can be slightly enlarged relative to its original definition.
4) Correct mistakes which occur while entering vectors during a shape definition by erasing them in a sequential fashion.
5) View all the shapes in the current table (using the game paddles).
6) Display any particular shape, with the effect of ROT and SCALE variations (using the game paddles) on the shape immediately displayed on the hi-res screen.
7) Once a shape table is BSAVEd to diskette using this utility, it may be BLOADed with the utility and the stored shapes redefined and new shapes added (assuming the table does not contain the maximum number of shapes originally designated).
8) The current shape table in RAM can be destroyed, and a new table created or an old table BLOADed into memory.

Use An EXEC File To Initialize

The entire program is written in Applesoft. The following program creates a text file, "Key Shape Loader", which reassigns the beginning of the program pointer (104, 103) and then RUNs the program.

Program 1.

```
5  REM  KEY SHAPE LOADER MAKER
10 D$ =  CHR$ (4)
15  PRINT D$"MON C,I,O"
17  PRINT D$"DELETE KEY SHAPE LOADER"
20  PRINT D$"OPEN KEY SHAPE LOADER"
30  PRINT D$"WRITE KEY SHAPE LOADER"
40  PRINT "POKE 104,96"
50  PRINT "POKE 103,1"
60  PRINT "POKE 24576,0"
70  PRINT "RUN KEY SHAPE MAKER"
80  PRINT D$"CLOSE KEY SHAPE LOADER"
90  END
```

By EXECing the text file Key Shape Loader, the required POKEs are completed, and then the Applesoft program "Key Shape Maker" is RUN.

Use Of RAM By "Key Shape Maker"

The Applesoft program is LOADed at $6001 (24577), just above the second hi-res page of graphics. The second hi-res page is used for the temporary storage of vectors that define the current shape. These vectors are then paired and converted into their equivalent hexadecimal code, with the resulting hex code defining the shape

stored on the second hi-res page. If the shape is to be saved, the hex code is then transferred to the shape table. The creation and display of all shapes utilizes the first hi-res page. The shape table is stored at $800 (2048), and its length may not exceed $2000 (8196) since the first hi-res page is used for display purposes.

Execution

The user is initially prompted for the number of shapes that will be entered into the table. Since extra shapes are invariably required at a future date, it is always best to enter a number larger than what is currently estimated. The minimum number is 1, and the maximum is 255. Since the table need not be completed at one setting, the partially constructed table can be BSAVEd, then BLOADed at a future date, with additional shapes added (up to the original number that was user-specified) or current table shapes redefined.

This maximum number of shapes is then POKEd into $801. Room for the shape table index (which immediately follows starting at $802) is then allocated. The index stores the locations of all shapes relative to the start of the table ($800). The index must contain two bytes for each stored shape. If the estimated number of shapes to be stored in this table is low, it will not be possible to exceed this limit since room in the table for the index can not be changed using this program. Location $800 initially contains a value of zero, and is incremented by one upon the addition of each shape to the table.

The shapes are created using two different sets of four keys. Plotting vectors are entered using the I, K, M, and J keys, while the nonplotting vectors are entered using the E, D, X, and S keys. Both sets of keys are arranged on the keyboard in a north-east-south-west fashion, with the right-hand set for plotting and the left-hand set for nonplotting. The back arrow key (<-) may be used to sequentially erase vectors starting with the last one entered, and is very useful for correcting any mistakes. The keystroke "!" (a shift-1) terminates the shape definition.

Prior to the actual construction of the shape, a "dot-cursor" is positioned on the first hi-res screen. This is the point at which the shape definition is initiated. The shape is then displayed as it is constructed, using the previously defined keystrokes. Due to the algorithm used to display the shape as it is defined, any nonplotting vectors which cross any existing outline of the shape will result in the boundary being erased where the crossover occurs.

However, when the final shape is displayed for verification, it will exhibit the contiguous boundary that was originally constructed. Also displayed during the construction of the shape are the current x and y coordinates of the "dot-cursor," the three-digit binary code of each vector as it is entered, and the maximum number of bytes which may be used to define the present shape.

When the definition of the shape is terminated, the keystroke vectors are converted to hexadecimal code, with the resulting shape displayed prior to its storage in the table. If the user chooses to save the shape, he or she appends it to the current table, updates the corresponding index locations, and increments location $800 by one. If the shape is not saved, the defining of additional shapes simply continues.

Applesoft Shape Table Commands

Several subroutines in this program allow the user to experiment with several shape table commands and to view the result. This was purposely included to aid the user in exploring the capabilities (as well as the limitations) of shapes within Applesoft. This will perhaps facilitate inclusion of shape tables within programs.

The SCALE command allows the expansion of a defined shape. Since the originally defined shape is constructed using the smallest SCALE value, a figure may only be expanded using this command. It will soon be discovered, however, that the contiguous boundary of a shape may become segmented when its size is enlarged through SCALEing, and may rapidly become unrecognizable. This can usually be overcome by redefining the same shape boundary using a different sequence of plotting/nonplotting vectors. The ability to redefine any given shape will allow the user to experiment.

Rotations in the plane of the screen are controlled by the ROT command. An inverse relationship exists between the number of unique rotational values defined by the ROT command and the SCALE command. Increasing ROT from 0 to 64 will rotate it 360 degrees about the origin. As the value for SCALE increases from 0, more unique rotational values are recognized between the ROT values of 0 and 64, and hence the incremental rotational angle decreases. By making the original shape very small, and then expanding it using the SCALE command, a smaller angle of rotation can be realized between the ROT values of 0 and 64. The values for both of the commands may be varied for a chosen shape, with the effects on the shape displayed on the screen.

A shape may be displayed from Applesoft using either the DRAW or XDRAW commands. The XDRAW command simply complements the current color of the shape at its present location and is very convenient for displaying and erasing shapes. The DRAW command requires that HCOLOR be changed from a value of 3 to 0 if the shape is to first be drawn and then erased. These commands may also display the same shape differently. If any nonplotting vectors cross the boundary of plotting vectors in the original shape definition, the DRAW command (HCOLOR=3) will display a contiguous shape.

The XDRAW command, however, displays the shape with any regions of plotting/nonplotting vector overlap being effectively erased. This should be taken into consideration when originally defining the shape boundary, since one of the two display techniques may be preferred in the Applesoft program which uses the shapes. The shape display for verification purposes (prior to appending the shape to the current table) is displayed using DRAW (HCOLOR=3). During viewing of a shape in the current table with ROT and SCALE variations, the shape is drawn and erased using XDRAW.

Using A Shape Table

Key Shape Maker creates a shape table starting at $800 (2048) in RAM. It may be BLOADed into another region if there exists a conflict with the storage of the controlling Applesoft program or a machine language program which must occupy this region. There are two DOS entry points which store both the starting address and length of a BLOADed file. Since the user determines the starting address of a binary file, only the length must be determined. This is accomplished in the following manner.

After BSAVEing your shape table to diskette, BLOAD it back into memory (this may be done in direct execution or under Key Shape Maker control). If the shape table has been loaded by an Applesoft program, press the reset button. Now enter the following as a direct execution instruction, where <ret> simply designates pressing the return key.

PRINT PEEK(43616) + PEEK(43617) * 256 <ret>

The base ten number that appears on the screen immediately after this instruction is the length of the shape table (see Appendix E of the DOS manual, DOS Entry Points And Schematics). Using this additional piece of information, the user is offered some flexibility in BLOADing the shape table into various regions of RAM. For example, a shape table of byte length 350 may be BLOADed at location 24577 (immediately above the second hi-res page) with the following instruction in an Applesoft statement.

100 PRINT CHR$(4) "BLOAD SHAPE TABLE-1, A24577, L350"

The final piece of information which must be supplied is the location of the shape table. The pointer designating the beginning of the current shape table is located on the zero page of memory, and is comprised of the locations $E8 (232) and $E9 (233). The integer value obtained by dividing the starting address by 256 is POKEd into 233, with the remainder POKEd into 232 (i.e., 24577/256=96 with a remainder of 1).

110 POKE 233,96 : POKE 232,1

Your Applesoft program will now be able to effectively use the shape table currently residing in RAM.

Program 2.

```
5  REM  KEY SHAPE MAKER
60  REM    TS=START OF SHAPE TABLE///VC=MARK
     ER USED IN DISPLAY OF 6 DIGITS REPRESEN
     TING 2 VECTORS///VS=MARKER FOR START OF
      TEMPORARY STORAGE FOR VECTOR TABLE AND
      ENSUING TEMPORARY STORAGE DERIVED SHAP
     E///16395=START OF TEMPORARY SHAPE TABL
     E
70 A$ = "PRESS ! TO STOP DRAWING SHAPE."
80 TS = 2048: POKE TS,0:VC = 16389:VS = 1639
     6:LI = 2050:MI = 2051:D$ =  CHR$ (4): GOTO
     4000
100  HCOLOR= 3: HPLOT X,Y: FOR J = 1 TO 20: NEXT
     J: HCOLOR= 0: HPLOT X,Y:X =  PDL (0) /
     .913:Y =  PDL (1) / 1.6: IF  PEEK ( - 1
     6287) > 127 OR  PEEK ( - 16286) > 127 THEN
      RETURN
105  GOTO 100
110 S1 =  INT (1 +  PDL (0) * ( PEEK (TS) -
     1) / 240): ROT= 0: HCOLOR= 3: SCALE= 1:
      RETURN
115 S2 =  INT (1 +  PDL (0) * ( PEEK (TS) -
     1) / 240): RETURN
120  XDRAW S1 AT X,Y: VTAB 24: HTAB 1: CALL
      - 868: PRINT "SHAPE #"S1".";
125  GOSUB 115: IF  PEEK ( - 16287) > 127 THEN
      RETURN
130  IF S2 <  > S1 THEN  XDRAW S1 AT X,Y:S1 =
     S2: GOTO 120
135  GOTO 125
140  GOSUB 110
145  VTAB 5: HTAB 1: CALL  - 868: PRINT "SHA
     PE #"S1"."
150  GOSUB 115: IF S2 <  > S1 THEN S1 = S2: GOTO
     145
152  IF  PEEK ( - 16287) > 127 THEN  RETURN
154  GOTO 150
158 S1 =  INT ( PDL (1) * 7 / 240): RETURN
159 S2 =  INT ( PDL (1) * 7 / 240): RETURN
160  GOSUB 158
162  VTAB 10: HTAB 1: CALL  - 868: PRINT "HC
     OLOR="S1"."
164  GOSUB 159: IF S2 <  > S1 THEN S1 = S2: GOTO
     162
166  IF  PEEK ( - 16286) > 127 THEN  RETURN
168  GOTO 164
170  GOTO 166
172 R1 =  PDL (0) / 3:S1 =  PDL (1) / 3: RETURN
173 R2 =  PDL (0) / 3:S2 =  PDL (1) / 3: RETURN
174  GOSUB 172
175  HCOLOR= HC: ROT= R1: SCALE= S1: DRAW SH
      AT XI,YI: VTAB 24: HTAB 1: CALL  - 868
     : PRINT "ROT=" INT (R1) SPC( 8)"SCALE="
      INT (S1);
176  GOSUB 173: IF R2 <  > R1 OR S2 <  > S1 THEN
     R1 = R2:S1 = S2: CALL 62450: GOTO 175
177  IF  PEEK ( - 16287) > 127 OR  PEEK ( -
     16286) > 127 THEN  RETURN
178  GOTO 176
200  POKE TS + 1, VAL (NS$): RETURN : REM  M
     AXIMUM NUMBER OF SHAPES THAT CAN BE ENT
     ERED INTO THIS TABLE
203 PA = 256 *  PEEK (MI) +  PEEK (LI) + TS:
      RETURN
205 PA = TS + 4 + 2 *  VAL (NS$): RETURN : REM
      IS LOCATION IN TABLE WHERE FIRST SHA
     PE WILL BE SAVED
210 LS = TS + 2 * SH:MS = TS + 1 + 2 * SH:DD
      = 256 * ( PEEK (MS + 2) -  PEEK (MS)) +
      ( PEEK (LS + 2) -  PEEK (LS)): RETURN
```

```
212 LI = TS + 2 * ( PEEK (TS) + 1):MI = LI +
     1: RETURN : REM  INIT INDEX FOR TABLE
     THAT HAS BEEN LOADED
215 LI = LI + 2:MI = MI + 2: RETURN : REM
     INCREMENT INDEX LOCATION FOR NEXT SHAPE
220 LI = LI - 2:MI = MI - 2: RETURN : REM
     DECREMENT INDEX LOCATION FOR FIRST SHAP
     E TO BE DRAWN IN LOADED OR ALTERED TABL
     E
225 IP = VS: RETURN : REM  INITIALIZE LOCATI
     ON WHERE PLOTTED VECTORS ARE STORED TEM
     PORARILY UNTIL THEY ARE CONVERTED INTO
     A SHAPE
230 N = VS + 1:SL = VS + 1: RETURN : REM  IN
     ITIALIZE TWO COUNTERS WHICH ARE USED DU
     RING THE CONVERSION OF STORED VECTORS I
     NTO A SHAPE
235 PA = TS + 256 *  PEEK (MS) +  PEEK (LS):
      RETURN : REM  LOCATION IN TABLE OF STA
     RT OF NEXT SHAPE
240  POKE LI, INT ((((PA - TS) / 256) -  INT
     ((PA - TS) / 256)) * 256 + .5): POKE MI
     , INT ((PA - TS) / 256): RETURN : REM
      POKE STARTING LOCATION FOR GIVEN SHAP
     E IN APPROPRIATE INDEX LOCATION
250 A = 0:B = 0:C = 0: RETURN : REM   INITIA
     LIZE A,B,C TO ZERO
255 L = IP - VS:K =  INT (L / 2) +  INT ((L /
     2 -  INT (L / 2)) * 2 + .05): RETURN : REM
      L=#BYTES CONTAINING VECTORS///K=#BYTES
      REQUIRED TO STORE SHAPE;1 SHAPE BYTE P
     ER 2 VECTOR BYTES
260  POKE 233,64: POKE 232,9: POKE 16393,1: POKE
     16395,4: POKE 16396,0: RETURN : REM   D
     EFINE UNIT SHAPE TABLE WHERE TEMPORARIL
     Y DEFINED SHAPE EXISTS
265  POKE 233,8: POKE 232,0: RETURN : REM  L
     OCATION OF SHAPE TABLE
270 RS =  PEEK (TS + 1) -  PEEK (TS): RETURN
     : REM   RS=# OF SHAPES THAT MAY STILL B
     E ENTERED INTO SHAPE TABLE
299  REM  PLOT/ERASE POINT AT CURRENT X,Y UN
     TIL KEY PRESS OCCURS.
300 XO = X:YO = Y: HCOLOR= 3: HPLOT XO,YO: FOR
     J = 1 TO 20: NEXT J: HCOLOR= 0: HPLOT X
     O,YO: FOR J = 1 TO 20: NEXT J: IF  PEEK
     ( - 16384) < 128 THEN 300
310  HCOLOR= 3: POKE  - 16368,0:Z =  PEEK ( -
     16384): RETURN
324  REM  PLOT PRESENT POINT IF ENTERED VEC
     TOR IS A PLOT-THEN-MOVE VECTOR
325  HCOLOR= 3: HPLOT XO,YO: RETURN
329  REM  ERASE PREVIOUS POINT PLOTTED
330  HCOLOR= 0: HPLOT XO,YO: RETURN
349  REM  EVALUATE KEY PRESS IN TERMS OF NEW
      X,Y COORDINATES.
350 F1 = 0
352  IF Z = 73 OR Z = 69 THEN Y = Y - 1: GOSUB
     362: RETURN : REM  MOVE UP
354  IF Z = 75 OR Z = 68 THEN X = X + 1: GOSUB
     364: RETURN : REM   MOVE RIGHT
356  IF Z = 77 OR Z = 88 THEN Y = Y + 1: GOSUB
     366: RETURN : REM  MOVE DOWN
358  IF Z = 74 OR Z = 83 THEN X = X - 1: GOSUB
     368: RETURN : REM   MOVE LEFT
360 F1 = 1: RETURN : REM   FLAG F1 SET TRUE
     IF NO U,R,D,L MOVE
362  IF Y < 0 THEN Y = 0:F1 = 1
363  RETURN
364  IF X > 279 THEN X = 279:F1 = 1
365  RETURN
366  IF Y > 159 THEN Y = 159:F1 = 1
367  RETURN
368  IF X < 0 THEN X = 0:F1 = 1
369  RETURN
399  REM  EVALUATE 3 DIGIT BINARY EQUIVALENT
      OF INDIVIDUAL VECTOR
400 F1 = 0: IF Z = 73 THEN A = 1:B = 0:C = 0
     : RETURN
402  IF Z = 75 THEN A = 1:B = 0:C = 1: RETURN
404  IF Z = 77 THEN A = 1:B = 1:C = 0: RETURN
406  IF Z = 74 THEN A = 1:B = 1:C = 1: RETURN
408  IF Z = 69 THEN A = 0:B = 0:C = 0: RETURN
410  IF Z = 68 THEN A = 0:B = 0:C = 1: RETURN
412  IF Z = 88 THEN A = 0:B = 1:C = 0: RETURN
414  IF Z = 83 THEN A = 0:B = 1:C = 1: RETURN
418 F1 = 1: RETURN
424  REM  PRINT PRESENT COORDINATES OF X,Y
425  VTAB 21: HTAB 1: CALL  - 868: PRINT "X=
     "X,"Y="Y: RETURN
449  REM  ERASE CURRENT POINT AND MOVE BACK
     ONE POINT
450 PP =  PEEK (IP): IF IP = VS THEN  RETURN
     : REM  CAN'T ERASE PAST ORIGIN OF SHAPE
455  IF PP = 0 OR PP = 4 THEN Y = Y + 1: GOSUB
     475: RETURN
460  IF PP = 1 OR PP = 5 THEN X = X - 1: GOSUB
     475: RETURN
465  IF PP = 2 OR PP = 6 THEN Y = Y - 1: GOSUB
     475: RETURN
470  IF PP = 3 OR PP = 7 THEN X = X + 1: GOSUB
     475: RETURN
475 XO = X:YO = Y: GOSUB 330: POKE IP,0:IP =
     IP - 1: RETURN
499  REM  POKE VECTOR INTO RAM LOCATION IP
500 IP = IP + 1: POKE IP,4 * A + 2 * B + C: RETURN
509  REM  POKE BINARY EQUIVALENT OF VECTOR M
     OVE
510 P(1 + I * 3) = A:P(2 + I * 3) = B:P(3 +
     I * 3) = C
515  IF I = 1 THEN  FOR J = 0 TO 5: POKE 187
     2 + J,48: NEXT J: FOR J = 0 TO 2: POKE
     1875 + J,P(4 + J) + 48: NEXT J: RETURN
520  FOR J = 0 TO 2: POKE 1872 + J,P(1 + J) +
     48: NEXT J: RETURN
525  FOR J = 1 TO 6:P(J) = 0: NEXT J: RETURN
600  HGR2 : HGR : SCALE= 1: ROT= 0: HCOLOR=
     3:XX = 139:YY = 80:X = XX:Y = YY: RETURN
     : REM    HI-RES INITIALIZATION
700 BL = 8190 - PA:DI = 24576 - 16396:VL = D
     I: RETURN : REM  NEW TABLE BYTE LIMITS
710 NS =  PEEK (2048):LI = TS + 2 * (NS + 1)
     :MI = TS + 1 + 2 * (NS + 1):PA = TS + 2
     56 *  PEEK (MI) +  PEEK (LI)
720 BL = 8190 - PA: IF DI < 2 * (8190 - PA) THEN
     VL = DI: RETURN
730 VL = 2 * (8190 - PA): RETURN
765 F1 = 0: IF VL < 100 THEN F1 = 1
767  RETURN
770 F2 = 0: VTAB 21: PRINT "THERE ARE "8190 -
     PA" BYTES REMAINING FOR MORE": PRINT "S
     HAPES IN CURRENT TABLE IF YOU HAVE NOT
     CONSTRUCTED THE LAST SHAPE."
775  IF 8190 - PA < 100 THEN  PRINT "NO MORE
      SHAPES MAY BE ADDED TO CURRENT  TABLE.
     ":F2 = 1
780  RETURN
800 F3 = 0:VL = VL - 1: VTAB 21: HTAB 33: CALL
      - 868: PRINT VL
805  IF VL < 200 THEN  VTAB 22: HTAB 1: PRINT
     "ONLY "VL - 190" MOVES LEFT.";: FOR J =
     1 TO 1000: NEXT J: HTAB 1: CALL  - 868:
      IF VL <  = 191 THEN F3 = 1
810  RETURN
975  VTAB 24: HTAB 5: CALL  - 958: PRINT "PR
     ESS ANY LETTER TO CONTINUE.";: GET Z$:J
      =  FRE (0): RETURN
999  REM  INITIALIZE SHAPE TABLE PARAMETERS
1000  TEXT : HOME : PRINT  TAB( 5);"THE NUMB
     ER OF SHAPES THAT MAY BE    ENTERED IN
     A SHAPE TABLE IS IN THE RANGEOF 1-255.
      IT IS ALWAYS BEST TO ALLOW   EXTRA ROO
     M FOR ADDITIONAL SHAPES YOU MAYWISH TO
     INCLUDE IN THE FUTURE."
1010  INPUT "      ENTER A NUMBER BETWEEN 1 A
     ND 255,  THEN PRESS RETURN.";NS$: IF  VAL
     (NS$) < 1 OR  VAL (NS$) > 255 THEN 1000
1020  GOSUB 200: REM   POKE MAX # OF SHAPES
     THAT CAN BE ENTERED INTO THIS TABLE
1030  GOSUB 205: REM  INITIAL RAM LOCATION F
     OR FIRST SHAPE
1040  GOSUB 240: REM  STARTING POINT OF FIRS
```

```
     T SHAPE AND POKE INTO INDEX
1050  GOSUB 700: REM  BL,DI,VL
1055  RETURN
1060  GOSUB 250: REM  INITIALIZE COMPONENTS
     OF VECTOR MOVE
1070  GOSUB 600: REM  HI-RES INIT
1080  RETURN
1200  TEXT : HOME : PRINT  TAB( 5);"BEFORE A
     CTUALLY DRAWING A SHAPE,    THE BLINKIN
     G DOT MAY BE MOVED TO ANY    POSITION O
     N THE SCREEN.  USE THE E,S,D  AND X KEY
     S FOR DOT POSITIONING ONLY."
1205  PRINT "PRESS ! WHEN READY TO DRAW A SH
     APE."
1210  PRINT  TAB( 5);"THE SHAPE YOU ARE TO D
     RAW MAY THEN  BE COMPRISED OF PLOTTING
     AS WELL AS NON PLOTTING VECORS.  USE TH
     E E,S,D AND X   KEYS FOR NONPLOTTING VE
     CTORS, AND THE   I,J,K AND M KEYS FOR P
     LOTTING VECTORS."
1220  PRINT "THE LEFT ARROW KEY (<-) MAY BE
     USED TO  ERASE MISTAKES, AND THE ! KEY
     TO TERM-  INATE THE SHAPE.": PRINT
1240  PRINT  TAB( 1);"-NONPLOTTING-"; SPC( 9
     );"-PLOTTING-"
1250  PRINT  TAB( 2);"E-MOVE UP" SPC( 7)"I-P
     LOT THEN MOVE UP": PRINT  TAB( 2);"S-MO
     VE LEFT" SPC( 5)"J-PLOT THEN MOVE LEFT"
1260  PRINT  TAB( 2);"D-MOVE RIGHT" SPC( 4)"
     K-PLOT THEN MOVE RIGHT": PRINT  TAB( 2)
     ;"X-MOVE DOWN" SPC( 5)"M-PLOT THEN MOVE
      DOWN"
1270  PRINT  TAB( 12);"<-  ERASER": PRINT  TAB(
     12);"!   STOP"
1280  GOSUB 975
1285  HOME : VTAB 23: PRINT "PRESS ! WHEN YO
     U ARE READY TO DRAW YOUR SHAPE.": GOSUB
     600: GOSUB 425
1290  GOSUB 300: IF Z = 33 THEN XI = X:YI =
     Y: HOME : RETURN
1300  GOSUB 350: GOSUB 425: GOTO 1290
1350  GOSUB 225: GOSUB 425: GOSUB 525:I = 0:
      GOSUB 515: VTAB 22: HTAB 1: PRINT A$: IF
      NOT F5 THEN  GOSUB 720: GOSUB 800: IF
     F3 THEN  RETURN
1360 I = 1 - I: REM  TOGGLE
1370  IF F5 THEN  HTAB 1: VTAB 24: CALL  - 8
     68: PRINT "YOU HAVE UP TO "2 * DD - 3 -
     (IP - 16394)" MOVES LEFT.";: IF 2 * DD -
     3 - (IP - 16394) = 0 THEN  RETURN
1380  GOSUB 300: IF Z = 33 THEN  RETURN
1390  IF Z = 8 THEN  GOSUB 450: GOSUB 425: GOTO
     1360: REM  ERASE LAST MOVE
1400  IF Z = 69 AND I = 0 THEN  VTAB 22: HTAB
     1: PRINT "THIS MOVE HAS NO EFFECT ON TH
     E SHAPE.";: FOR J = 1 TO 2000: NEXT J: HTAB
     1: CALL  - 868: PRINT A$: GOTO 1370
1405  GOSUB 350: IF F1 THEN 1370: REM   EVAL
      KEY PRESS FOR NEW X,Y : SET FLAG F1 IF
      ILLEGAL
1410  GOSUB 400: REM  EVALUATE 3 DIGIT BINAR
     Y EQUILVALENT OF KEY PRESS
1420  GOSUB 500: REM  SAVE VECTOR MOVE WITH
     POKE
1430  GOSUB 510: REM  DISPLAY 'ACCUMULATOR'
     WITH TEXT POKES
1440  GOSUB 425: REM   PRINT NEW X,Y COORDS
     TO SCREEN
1450  IF Z > 72 AND Z < 78 THEN  GOSUB 325: REM
       PLOT POINT ON HI-RES FOR APPROPRIATE
     PLOTTING VECTOR
1455  IF  NOT F5 THEN  GOSUB 800: IF F3 THEN
      RETURN
1460  GOTO 1360
1500  GOSUB 230
1510  GOSUB 255
1520  FOR J = 1 TO K: POKE N,( PEEK (SL) + 8
      *  PEEK (SL + 1)):SL = SL + 2:N = N +
     1: NEXT J: POKE N,0: REM  POKE SHAPE 'O
     N TOP OF' VECTORS
1530  GOSUB 260: HGR : HCOLOR= 3: DRAW 1 AT
     XI,YI: GOSUB 265
1540  HOME : VTAB 21: PRINT "DO YOU WISH TO
     SAVE THIS SHAPE (Y/N)?";: GET Z$: IF Z$
      <  > "Y" AND Z$ <  > "N" THEN 1540
1545  IF F5 THEN  RETURN
1550  IF Z$ = "N" THEN  RETURN
1560  FOR J = N + 1 TO N + 2 + .25 * (N - VS
      + 1): POKE J,0: NEXT J: REM   EXPAND S
     HAPE 25% BY ADDING ZEROS AT END
1570 N = J - 1: FOR J = VS + 1 TO N: POKE PA
     , PEEK (J):PA = PA + 1: NEXT J: REM   T
     RANSFER SHAPE FROM TEMPORARY LOCATION T
     O SHAPE TABLE
1580 NS =  PEEK (TS):NS = NS + 1: POKE TS,NS
     : REM  INCREASE # SHAPES IN INDEX BY 1

1590  GOSUB 215: GOSUB 240: REM   POKE DATA
     INTO THIS INDEX LOCATION///INCREMENT IN
     DEX LOCATIION OF NEXT SHAPE
1610  RETURN
1700  GOSUB 600: HOME : VTAB 21: PRINT "USE
     THE GAME PADDLES TO POSITION THE DOTAT
     WHICH POINT THE SHAPE WILL BE DRAWN. PR
     ESS EITHER BUTTON WHEN READY TO VIEW  S
     HAPES.";
1720 X = 140:Y = 80: GOSUB 100:NS =  PEEK (2
     048): HOME : VTAB 21: PRINT "USE THE X
     GAME PADDLE TO VIEW ALL SHAPESIN CURREN
     T TABLE.  PRESS BUTTON WHEN    FINISHED
      VIEWING.": GOSUB 110: GOSUB 120: RETURN

1750  TEXT : HOME : PRINT  TAB( 5);"THE FOLL
     OWING SEQUENCE WILL BE      FOLLOWED IN
      VIEWING A SHAPE."
1755  PRINT : PRINT "1) INPUT SHAPE NO. USIN
     G X GAME PADDLE.": PRINT : PRINT "2) IN
     PUT HCOLOR USING Y GAME PADDLE.": PRINT
     : PRINT "3) MOVE SHAPE TO DESIRED POSIT
     ION.": PRINT : PRINT "4) USE X PADDLE T
     O VARY ROT, AND             Y PADDLE TO V
     ARY SCALE.": GOSUB 975
1760  HOME : PRINT  TAB( 5);"USE THE X GAME
     PADDLE TO CHOOSE YOURSHAPE NO.  PRESS T
     HE PADDLE'S BUTTON    WHEN FINISHED.": GOSUB
     140:SH = S1
1765  PRINT : PRINT  TAB( 5);"INPUT THE HCOL
     OR USING THE Y PADDLE.PRESS ITS BUTTON
     WHEN FINISHED.": GOSUB 160:HC = S1
1770  HGR : HOME : VTAB 21: PRINT  TAB( 5);"
     USE THE GAME PADDLES TO LOCATE THE  POI
     NT WHERE THE SHAPE WILL BE DRAWN.    PR
     ESS EITHER BUTTON WHEN FINISHED.": GOSUB
     100:XI =  INT (X):YI =  INT (Y)
1775  HOME : VTAB 21: PRINT  TAB( 5);"USE PA
     DDLES TO VARY ROTATION (X) ANDSCALE (Y)
     .  PRESS EITHER BUTTON TO STOP.": VTAB
     23: PRINT "SHAPE #"SH SPC( 3)"HCOLOR="H
     C SPC( 3)"X="XI SPC( 3)"Y="YI: GOSUB 17
     4: RETURN
1800  FOR J = N - VS + 1 TO DD:N = N + 1: POKE
     N,0: NEXT J
1810 N = VS + 1:J = 256 *  PEEK (MS) +  PEEK
      (LS) + TS: FOR K = 1 TO DD - 1: POKE J,
      PEEK (N):J = J + 1:N = N + 1: NEXT K: RETURN
3500  GOSUB 1000
3501  GOSUB 1060: REM  ENTRY FOR ADDING TO E
     XISTING TABLE
3502  HOME : GOSUB 770: GOSUB 975: IF F2 THEN
      RETURN
3505  GOSUB 270: HOME : TEXT : PRINT RS" SHA
     PES MAY BE ADDED TO THE CURRENT": PRINT
     "TABLE WHICH CONTAINS "; PEEK (2048);"
     SHAPES.": GOSUB 975
3510  IF  NOT RS THEN 3575
3515  HOME : PRINT  TAB( 5);"DO YOU WISH TO
     DRAW A SHAPE": PRINT "Y/N?";: GET Z$: IF
     Z$ <  > "Y" AND Z$ <  > "N" THEN 3515
3520  IF Z$ = "N" THEN 3575
3525  GOSUB 1200
3530  GOSUB 1350
3535  GOSUB 1500
3540  GOTO 3502
3575  RETURN
3650  GOSUB 8000: ONERR  GOTO 20000
3660  PRINT : PRINT D$"BLOAD"NA$",A"TS: GOSUB
     270: GOSUB 212: GOSUB 203: GOSUB 700: POKE
     216,0: RETURN
3670  HOME : PRINT  TAB( 5);"YOUR FILE NAME
     LENGTH IS ZERO.  DO  YOU STILL WISH TO
     BLOAD A SHAPE TABLE   FROM DISKETTE (Y/
     N)?": GET Z$: IF Z$ <  > "Y" AND Z$ <  >
```

```
      "N" THEN 3670
3680  IF Z$ = "N" THEN  RETURN
3690  IF Z$ = "Y" THEN 3650
4000  HOME : IF  PEEK (TS) > 0 THEN 4100
4010  PRINT  TAB( 5);"PRESS THE NUMBER OF YO
     UR CHOICE.": PRINT : PRINT "1) DRAW SHA
     PES/CONSTRUCT A SHAPE TABLE.": PRINT "2
     ) BLOAD A SHAPE TABLE THAT HAS BEEN
        CONSTRUCTED WITH THIS ROUTINE.": PRINT
     "3) QUIT."
4014  GET Z$: IF  VAL (Z$) < 1 OR  VAL (Z$) >
     3 THEN  HOME : GOTO 4010
4016  IF Z$ = "3" THEN 30000
4020  ON  VAL (Z$) GOSUB 3500,3650
4030  GOTO 4000
4100  HOME : PRINT  TAB( 5);"PRESS THE NUMBE
     R OF YOUR CHOICE.": PRINT
4105  PRINT : PRINT "1) DISPLAY SHAPES IN CU
     RRENT TABLE.": PRINT : PRINT "2) ADD SH
     APES TO CURRENT TABLE.": PRINT : PRINT
     "3) CHANGE A SHAPE IN CURRENT TABLE."
4110  PRINT : PRINT "4) BSAVE CURRENT TABLE
     TO DISKETTE.": PRINT : PRINT "5) DELETE
      TABLE CURRENTLY IN MEMORY.": PRINT : PRINT
     "6) QUIT.": PRINT
4120  GET Z$: IF  VAL (Z$) < 1 OR  VAL (Z$) >
     6 THEN 4100
4130  IF Z$ = "6" THEN 30000
4150  HOME : ON  VAL (Z$) GOSUB 5200,5400,56
     00,5800,6000
4160  GOTO 4000
5200  TEXT : HOME : IF  PEEK (TS) = 0 THEN  PRINT
     "THERE ARE NO SHAPES IN TABLE.": GOSUB
     975: RETURN
5205  GOSUB 265: PRINT  TAB( 5);"PRESS THE N
     UMBER OF YOUR CHOICE.": PRINT : PRINT "
     1) VIEW ALL SHAPES.": PRINT : PRINT "2)
      VIEW ONLY ONE SHAPE.": PRINT : PRINT "
     3) RETURN TO MAIN MENU."
5210  GET Z$: IF  VAL (Z$) < 1 OR  VAL (Z$) >
     3 THEN 5200
5215  IF Z$ = "3" THEN  RETURN
5220  ON  VAL (Z$) GOSUB 1700,1750: GOTO 520
     0
5400  GOSUB 3501: RETURN
5600  TEXT : HOME : IF  PEEK (TS) = 0 THEN  PRINT
      TAB( 5);"THERE IS NO TABLE CURRENTLY I
     N      MEMORY.": GOSUB 975: RETURN
5610  PRINT  TAB( 5);"THERE ARE " PEEK (2048
     )" SHAPES IN TABLE.": INPUT "    ENTER
     THE NUMBER OF THE SHAPE YOU   WISH TO C
     HANGE, OR A ! TO RETURN TO THE MAIN MEN
     U.";SH$: IF SH$ = "!" THEN F5 = 0: RETURN

5620 SH =  VAL (SH$): IF SH < 1 OR SH >  PEEK
     (TS) THEN 5600
5630 F5 = 1: GOSUB 210: GOSUB 1200: GOSUB 13
     50: GOSUB 1500
5640  IF Z$ = "Y" THEN  GOSUB 1800
5660  GOTO 5600
5800  IF  PEEK (TS) = 0 THEN  PRINT "THERE A
     RE NO SHAPES IN TABLE.": GOSUB 975: RETURN

5805  PRINT "IF YOU WISH TO SAVE THIS TABLE
     ON A      DIFFERENT DISKETTE, PUT IT IN
     THE DRIVE AT THIS TIME.": PRINT : PRINT
     "PUT THE UTILITY DISKETTE BACK INTO THE
       DRIVE AFTER THE DISK DRIVE'S RED LIGH
     T  GOES OFF.": GOSUB 975: GOSUB 8000: PRINT

5810  PRINT : PRINT D$"BSAVE"NA$",A"TS",L"PA
     - TS: RETURN
5820  HOME : PRINT  TAB( 5);"YOUR FILE NAME
     LENGTH IS ZERO.  DO  YOU STILL WISH TO
     SAVE THE SHAPE TABLE  THAT IS CURRENTLY
      IN MEMORY (Y/N)?";: GET Z$: IF Z$ <  >
     "Y" AND Z$ <  > "N" THEN 5820
5830  IF Z$ = "N" THEN  RETURN
5840  GOTO 5800
6000  HOME : PRINT  TAB( 5);"TYPE THE WORD "
     ;: FLASH : PRINT "DELETE";: NORMAL : PRINT
     " TO DESTROY": PRINT "THE SHAPE TABLE T
     HAT IS CURRENTLY IN    MEMORY.  TYPE ";
     : FLASH : PRINT "SAVE";
6002  NORMAL : PRINT " IF YOU DO NOT WISH TO
     DESTROY THE SHAPE TABLE THAT CURRENTLY
      IS IN MEMORY."
6005  PRINT : INPUT "     PRESS THE RETURN K
     EY AFTER YOUR    CHOSEN ENTRY -> ";Z$
6010  IF Z$ <  > "DELETE" AND Z$ <  > "SAVE"
      THEN 6000
6020  IF Z$ = "DELETE" THEN  RUN
6030  RETURN
8000  HOME : PRINT  TAB( 5);"ENTER THE NAME
     OF THE TABLE, THEN   PRESS RETURN.  THE
      TOTAL LENGTH CAN NOT EXCEED 30 CHARACT
     ERS, AND THE FIRST     CHARACTER MUST B
     E A LETTER."
8005 NA$ = "":X = 2:Y = 6: HTAB X: VTAB Y
8010  GET Z$
8020  IF  LEN (NA$) = 0 AND  ASC (Z$) < 65 OR
      LEN (NA$) = 0 AND  ASC (Z$) > 90 THEN
      VTAB 10: HTAB 1: PRINT "THE FIRST CHAR
     ACTER MUST BE A LETTER.";: FOR I = 1 TO
     1500: NEXT I: HTAB 1: CALL  - 868: HTAB
     X: VTAB Y: GOTO 8010
8030  IF Z$ = "," THEN  VTAB 10: HTAB 1: PRINT
     "DO NOT USE ANY COMMAS";: FOR I = 1 TO
     1500: NEXT I: HTAB 1: CALL  - 868: HTAB
     X: VTAB Y: GOTO 8010
8040  IF  ASC (Z$) = 8 AND  LEN (NA$) > 1 THEN
     X = X - 1: HTAB X: CALL  - 868:NA$ =  LEFT$
     (NA$, LEN (NA$) - 1): GOTO 8010
8050  IF  ASC (Z$) = 8 AND  LEN (NA$) = 1 THEN
     X = X - 1: HTAB X: CALL  - 868:NA$ = ""
     : GOTO 8010
8055  IF  ASC (Z$) = 13 OR  LEN (NA$) > 29 THEN
      RETURN
8060  PRINT Z$;:NA$ = NA$ + Z$:X = X + 1: HTAB
     X: GOTO 8010
8070  IF  ASC (Z$) = 13 THEN  RETURN
20000 ER =  PEEK (222):LN =  PEEK (218) +  PEEK
     (219) * 256
20010  IF LN = 3660 THEN 21000: REM   FILE N
     OT FOUND ERROR WHEN ATTEMPTING TO LOAD
     A SHAPE TABLE
20020  IF ER = 11 AND LN = 5810 THEN  PRINT
     "FIRST CHARACTER IN FILE NAME MUST BE
       A LETTER, AND NO COMMAS MAY APPEAR IN
        THE NAME.  PRESS ANY KEY TO CONTINUE
     .": GET Z$:Z$ = "4": GOTO 4150
20050  STOP
21000  POKE 34,7: HOME : PRINT  TAB( 5);"YOU
     R INPUT FILE NAME DOES NOT EXIST ON DIS
     KETTE.  DO YOU WISH TO SEE A     CATAL
     OG LISTING OF THE DISKETTE THAT IS CURR
     ENTLY IN THE DRIVE (Y/N)?": POKE 34,0
21010  GET Z$: IF Z$ <  > "Y" AND Z$ <  > "N
     " THEN 21000
21020  IF Z$ = "N" THEN  GOTO 21050
21030  PRINT : PRINT D$"CATALOG"
21040  PRINT : PRINT  TAB( 5);"PRESS ANY LET
     TER TO CONTINUE.": GET Z$
21050  POKE 216,0: GOTO 4000
30000  END
```

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Atari Player/Missile Graphics Simplified

Staffan Sandberg

You've seen the wonderful things the Atari can do with player/missile graphics, but until now you've either had to settle for slow moving wabbles or learn machine language. Here is an overlay method which is simple to use and results in extremely fast animation of up to five players.

In the overlay method we will design overlays or patterns that we can place on the screen. We can create as many patterns as we want and use them as often as we want. Each overlay is eight dots wide and anything from one to 128 dots high. The overlay allows specified dots to be lit up on the screen. When we want an object to appear to be moving, we place one of the overlays on the screen by specifying its X and Y coordinates. We then give it new X and Y coordinates, and it appears to move. This process is very fast, so the object appears to move quite quickly. These overlays are totally separate from player/missile graphics. It is the combination of the overlays and player/missile graphics that allows us the freedom of movement of the overlay method.

To use overlays, just follow these steps:

Step 1: Decide how many players you wish to use and set aside enough memory to hold them. That is, what is the maximum number of objects you want on the screen at one time? You can have up to five. We must give each one a name and set aside 128 spaces for it because each player is potentially 128 dots high. We do this by DIMensioning the space:

```
10 DIM PM1$(128), PM2$(128), PM3$(128)
```

The DIMensioning must be the first thing the computer sees when it is turned on, so before you start programming, turn off the computer and turn it back on. This is necessary because as the computer constructs a variable table, the variables are stored in the order that they are entered. The variable table is not cleared by typing NEW. We want these variables at the beginning of the table so we can find them easily later. If they are not the first thing that the computer sees, the method will not work.

Step 2: Design the overlays or patterns that you wish to use. Remember, you can create as many overlays as you wish. They are stored in strings (ALIEN$, SHIP$, etc.), so you must give each overlay a name and DIMension its size. When deciding the size of each overlay, keep the following questions in mind:

1. How tall do you want to make your overlay?

2. What directions do you want to move your player?

3. How fast do you want to move your players?

You don't need to worry about the width of the overlay. But you must decide how many dots high you wish to make an overlay. It can be up to 128 dots in height (an average spaceship might be six dots high). If you are going to be moving your players down the screen, you must leave blank spaces to cover up the old overlay, and you must take into account the speed at which your player will move. The speed is measured in Dots Per Move (DPM). If your players will be moving at a top speed of three DPM up and down the screen, then you need to leave three spaces above and three spaces below. To help decide the size to be DIMensioned for each overlay, use the formula:

SIZE = height of overlay + DPM up + DPM down

SHIP$ And ALIEN$ Examples

In our example we will have one ship which we'll call SHIP$, with a height of six moving up and down at the speed of five DPM, and another ship which we'll call ALIEN$, with a height of eight moving neither up nor down.

```
20 SIZE1=16:SIZE2=8
30 DIM SHIP$(SIZE1), ALIEN$(SIZE2)
```

We also want a blank overlay that we use to erase the player from the screen quickly. We'll call this overlay CLEAR$. It should be 128 dots high so that it can erase anything on the 128 dot high player.

```
40 DIM CLEAR$(128)
```

Now you must create the overlays line by line. Each line or row is made up of dots or "boxes." Each box is numbered from right to left 1, 2, 4, 8, 16, 32, 64, and 128 (see Figure 1).

Figure 1.

128	64	32	16	8	4	2	1

To create the overlays you must decide which boxes you want filled or lit up on the screen. You then add the value of each filled box for each row (see Figures 2 and 3).

Figure 2.

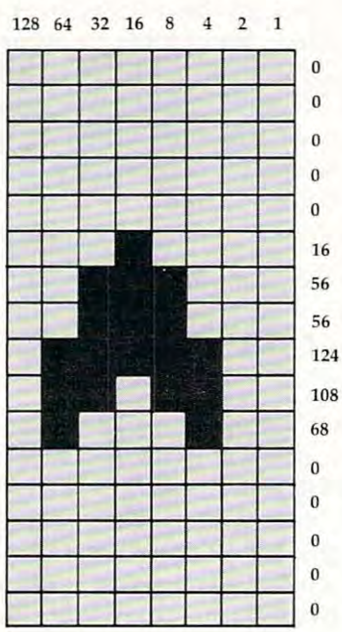
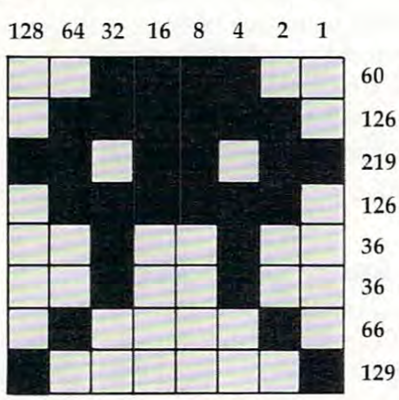


Figure 3.



Now that you have the totals for each row, you must put them in the string that you have DIMensioned for them. This is done in a short loop such as the one below.

```
50 FOR ROWS=1 TO SIZE1
60 READ DOTS
70 SHIP$(ROWS,ROWS)=CHR$(DOTS)
80 NEXT ROWS
90 DATA 0,0,0,0,0
100 DATA 16,56,56,124,108,68
110 DATA 0,0,0,0,0
120 FOR ROWS=1 TO SIZE2
130 READ DOTS
140 ALIEN$(ROWS,ROWS)=CHR$(DOTS)
150 NEXT ROWS
160 DATA 60,126,219,126,36,36,66,129
```

You need a loop for each overlay that you have.

You also need to create the blank overlay, CLEAR$, by entering 128 blank lines into CLEAR$.

```
170 FOR ROWS=1 TO 128
180 CLEAR$(ROWS,ROWS)=CHR$(0)
190 NEXT ROWS
```

Step 3: Tell the computer that you are going to be using Player/Missile Graphics with overlay method by entering the following lines, substituting a value for NUMBEROFPLAYERS.

```
200 A=4*(INT(PEEK(742)/4)-1)
210 POKE 54279,A
220 VSA=256*PEEK(135)+PEEK(134)
230 BOA=256*PEEK(141)+PEEK(140)
240 PM=256*A+512
250 DISP=PM-BOA
260 ADD=2
270 FOR T=1 TO NUMBEROFPLAYERS
280 PMHIGH=INT(DISP/256)
290 PMLOW=DISP-256*PMHIGH
300 POKE VSA+ADD,PMLOW
310 POKE VSA+ADD+A,PMHIGH
320 DISP=DISP+128:ADD=ADD+8
330 NEXT T
```

If you are going to have five players on the screen at one time, you must change line 240 from PM=256*A+512 to PM=256*A+384. This tells the computer to let us use the fourth missile as a player.

Step 4: Now we are ready to add the initial specifications, such as color, size and shape to the players. First, line 340 places the blank overlay on each player, clearing out any stray data.

```
340 PM1$=CLEAR$: PM2$=CLEAR$: PM3$=CLEAR$
```

Next we set the Player/Missile Graphics to double line resolution and turn on the P/M Graphics (a 3 enables them and a 0 disables them).

```
350 POKE 559,46: POKE 53277,3
```

To set the colors of the players, we must POKE the color register for each player with the proper color number. The registers go from 704 (for Player 0) through 707 (for Player 3). The fifth player takes on a combination of the colors of the other four. The colors that I have chosen are: COLOR1 is yellow, COLOR2 is white, and COLOR3 is pink.

```
360 COLOR1=25:COLOR2=11:COLOR3=74
370 POKE 704,COLOR1: POKE 705,COLOR2: POKE
    706,COLOR3
```

...and so there were keys for the Atari 400.

In the beginning there was the membrane keyboard.

So it was to be done that Inhome Software would create a full-stroke keyboard for the Atari 400 Home Computer and it would be called the B Key 400, and would sell for $119.95 U.S. funds.

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With the B Key 400 keyboard from Inhome Software, you will follow into the land of professional home computers that are powerful, easy to program and have a great capacity that can be made even greater with Inhome Software 48K and 32K memory boards. It was done and it was good.

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The size of the players is automatically set to normal. If you want to change the size, POKE 0 for normal, 1 for double, and 3 for quadruple size into the size register for the corresponding player. These registers go from 53256 (for Player 0) through 53259 (for Player 3).

POKE 53256,1 would make Player 0 double size.

Now we can place the player on the screen. First, we give the player an X (horizontal) value and POKE it into the horizontal position register for each player. The registers go from 53248 (for Player 0) through 53251 (for Player 3). The horizontal positions that show up on the screen range from about 50 to 200 (depending on your TV). Numbers lower than 50 and greater than 200 are to the right and left of the screen.

```
380 X1=125:X2=75:X3=175
390 POKE 53248,X1: POKE 53249,X2: POKE 532
   50,X3
```

Now we must give our player a Y (vertical) value and an overlay. The format is PM$ (Y value) = overlay.

```
400 Y1=150:Y2=25:Y3=25
410 PM1$(Y1)=SHIP$: PM2$(Y2)=ALIEN$: PM3$(
   Y3)=ALIEN$
```

To move the player around the screen, change the X and/or the Y value and repeat steps 390 and 410. Be sure not to change the X value more than the maximum DPM that you decided earlier. If you do, you will leave parts of the overlay on the screen.

Program 1.
Player/Missile Graphics Example 1

```
5 REM PMSAMPLE1
10 DIM PM1$(128),PM2$(128),PM3$(128)
20 SIZE1=16:SIZE2=8
30 DIM SHIP$(SIZE1),ALIEN$(SIZE2)
40 DIM CLEAR$(128)
50 FOR ROWS=1 TO SIZE1
60 READ DOTS
70 SHIP$(ROWS,ROWS)=CHR$(DOTS)
80 NEXT ROWS
90 DATA 0,0,0,0,0
100 DATA 16,56,56,124,108,68
110 DATA 0,0,0,0,0
120 FOR ROWS=1 TO SIZE2
130 READ DOTS
140 ALIEN$(ROWS,ROWS)=CHR$(DOTS)
150 NEXT ROWS
160 DATA 60,126,219,126,36,36,66,129
170 FOR ROWS=1 TO 128
180 CLEAR$(ROWS,ROWS)=CHR$(0)
190 NEXT ROWS
200 A=4*(INT(PEEK(742)/4)-1)
210 POKE 54279,A
220 VSA=256*PEEK(135)+PEEK(134)
230 BOA=256*PEEK(141)+PEEK(140)
240 PM=256*A+512
250 DISP=PM-BOA
260 ADD=2
270 FOR T=1 TO 3
280 PMHIGH=INT(DISP/256)
290 PMLOW=DISP-256*PMHIGH
300 POKE VSA+ADD,PMLOW
310 POKE VSA+ADD+1,PMHIGH
320 DISP=DISP+128:ADD=ADD+8
330 NEXT T
340 PM1$=CLEAR$:PM2$=CLEAR$:PM3$=CLE
    AR$
350 POKE 559,46:POKE 53277,3
360 COLR1=25:COLR2=11:COLR3=74
370 POKE 704,COLR1:POKE 705,COLR2:PO
    KE 706,COLR3
380 X1=125:X2=75:X3=175
390 POKE 53248,X1:POKE 53249,X2:POKE
     53250,X3
400 Y1=75:Y2=25:Y3=25
410 PM1$(Y1)=SHIP$:PM2$(Y2)=ALIEN$:P
    M3$(Y3)=ALIEN$
420 IF STICK(0)<8 THEN X1=X1+3
430 IF STICK(0)>8 AND STICK(0)<13 TH
    EN X1=X1-3
440 IF STICK(0)=14 THEN Y1=Y1-3
450 IF STICK(0)=13 THEN Y1=Y1+3
460 POKE 53248,X1:PM1$(Y1)=SHIP$
470 IF STICK(1)<8 THEN X2=X2+2
480 IF STICK(1)>8 AND STICK(1)<13 TH
    EN X2=X2-2
490 POKE 53249,X2
500 IF STICK(2)<8 THEN X3=X3+2
510 IF STICK(2)>8 AND STICK(2)<13 TH
    EN X3=X3-2
520 POKE 53250,X3
530 GOTO 420
```

Program 2.
Player/Missile Graphics Example 2

```
5 REM PMSAMPLE2
10 DIM PM$(128)
20 DIM SHIP$(16),CLEAR$(128)
30 FOR ROW=1 TO 16
40 READ DOTS
50 SHIP$(ROW,ROW)=CHR$(DOTS)
60 NEXT ROW
70 DATA 0,0,0,0,0
80 DATA 16,56,56,124,108,68
90 DATA 0,0,0,0,0
100 FOR ROW=1 TO 128
110 CLEAR$(ROW,ROW)=CHR$(0)
120 NEXT ROW
130 A=4*(INT(PEEK(742)/4)-1)
140 POKE 54279,A
150 VSA=256*PEEK(135)+PEEK(134)
160 BOA=256*PEEK(141)+PEEK(140)
170 PM=256*A+512
180 DISP=PM-BOA
190 ADD=2
200 FOR T=1 TO 1
210 PMHIGH=INT(DISP/256)
220 PMLOW=DISP-256*PMHIGH
230 POKE VSA+ADD,PMLOW
240 POKE VSA+ADD+1,PMHIGH
250 DISP=DISP+128:ADD=ADD+8
260 NEXT T
270 PM$=CLEAR$
280 POKE 559,46:POKE 53277,3
290 POKE 704,12
300 POKE 53248,50
310 PM$(10)=SHIP$
320 N=1
330 FOR X=60 TO 190 STEP N
```

```
340 POKE 53248,X
350 NEXT X
360 FOR Y=10 TO 100 STEP N
370 PM$(Y)=SHIP$
380 NEXT Y
390 FOR X=190 TO 60 STEP -N
400 POKE 53248,X
410 NEXT X
420 FOR Y=100 TO 10 STEP -N
430 PM$(Y)=SHIP$
440 NEXT Y
450 N=N+0.1
460 IF N>5 THEN N=1
470 GOTO 330
```

©

Beginners: see the special program typing instructions on page 144.

Slow List On The VIC-20

Ken Bowd

Watching a listing fly by faster than you can read it can be a frustrating experience. Here's a simple way to get control of your VIC's speed and slow down, stop, or speed up the LIST command.

When you don't have a printer, editing a program can sometimes require special techniques. As you LIST, the program flows past faster than you can follow it. Even under CTRL, it is sometimes difficult. There are machine language programs that allow you to slow LIST down, but there is an easier and shorter answer for the VIC owner. The key is memory location 37879.

As complete as the *VIC-20 Programmer's Manual* is, it does not document this location. Whatever its exact function, there is a definite connection between its value and the rate at which the system clock keeps time. The clock can be caused to run faster or slower than realtime. For instance, you can increase or decrease the handicap on timed games with as few as seven keystrokes.

To give you an idea of what can be done, a POKE of 0 here will cause the clock to run 60 times faster than realtime. Conversely, if you POKE 37879,255, the clock will be keeping time at about 25% of realtime. The normal value of this location is 64.

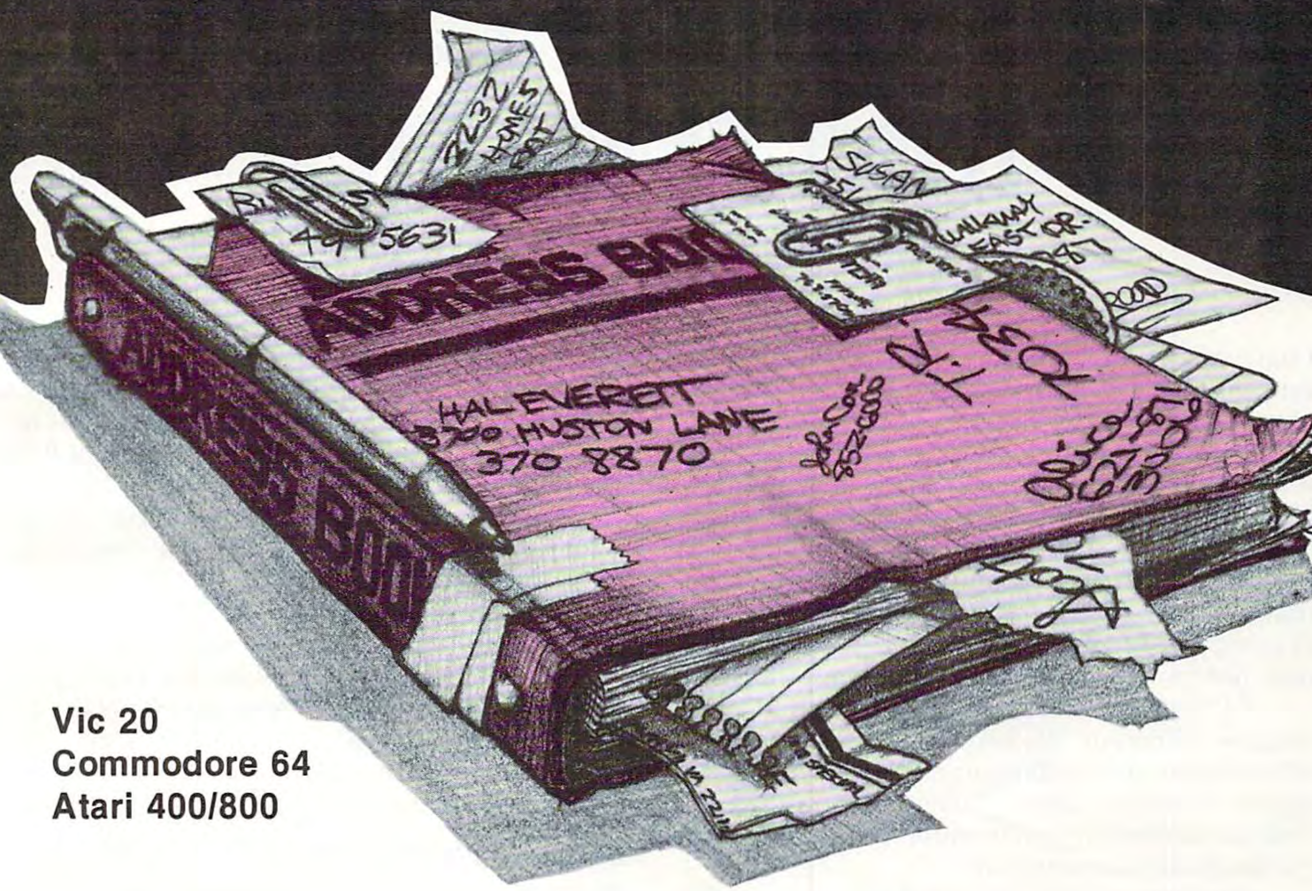
Probably the most beneficial effect of this location is its influence on the LIST command. If a POKE 37879,0 is entered and a list is then requested, you will have much better control. If you hold SHIFT down while listing, the VIC will list one line every one and one-half seconds. Holding CTRL down as well will cause the list to stop. You can still stop the list with RUN/STOP and edit as usual. Values greater than zero will gradually speed up the list.

If you have a Super Expander cartridge plugged in and location 37879 POKEd to zero, the DRAW, COLOR, etc., commands will execute very slowly when CTRL is held down. This feature may be useful in game programming.

There are, however, side effects. The blink rate of the cursor increases as location 37879 is POKEd lower. Since the speed of the cursor movement around the screen also is linked to this location, putting the cursor where you want it can be tricky.

By the way, it is interesting to note that if you PEEK 37879, a value of zero is often returned. This will often occur after a RUN/STOP RESTORE. The clock will be running at realtime. If you enter POKE 37879,0, the cursor will begin flashing rapidly. We haven't changed location 37879, but the VIC responds by keeping time much faster. ©

Stop Losing Your Friends



Vic 20
Commodore 64
Atari 400/800

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C. Regena

Translating Programs Into TI BASIC

I have had several requests to explain how to translate a BASIC program from another brand of microcomputer to TI BASIC. For example, you may see a program that fits your needs, but it's written for the Apple, or Atari, or TRS 80. How can you rewrite it so that it works on your TI-99/4A?

All the main microcomputers use a programming language called BASIC. However, each brand of computer has its own form of BASIC which may not be compatible with other computers.

To "convert" programs, you first need to be familiar with your TI's language idiosyncrasies: what syntax and spelling to use; where to put spaces, commas, colons, and semicolons; what type of numbers to put in parentheses; and what the limits of parameters are.

The command module for TI Extended BASIC makes conversion easier because Extended BASIC increases programming power by allowing multi-statement lines, PRINT AT or DISPLAY AT features, and more versatile IF-THEN-ELSE logic. This column, however, concerns conversions to the built-in console TI BASIC.

You cannot load a program from cassette or diskette from another brand of microcomputer to your own. In general, the *baud rates* (the rates at which information is transferred from one place to another) are different, and each computer has special character codes which may not be recognized by another computer. Graphics are especially machine-specific.

Games With Graphics And Sound

Action games are probably the most challenging programs to translate because they use graphics and sound. You could run the program on the computer for which it was written (to see what it looks like) and then write your own TI graphics. It's really easier to design your own graphics and sound than to try to convert line by line. If you see a command in another program with the word SOUND or PLAY, the command is for noises or music; and TI BASIC will require a CALL SOUND statement.

Typical graphics statements in other versions of BASIC contain PRINT with special characters in quotes, or such words as LINE, DRAWTO, HLIN, VLIN, CIRCLE, PAINT, COLOR, SETCOLOR, SET, PSET, RESET, PRESET, INVERSE, GRAPHICS, GR, PMODE, SCREEN, DRAW, or PLOT. Many POKE statements also display graphics or play sounds. Also numbers for graphics commands may be contained in DATA and READ statements.

Common Statements

Many general-purpose programs can be easily converted from a printed listing for another brand of computer. Below are examples of common statements and the translations. The left column contains examples you may see in listings for other computers. The right column gives the TI BASIC equivalent.

Other computers that allow multi-statements often use a colon to separate commands. For the TI simply separate the statements with new line numbers. If there are any branching statements, be especially careful of proper logic and program flow.

100 X=1:Y=1:Z=2 110 PRINT Y:GOTO 400	100 X=1 102 Y=1 104 Z=2 110 PRINT Y 112 GOTO 400

Spaces which are required in TI BASIC may be omitted in other versions of BASIC:

200FORX=1TO5:PRINTX: NEXTX	200 FOR X=1 TO 5 202 PRINT X 204 NEXT X

A NEXT statement requires the name of the loop variable, and NEXT statements may not be combined.

```
200 FOR D = 1 TO 500:NEXT     200 FOR D = 1 TO 500
                              202 NEXT D
300 FOR I = 1 TO 10           300 FOR I = 1 TO 10
310 PRINT I                   310 PRINT I
320 FOR J = 1 TO 100:NEXT J,I 320 FOR J = 1 TO 100
                              322 NEXT J
                              324 NEXT I
```

Some computers have special function keys to clear the screen, or they may use the command CLS.

```
100 PRINT {CLEAR}             100 CALL CLEAR
100 CLS
```

CLS with a number following the command clears the screen with a certain color number. TI BASIC can use CALL CLEAR then CALL SCREEN(C) for the color C.

INPUT statements in TI BASIC may have a prompt which is followed by a colon. Other computers may use a semicolon or a comma.

```
200 PRINT "NUMBER?";          200 INPUT "NUMBER? ":N
210 INPUT N
300 INPUT "ENTER              300 INPUT "ENTER
    COST ";C                      COST ":C
```

TI BASIC allows colons in the PRINT statements to indicate blank lines or to start a new line.

```
200 PRINT:PRINT:PRINT X       200 PRINT ::X
300 PRINT "JOHN":PRINT        300 PRINT "JOHN":"JACK"
    "JACK"
400 FOR L = 1 TO 5            400 PRINT :::::
410 PRINT
420 NEXT L
```

An IF statement must contain a line number rather than a command after THEN or ELSE. Some computers do not have the ELSE option, but in your translations you may notice it would be appropriate to use an ELSE.

```
200 IF X = 20 THEN X = 1      200 IF X<>20 THEN 210
210 PRINT X                   202 X = 1
                              210 PRINT X

300 IF A = B THEN C = 1:      300 IF A<>B THEN 310
    GOTO 100
310 A = A + 1                 302 C = 1
                              304 GOTO 100
                              310 A = A + 1

400 IF N<10 THEN N =          400 IF N>= 10 THEN 600
    N + 1:GOTO 100
410 GOTO 600                  402 N = N + 1
                              404 GOTO 100

500 IF I>J THEN 250           500 IF I>J THEN 250 ELSE 700
510 GOTO 700
```

Random numbers may be generated in a variety of ways. The TI BASIC command RND yields a decimal from 0 to 1 (which may then be multiplied by another number). The INT command is used to get random integer numbers (whole numbers). For example, INT(10*RND) yields a random number from 0 to 9, so INT(10*RND) + 1 or INT(10*RND + 1) will give a random number from 1 to 10. INT(5*RND) + 10 will give a random integer from 10 to 14 – 10, 11, 12, 13, or 14.

TI BASIC also has the command RANDOMIZE to mix up the random selection. Other computers may not have this function or may use the words RANDOM or RAND.

To get a random number from 1 to 6, the following statements are equivalent.

```
VIC-20        X = INT(6*RND(0)) + 1
TRS-80 CC     X = RND(6)
Apple         X = RND(6) + 1
Atari         X = INT(6*RND(1)) + 1
TI            X = INT(6*RND) + 1
```

GET and INKEY$ check to see which key has been pressed on the keyboard for a single keystroke answer. Some computers may "buffer" several keys. The equivalent TI statement is CALL KEY.

```
200 GET A$:IF A$ = ""         200 CALL KEY (0,K,S)
    THEN 200
210 IF A$ = "Y" THEN 300      210 IF K = 89 THEN 300
220 IF A$ = "N" THEN END      220 IF K<>78 THEN 200
    ELSE 200
                              230 END

200 A$ = INKEY$:IF A$ = "" THEN 200
210 IF A$ = "Y" THEN 300
220 IF A$ = "N" THEN END
230 GOTO 200
```

How Variables Vary

String variables are handled differently in different computers, so it helps to know what the other computer is doing to be able to convert to the TI. For example, the Atari requires a DIMension statement for the string length. The TI uses a DIMension statement when the string is in an array. The TRS-80 Color Computer may have a statement such as PCLEAR 2000 to clear more memory for strings.

LEN(A$) returns the length of the string variable A$. Some computers give the length of the null string, "", as 1, but the TI says the length is zero.

To combine strings in TI BASIC, use the ampersand symbol.

```
200 D$ = A$ + B$ + "XYZ"      200 D$ = A$&B$&"XYZ"
```

LEFT$, MID$, and RIGHT$ are functions that refer to part of the string. The TI BASIC equivalent function is SEG$.

```
200 B$ = LEFT$(A$,5)          200 B$ = SEG$(A$,1,5)
(Left five characters of A$ starting with the first character)
210 C$ = MID$(A$,7,3)         210 C$ = SEG$(A$,7,3)
(Three characters of A$ starting with the 7th character)
220 D$ = RIGHT$(A$,2)         220 D$ = SEG$(A$,LEN(A$)
                                  -1,2)
(Right or last two characters of A$)
230 E$ = RIGHT$(A$,R)         230 E$ = SEG$(A$,LEN(A$)
(Right R characters of A$)        -R + 1,R)
```

The PRINT AT or PRINT @ statement is another statement you may wish to convert. The PRINT AT statement is followed by one or two numbers which indicate a position on the screen to begin printing. There are two main ways to write this procedure in TI BASIC.

```
200 PRINT TAB(COL);"HELLO"::::::
```

(where the colons scroll the printing up to the proper row.)

To print without scrolling:

```
200 M$="MESSAGE"
210 FOR I=1 TO LEN(M$)
220 CALL HCHAR(ROW,COL-1+I,ASC(SEG$
    (M$,I,1)))
230 NEXT I
```

Lines 210-230 graphically place one letter at a time for the length of the message on the screen.

Several microcomputers distinguish between integers (whole numbers) and floating point numbers (numbers which may contain a decimal). Often the symbol % is used to designate an integer in a variable name (as in B%). This is similar to the way we use $ to designate a string variable such as S$. In TI BASIC all numbers are able to contain a decimal (they are floating point numbers). TI BASIC programmers also do not need to worry about single precision and double precision designations.

A function you may see in other listings is FIX. FIX(N) is the same as INT(N) which returns the integer or whole number portion of a number N.

Two symbols you may see in listings are "tokens" or abbreviations: ? (question mark) is the abbreviation for the word PRINT, and ' (apostrophe) is the abbreviation for REM or REMARK.

You may also need to adjust DATA and READ statements because TI BASIC contains the command RESTORE. Other computers might not have it. RESTORE means to start at the beginning of the data list with the next READ statement. You may also RESTORE data beginning with a certain line number. RESTORE 430 indicates that the next READ statement should start with the first data item in line 430. ©

VIC, 64, And PET Supermon Questions And Answers

Jim Butterfield, Associate Editor

Several questions are frequently asked about Supermon, the machine language monitor program published in various versions for Commodore computers in past **COMPUTE!** *issues. Some are general, but a number of these questions refer specifically to Supermon64 (***COMPUTE!***, January 1983).*

Q *How does Supermon compare to other monitor systems: say, VICmon, Extramon, Micromon, etc.?*

A Many of the other monitor packages are more powerful than Supermon, having extra commands. Supermon is particularly good for beginners, because:

- it self-relocates, making it easy to load into various configurations of machines;
- it doesn't alter normal interrupt sequences (except, to a limited extent, where Single Step is implemented).

But many experienced users move along to other packages which have features that they like.

Q *Where does Supermon fit into memory?*

A The program called Supermon on disk or tape is not Supermon itself: it's a building program which constructs the "live" Supermon at top-of-memory.

When you load Supermon, you load the building program into the same area normally occupied by BASIC. When you say RUN, an operating version of Supermon is constructed and sealed off so that it won't be disturbed. This version of Supermon normally stays put until you turn off the power.

If you return to BASIC (using the .X command), you should not go back to Supermon by saying RUN – that would build a second working copy of Supermon. In fact, it's best to say NEW the moment you return to BASIC to avoid the chance of this happening.

Q *How do I get back to Supermon, then?*

A On VIC and Commodore 64, type: SYS 8. On CBM/PET computers, except for original ROM units, type: SYS 4. On original ROM PETs, type SYS 1024.

Q *If SYS 8 gets me to Supermon, does that mean that Supermon is located at address 8?*

A No. At the appropriate address (8, 4, or 1024), you'll find a zero. Now, zero corresponds to the command BRK (Break). And with Supermon implanted, this command may be taken to read: "Go directly to Supermon. Do not pass GO."

Thus, the zero or Break command "finds" Supermon and takes you there. This is a handy feature. When you are writing a machine language program, you can end a piece of coding with BRK; when you run the program, it will stop at that point and go to the monitor.

Q *I tried to disassemble Supermon, using its built-in disassembler, but it didn't look sensible. Am I missing something?*

A Don't try to disassemble the "builder" version of Supermon – it's not a finished machine language program since it contains both program and "relocation" information. Look instead at the completed version. In a normal Commodore 64, for example, the finished Supermon will start at hexadecimal address 97ED. In other machines, it's usually easiest to find by looking at the BASIC top-of-memory pointer (hex 34 and 35 on PET/CBM, hex 37 and 38 on VIC and 64). Supermon starts at the address indicated.

Don't forget that, like any other machine language program, Supermon contains both instructions and data, and you can't meaningfully disassemble data. It's especially difficult with things like mnemonics such as LDX where the three characters are packed into two bytes. For example, values 1C and D8 contain, in packed form, the three letters of the mnemonic BRK – if you can figure it out.

Q *I don't like the screen colors of Supermon64. What can I do about them?*

A Sorry about that. For lecturing purposes, I picked black and white so that students could see what I was typing and what the computer typed. It looks OK on my monitor, but several others have complained.

An easy way to improve visibility is to change the background color to grey. POKE 53281,12 produces a color combination that many users like. Try values other than 12 if this doesn't suit you.

If you want more control, you can go to where Supermon sets the colors and change the code as you like. You may find these locations with the Hunt command. Try searching the relocated Supermon for the color change to white with:

```
.H 97ED 9FFF A9 05 20 D2 FF
```

You should find one occurrence. Change the 05 (ASCII code for "white") to another color, or perhaps to 01 for no color change.

There are a lot more changes to black. Hunt for them with:

```
.H 97ED 9FFF A9 90 20 D2 FF
```

You'll find a dozen. You may change each 90 ("black") to the color of your choice or to no change. Each color change, by the way, is associated with a particular display function, so if you want memory displays in green and disassemblies in black, try various combinations.

To make permanent changes, you'll need to change the Supermon builder program. In this case, do your hunts in the BASIC area, e.g.,

```
.H 0800 11EA ....
```

Q *Command .P doesn't send to the printer. Why?*

A This command generates a format suitable for sending to the printer. You must hook in the printer with a BASIC command before calling in Supermon:

```
OPEN 4,4:CMD 4:SYS 8
```

(or SYS 4 as your system needs). The same technique can be used to send monitor output to disk. By the way, CBM BASIC 4.0 won't allow you to use SYS 4 if you want to hook in a printer or other output device: you must "Call" the monitor with SYS 54386 to keep the printer connected.

When you're finished with the printer, type .X to return to BASIC, and then:

```
PRINT#4:CLOSE 4
```

Q *I want to put Supermon somewhere else, not in the top of memory where it normally goes. How?*

A Just change the top-of-memory pointer (decimal 52 and 53 in the PET, decimal 55 and 56 in the VIC or 64) to where you want the top-of-Supermon to go, and run the Supermon builder program. Then, if it's necessary, put the top-of-memory pointer back to wherever you want it.

Q *Why don't you print an assembly listing of Supermon64 so we can see how it works?*

A The uncommented listing runs for 16 pages. With comments and explanations, it would go at least 30 or 40 pages. That's a lot of space, and it's not clear that there is sufficient interest in this rather specialized program to make publication desirable.

Q *When I do a .D disassembly, why does the cursor end up on the last line instead of on the line below?*

A So that you can type D, Return, and get a continuation of the disassembly. If you don't want to continue, give a cursor down before your next command.

Q *Supermon64 doesn't have single step. Right?*

A Right. Things get delicate when a user wants to play with the interrupt facility. It seemed to me that the system would be cleaner without the .I command used in previous versions of Supermon.

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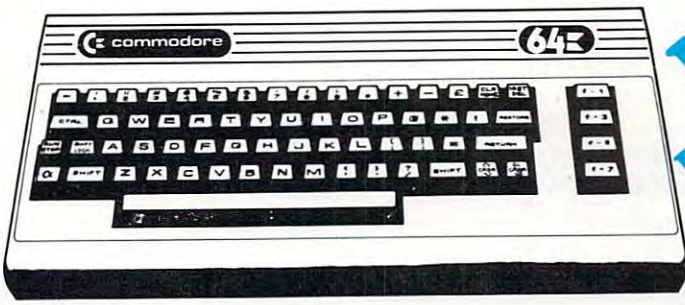

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An Interesting Fragment Of Code

Chris Crawford

This fascinating byte-folding idea has several potential uses for machine language programmers. If you find it obscure, however, try out the applications note on an Atari to see one of the effects it makes possible.

Three years ago, a programmer showed me a fragment of code and challenged me to figure out what it did. After a great deal of head-scratching and paper-scribbling, I had to admit that I couldn't figure out what it did. The confusing code was:

```
LDA FIRST
EOR SECOND
AND SELECT
EOR SECOND
STA RESULT
```

This is a very tricky and obscure piece of code. Loosely speaking, it takes the two bytes FIRST and SECOND and folds parts of them together into a single byte, RESULT. More precisely, it takes the individual bits from the two bytes and puts them together into a new byte. The bits in SELECT control this process. In general, bit DX of RESULT will be equal to bit DX of FIRST if bit DX of SELECT is equal to 1; if bit DX of SELECT is equal to 0, then bit DX of RESULT will be equal to bit DX of SECOND. For example, if SELECT is 0, RESULT will be the same as SECOND; if SELECT is $FF, RESULT will be the same as FIRST. If SELECT is $F0, then the high nybble (highest four bits) of RESULT will be the high nybble of FIRST, and the low nybble of RESULT will be the low nybble of SECOND. Let's work out an example:

```
FIRST:   01010111  ($57)
SECOND:  10101101  ($AD)
SELECT:  11110000  ($F0)

INSTRUCTION     ACCUMULATOR
LDA FIRST       01010111  ($57)
EOR SECOND      11111010  ($FA)
AND SELECT      11110000  ($F0)
EOR SECOND      01011101  ($5D)
STA RESULT      01011101  ($5D)
```

The output of this code makes more sense when the bits are grouped suggestively:

```
FIRST:   0101 0111  ($57)
SECOND:  1010 1101  ($AD)
SELECT:  1111 0000  ($F0)
RESULT:  0101 1101  ($5D)
```

The pattern should be obvious. The upper four bits come from FIRST, the lower four bits come from SECOND.

Using A Byte Mixmaster

This may all seem rather confusing and pointless to you. Why would anybody want to mix together a bunch of bits? What good is a mixmaster for bytes? As it happens, this code fragment has a number of uses, and makes some very interesting graphics effects possible.

The simplest application for this code is for nondestructive bit-packing. In most assembly language programs, each byte represents a single quantity. This makes it easier for us to keep things straight. For example, consider the idea of giving orders to an army in a game like *Eastern Front 1941*. An army can move in only one of four directions: up, down, right, and left. It therefore takes only two bits to represent a single order. If we store one order in each byte, it will waste six bits. Now, if we are storing only one order, the waste of six bits is not significant. But *Eastern Front 1941* allows eight orders per unit and up to 160 units. That amounts to 1280 possible orders. At one byte per order, it would cost 1280 bytes to store all that information, when only 2560 bits, or 320 bytes, are truly needed. Thus, 960 bytes would have been wasted in a 16K program. Tsk, tsk, we can't have that.

The solution is bit-packing. We pack four independent orders into a single byte. The trick to bit-packing lies in changing some of the bits without disturbing the other bits. That's where our magic code comes in. It can fold a pair of bits into a byte without disturbing the rest of the byte.

COMPUTE!'s Mapping The Atari

Author: Ian Chadwick
(Introduction by Bill Wilkinson)
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The inner workings of today's advanced personal computers unfortunately remain a mystery to many users. From beginners to machine language programmers, people are hungry for vital information about the insides of their machines. For example, there are tens of thousands of memory locations...which are safe to use? How can changing one number in a certain memory cell dramatically speed up output to the disk drive? Which memory address reveals what Operating System is in the computer? How can changing certain numbers in various memory locations improve a program's sound and graphics?

The key to finding one's way around the inside of a computer is a memory map. But often this important information is unavailable from the manufacturer. Or it can be obtained only in piecemeal fashion from scattered sources.

Now, for the first time, there is a comprehensive guidebook available for the Atari 400/800 computers which answers all of these questions, and hundreds more. *Mapping The Atari*, by Ian Chadwick, is a complete reference guide and memory map for one of the most popular of personal computers. From memory location zero to 65,535, *Mapping The Atari* is the most exhaustive memory sourcebook ever offered to Atari users.

Chadwick started by diligently assembling all the information he could find. Then he went a step further by testing this information, to verify its accuracy. And finally, he added months of his own research, delving deep into little-known areas of the Atari's memory to explore every secret. The result, *Mapping The Atari*, is an indispensable reference work for Atari programmers.

But *Mapping The Atari* is more than just a comprehensive reference book. It is also a tutorial for *all* inquisitive Atari enthusiasts – not just advanced programmers. *Mapping The Atari* explains each memory location in depth for beginning and intermediate programmers. Some descriptions of important locations fill several pages. And the book is packed with ready-to-type example programs and routines which show exactly how to put the information to work.

There's more. A special introduction by Bill Wilkinson, an author of Atari BASIC and the Atari Disk Operating System, explains how to access the Atari's memory in every available programming language. And there are *ten* appendices, covering such topics as "VBLANK Processes," "Atari Timing Values," "Color," "Sound And Music," "Player/Missile Graphics Memory Map," "Display Lists," and others. And to make the book still more useful, there are *two* indices – an Index By Label, and an Index By Subject.

Best of all, *Mapping The Atari* is from **COMPUTE! Books**, associated with **COMPUTE!** Magazine, the leading consumer publication of home, educational, and recreational computing. **COMPUTE!** has led the way for Atari owners since the computers were first introduced in 1979. In the **COMPUTE!** tradition, *Mapping The Atari* is carefully written and edited to be useful to beginners and experts alike. And it is spiral-bound to lie flat while typing programs.

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Here's an example: suppose that we have an order (only two bits) in the accumulator. The order is right-justified; that is, the two critical bits are in the lowest order position in the byte. Another way of saying this is that the accumulator contains a number between zero and three. Suppose also that the X register contains the order sequence number; that is, it tells whether this is the first order in the final byte, the second, the third, or the fourth. Thus, the X register contains a number between one and four. Finally, suppose that the bit-packed byte is labelled ORDER. The code to do the trick is:

```
MASK    DB   3,$C,$30,$C0
        LDY  #0
LOOP    DEX
        BEQ  FOLDIN
        ASL  A
        ASL  A
        INY
        BNE  LOOP
FOLDIN  EOR  ORDER
        AND  MASK,Y
        EOR  ORDER
        STA  ORDER
```

Safe Graphics Animation

You may still wonder what makes this code so useful. After all, seldom do you need to work so hard to save bytes. There are still more uses of this code fragment. One of the most common uses of this code is for graphics. Suppose you have a bit-mapped display and desire to move a number of objects around the screen without disturbing the background. If you had player/missile graphics, you would simply use them directly. However, let us say that for some reason you cannot use player/missile graphics. Perhaps you are stuck with a primitive machine lacking such a facility. Perhaps you need to move so many objects that player/missile graphics are insufficient. In such a case, our magic code fragment is just the ticket for your problem. With it you can go into a bit map and modify only the bits you need to change without disturbing the other bits of the map. This is essential if you are to move objects around on the screen without disturbing the background.

The basic idea behind this code can be extended to entire chunks of a bit map. Instead of merely mixing together the bits in single bytes, we can mix together the bits in two different bit-maps. Thus, if we have two source bit maps, suggestively labeled FIRST and SECOND, we can write a loop that will perform this fragment of code on every single pair of bytes in the two source bit maps to produce a final bit map that reflects both source maps. The degree to which one or the other source map appears in our final map depends on the value of SELECT. If SELECT is equal to zero, then only the second map will appear. If SELECT is $FF, then only the first map will appear. If SELECT is some other value, then we will see portions of both bit maps mixed together. If we use a random number for SELECT each time we process a byte, we will get a random mix of the two maps. If we then repeat the process of mixing the two many times in one second, the viewer will see a rather intriguing flickering display of the two bit maps enfolded together.

We can extend the idea even further. If we now use a random number generating routine that allows us to specify the average number of bits that will be set in the random number used for SELECT, we can then control the degree to which we see either the first or the second bit map. For example, if we use random numbers with an average of six bits set, we shall see mostly the first bit map with only a faint image of the second superimposed. If we then create a routine that starts off using an average of zero bits set and then increases the average number of bits set in sequence until finally all eight bits are set, we will see on the screen a dissolve from the second image to the first.

This technique can be extended further by chaining together enfolding fragments in sequence. Thus, if we enfold FIRST with SECOND to get RESULT, we can then enfold RESULT with THIRD to get a new result. This allows us to mix three images together, an impressive trick that has little utility. It is of some value in improving the overall visual impact of the dissolve algorithm. If the third image is a random bit map, the transition during the dissolve will look a little less mechanical. Unfortunately, it will run more slowly.

There is a more important conclusion we can draw from this little adventure with five lines of assembly code. The moral of the story is that imagination is often more important in programming than technical prowess. I understood this code fragment at the technical level for a long time, but I did not realize its potential until recently. I wonder how many more programming jewels like this one are out there, waiting to be uncovered by imagination, wit, or, as in my own case, dumb luck?

Fragment For Atari 400/800

```
100 REM DEMO FOR ENFOLD.OBJ
110 REM
120 DIM SDLIST(5)
130 OPEN #1,4,0,"K:"
140 P=PEEK(106)
150 FOR I=0 TO 2
160 POKE 106,P-I*8
170 GRAPHICS 4+16
180 SDLIST(I*2)=PEEK(560):SDLIST(I*2
    +1)=PEEK(561)
190 NEXT I:POKE 106,P:GOSUB 390:REM
    READ IN ML ROUTINE
200 CURR=0:X=0:Y=0:COLOUR=1
```

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```
210 POKE 560,SDLIST(CURR*2):POKE 561,SDLIST(CURR*2+1)
220 DL=PEEK(560)+256*PEEK(561)+4:POKE 88,PEEK(DL):POKE 89,PEEK(DL+1)
230 IF PEEK(53279)=5 THEN CURR=1-CURR:GOTO 210
240 IF PEEK(53279)=3 THEN 310
250 IF PEEK(764)<255 THEN GET #1,A:COLOUR=A-48*(A>48)
260 S=STICK(0):LOCATE X,Y,Z:COLOR 1+(Z=1):PLOT X,Y:COLOR COLOUR:PLOT X,Y
270 NX=X+(S>4 AND S<8)*(X<79)-(S>8 AND S<12)*(X>0)
280 NY=Y+(S=5 OR S=13 OR S=9)*(Y<23)-(S=6 OR S=10 OR S=14)*(Y>0)
290 IF STRIG(0) THEN COLOR Z:PLOT X,Y
300 X=NX:Y=NY:GOTO 230
310 FIRST=SDLIST(0)+SDLIST(1)*256:FIRST=PEEK(FIRST+4)+256*PEEK(FIRST+5)
320 SECOND=SDLIST(2)+SDLIST(3)*256:SECOND=PEEK(SECOND+4)+256*PEEK(SECOND+5)
330 RESULT=SDLIST(4)+SDLIST(5)*256:RESULT=PEEK(RESULT+4)+256*PEEK(RESULT+5)
340 POKE 560,SDLIST(4):POKE 561,SDLIST(5)
350 FOR I=0 TO 255
360 A=USR(1536,FIRST,SECOND,RESULT,I)
370 NEXT I
380 GET #1,A:GOTO 210
390 FOR I=0 TO 40:READ A:POKE 1536+I,A:NEXT I:RETURN
400 DATA 104,104,133,204,104,133
410 DATA 203,104,133,206,104,133
420 DATA 205,104,133,208,104,133
430 DATA 207,104,104,133,209,160
440 DATA 0,177,203,81,205,37
450 DATA 209,81,205,145,207,200
460 DATA 192,240,208,241,96
```

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Atari Applications Note

The program above illustrates the binary manipulation discussed in Chris Crawford's article. It lets you draw pictures on one of two screens with a joystick. Press FIRE to lay down points. To switch between the two screens, press SELECT (hold down SELECT for an interesting effect). You can change colors by pressing "0" (to erase) or "1" (to draw). For the purposes of the illustration, you are limited to one color and only half the normal height of GRAPHICS 4.

A Fascinating OPTION

The page flipping and joystick doodling are only a means to an end. The interesting effect happens when you press OPTION. A machine language routine in page six combines screens one and two in various ways, displaying them on a third page which you can see.

This is not page flipping. The data (points, pixels) on one screen are combined with the data on the other by "enfolding" pairs of bytes as described by Crawford. You can pass the SELECT byte to the machine language routine. Our demonstration uses the numbers 0-255 as SELECT to roughly transform the second screen into the first.

You could change the FOR/NEXT loop to "255 to 0 STEP-1" to reverse the process. Try changing the last parameter in the USR statement for different effects. You can use random numbers, for example. Trying different numbers may help you to better understand the powerful potential of Crawford's bit enfolding technique.

Part V

Commodore 64 Video– A Guided Tour

Jim Butterfield, Associate Editor

This is the fifth installment of a seven-part series exploring the phenomenal 64 video chip and how to harness its power for your own programs. For practice, here's a step-by-step illustration of how to build a moon lander game.

The story so far: we're touring the 6566 chip, which gives the Commodore 64 its video. We have noted that the chip goes to memory for its video information, but can only reach 16K; the computer controls which 16K bank via control lines in 56576 (hex DD00). We looked through the video control words at 53248 to 53286 (hex D000 to D026), and then discussed video memory planning.

First, The Craft

Here's a short program to demonstrate some of the features of the 64's video chip. We'll write a small lunar lander program.

First, let's draw the sprites for the rocket:

```
100 DATA 0,24,0,0,60,0,0,198,0,1,131,0,1,131,0,3,1,
      128,3,1,128,3,1,128
110 DATA 3,1,128,3,1,128,3,1,128,3,1,128,1,131,0,1,
      131,0,1,131,0
120 DATA 0,102,0,0,126,0,0,0,0,0,0,0,0,0,0,0,0,0
```

A fairly crude craft – you can improve it if you like. We have drawn the sprite into 63 bytes of memory; one more and we can continue to the next sprite.

```
130 DATA 0 :REM gap between sprites
```

Then The Flame

Now we're going to draw the rocket flame as a separate sprite. Why? Because later, when we look for collisions, we don't care what the flame hits, just what the rocket hits. There's another reason: when we're not thrusting, we can simply turn this sprite off, and the flame disappears.

```
140 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
      0,0,0,0,0,0,0,0,0,0,0,0
150 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,66,0,0,
      36,0,0,24,0,0,24,0
```

Mostly zeros. The flame is only at the bottom of the sprite. OK, we're ready to go. Let's clear the screen and print instructions:

```
160 PRINT CHR$(147)
170 PRINT "LUNAR LANDER   JIM BUTTERFIELD"
180 PRINT
190 PRINT "PRESS 'SPACE' FOR MAIN THRUST"
200 PRINT "PRESS 'F1'      FOR LEFT THRUST"
210 PRINT "PRESS 'F7'      FOR RIGHT THRUST"
220 PRINT
230 PRINT "WATCH OUT FOR THE MINES."
240 PRINT
250 PRINT "LAND GENTLY OR YOU'LL BOUNCE!"
```

While the user is reading the instructions, we can read in the sprites and put them into slots 13 and 14. We can also set our sprite "position" addresses as variables, and identify sprites 0 and 1 as using pictures 13 and 14.

```
260 REM SET UP
270 FOR J=0 TO 126:READ X:POKE 832+J,X:NEXT J
280 X0=53248:Y0=53249:C0=53279
290 X1=53250:Y1=53251:E=53269
300 POKE 2040,13:POKE 2041,14
```

We'll make the rocket exhaust go "behind" the main screen. This way, as we land, the exhaust will go behind the background. We'll also give it color to distinguish it from the rocket ship itself (you can pick your own).

```
310 POKE 53275,2
320 POKE 53288,3 : REM THRUST COLOR
330 PRINT "READY TO START";
340 X$="Y":INPUT X$
```

Variable E is used to enable the sprites. When we're ready, we'll turn them on; for now they can stay off.

```
350 POKE E,0
360 IF X$<>"Y" AND X$<>"YES" THEN END
```

We're ready to fly. Let's put the sprite high on the left part of the screen. Then we'll draw a screen with "mines" for the player to avoid.

```
370 V=100:H=100:V0=0:H0=0
380 POKE 54296,15:POKE 54278,240
390 REM DRAW SCREEN
400 PRINTCHR$(147)
410 FOR J=1 TO 18:PRINT:NEXT J
420 FOR J=1 TO 4:FOR K=1 TO 30
430 C$=" ":IF RND(1)<.1 and (K<20 OR K>25) THEN
    C$="#"
440 PRINT C$;:NEXT K:PRINT:NEXT J
450 FOR J=1 TO 30:PRINT"=";:NEXT J
```

Table 1:

6566 Video Chip
C64 Control and Miscellaneous Registers

D011		Extended Color Mode	Bit Map	Display Enable	Row Select	Y-Scroll	53265
D012	Raster Register						53266
D013	Light Pen Input X						53267
D014	Light Pen Input Y						53268
D016	X	X	Reset	Multi Color	Col Select	X-Scroll	53270

D018	Screen VM13	VM12	VM11	VM10	Character Base CB13	CB12	CB11	X	53272
D019	IRQ	Interrupt ←Sense→			LP	SSC	SBC	RST	53273
D01A	Interrupt Enable →				Light Pen	Sprite Collision with Sprite	Back	Raster	53274

Color Registers

D020	X	Exterior	53280
D021	X	Background #0	53281
D022	X	Background #1	53282
D023	X	Background #2	53283
D024	X	Background #3	53284
D025	X	Sprite Multicolor #0	53285
D026	X	Sprite Multicolor #1	53286

Table 2:

6566 Video Chip
C64 Sprite Registers

Sprite 0	Sprite 7			Sprite 0	Sprite 7
D000	D00E	Position	X	53248	53262
D001	D00F	Position	Y	53249	53263
D027	D02E	X	Color	53287	53294

Sprite 7 6 5 4 3 2 1 0

D010	X-Position High	53264
D015	Sprite Enable	53269
D017	Y-Expand	53271
D01B	Background Priority	53275
D01C	Multicolor	53276
D01D	X-Expand	53277
D01E	Interrupt: Sprite Collision	53278
D01F	Interrupt: Background Collision	53279

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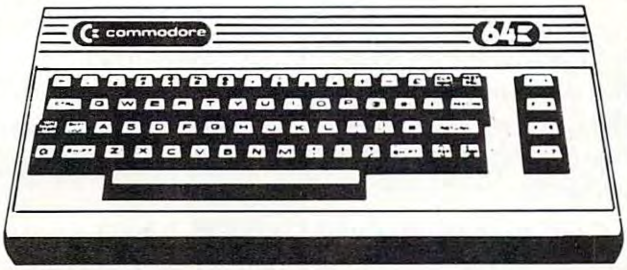

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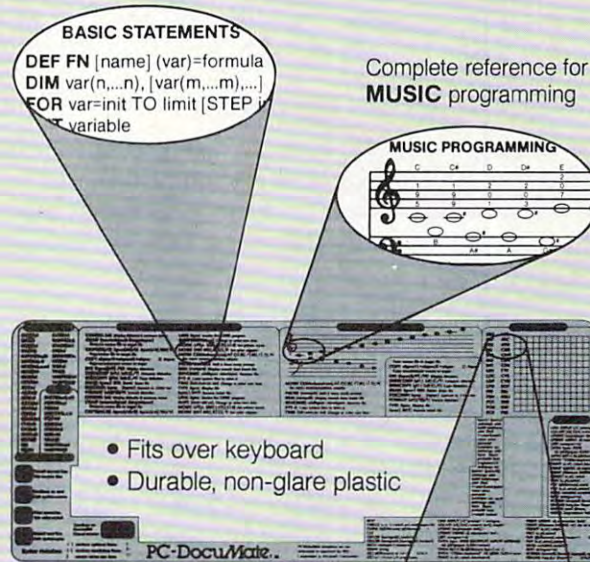

FEATURES
- Control keys defined
- BASIC language reference (Commands/Statements/Functions)
- Music programming guide
- Screen memory map
- Color graphics reference
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Color and character **SCREEN** map defined

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SMA

Keyboard Checks

Let's place the sprite, and start the main play by checking the keyboard. We check for two different things: a new key (K$), or an old key still being held down (K):

```
460 POKE X0,H:POKE Y0,V:POKE X1,H:POKE Y1,V
470 K=PEEK(203):GET K$
480 REM MAIN FLIGHT LOOP – TEST KEYS
490 IF K$="" GOTO 550
500 K0=ASC(K$):V1=.1:H1=0
```

Let's check for the space bar. If it's on, we want to energize the rocket, and the rocket flame. Our vertical thrust will be upwards (-.5), and we'll note that we want to enable the flame video with a note that E0=3. We'll spot lateral thrust as keys F1 and F7, and set value H1 accordingly.

```
510 E0=1:IF K0=32 THEN V1=-.5:E0=3
520 IF K0=133 THEN H1=-.2
530 IF K0=136 THEN H1=.2
540 GOTO 560
550 IF K=64 THEN V1=.1:H1=0:E0=1
```

Here's where we turn on our sprites – either rocket only (E0=1) or both rocket and flame (E0=3). As long as we're turning rockets on and off, we might as well add sound effects, too:

```
560 IF PEEK(E)=E0 GOTO 600
570 REM THRUST SOUND
580 POKE E,E0:IF E0=1 THEN POKE 54276,0:
    GOTO 600
590 POKE 54273,8:POKE 54276,129
600 IF H1=H9 GOTO 630
610 H9=H1:K=SGN(ABS(H9))*129:POKE 54273,99:
    POKE 54276,K
```

Gravity, thrust, or lateral thrust – they all involve *acceleration*. We add acceleration to our speed to get new speed; then we add speed to position to get new position.

```
620 REM LET'S MOVE IT!
630 V0=V0+V1:H0=H0+H1
```

To prevent the player going off screen, we'll invent a "field force" around the screen boundary. If you hit it, you'll bounce; that is, your speed will flip to the opposite direction. We'll fudge a bit. The "high bit" of the X position is tricky to set in BASIC; there's often a flicker during the moment that we set the low and high values. So let's limit the player's travel to the left-hand three quarters of the screen and avoid the problem.

```
640 REM FIELD FORCE BOUNDARIES
650 IF V<50 THEN V0=ABS(V0)
660 IF H<20 THEN H0=ABS(H0)
670 IF H>240 THEN H0=-ABS(H0)
680 V=V+V0:H=H+H0
```

We move the craft simply by changing its coordinates. Then we check the collision register to see if we've hit anything.

There's a problem here. It seems that collision is noted when the screen is drawn, not when you set the coordinates. BASIC isn't super fast, but it could be fast enough to miss that collision. If you watch the program closely, you will see that the rocket sometimes "bounces" after it goes below ground level.

There's an additional contributing factor. BASIC, being slow, may need to move the rocket several pixels in distance at a time. So, rather than just touching the ground and stopping, the rocket may leap from just above the ground to well into it, if it's going quite fast.

```
690 REM MOVE CRAFT, CHECK COLLISION
700 POKE X0,H:POKE Y0,V:POKE X1,H:POKE Y1,V
710 C=PEEK(C0):IF(C AND 1)=0 GOTO 470
```

Collision says we've hit something. We can look at our height (Y position) to see if it's the ground. If not, it must be a mine.

```
720 IF V>218 GOTO 780
730 IF V+V0<218 GOTO 470
```

We could do a sensational explosion here, but we'd need to define more sprites, or modify the ones we've got. Try your hand at it if you like. For the moment, hitting a mine will cause the rocket to disappear.

```
740 REM WE SEEM TO HAVE HIT A MINE
750 PRINT CHR$(19);"CRASHED!":POKE E,0
760 GOTO 820
```

Bounce And Overshoot

I arbitrarily decided to make the craft bounce if it hits too fast. If you'd rather crash, go ahead. See the previous note.

```
770 REM HIT THE DECK ... TOO FAST?
780 IF V0>1 OR V0<0 THEN V0=-ABS(V0):GOTO 470
790 PRINT CHR$(19);"LANDED!":POKE E,1
```

Because we may "overshoot" the ground and dig a little hole, we'll reset the vertical position of a successfully landed rocket to look neat. Then we wind up the game, or play another one.

```
800 POKE Y0,219
810 REM ALL DONE – SHUT DOWN
820 POKE 54276,0:POKE 54296,0
830 PRINT "WANT TO TRY AGAIN";
840 GOTO 340
```

There are many features you can add – such as a fuel supply.

We could have done a pretty background in high resolution graphics, but this would make it difficult to add features (if you wish) like meter readouts. In fact, I've used very dull graphics, but you may consider that a challenge.

That's it. We've done a simple sprite exercise. It's really not hard, even in BASIC. In machine language, it's almost too easy; you'll find that you need to slow your program down, or everything will happen too fast.

The graphics capability is there, and it's not hard to use. A little experimentation and practice, and you too can animate a picture that's worth a thousand words.