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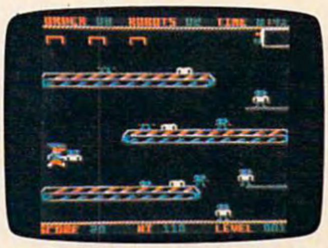

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```
    +206,N(3):IF N(3)=N(2) OR N(3)=N
    (1) THEN 210
220 N(4)=INT(RND(0)*26)+97:POKE SCRN
    +214,N(4):IF N(4)=N(3) OR N(4)=N
    (2) OR N(4)=N(1) THEN 220
225 REM ****  SHOOTING LOOP FOLLOWS
226 REM ****  ! # $ % ARE ALL INVERS
    E
230 ST=STICK(0)
240 IF T=1 THEN GOTO 800
250 IF ST=10 THEN POSITION 10,6:? #6
    ;"!":LOCATE 6,2,NUM:GOTO 320
260 IF ST=9 THEN POSITION 10,6:? #6;
    "#":LOCATE 6,10,NUM:GOTO 390
270 IF ST=6 THEN POSITION 10,6:? #6;
    "$":LOCATE 14,2,NUM:GOTO 460
280 IF ST=5 THEN POSITION 10,6:? #6;
    "%":LOCATE 14,10,NUM:GOTO 530
290 IF N(1)=32 AND N(2)=32 AND N(3)=
    32 AND N(4)=32 THEN 140:REM NEXT
     ROUND IF ALL LETTERS GONE
295 REM ****  CLOCK ROUTINE FOLLOWS
300 IF C+TIME<PEEK(20) THEN C=PEEK(2
    0):POSITION 2,T-1:? #6;" ":POKE
    53279,1:T=T-1:IF C>200 THEN POKE
     20,0:C=0
310 GOTO 230
315 REM ****  BULLET ROUTINES FOLLOW
320 IF NUM=32 THEN GOTO 230
325 Y=5:N(1)=32
330 FOR DIR=9 TO 5 STEP -1:POSITION
    DIR,Y:? #6;".":FOR W=1 TO 5:NEXT
    W:POSITION DIR,Y:? #6;" ":Y=Y-1
340 SOUND 0,DIR*10,10,DIR
350 NEXT DIR
370 SOUND 0,0,0,0
380 GOTO 590
390 IF NUM=32 THEN GOTO 230
395 Y=7:N(2)=32
400 FOR DIR=9 TO 5 STEP -1:POSITION
    DIR,Y:? #6;".":FOR W=1 TO 5:NEXT
     W:POSITION DIR,Y:? #6;" ":Y=Y+1
410 SOUND 0,DIR*10,10,DIR
420 NEXT DIR
440 SOUND 0,0,0,0
450 GOTO 590
460 IF NUM=32 THEN GOTO 230
465 Y=5:N(3)=32
470 FOR DIR=11 TO 15:POSITION DIR,Y:
    ? #6;".":FOR W=1 TO 5:NEXT W:POS
    ITION DIR,Y:? #6;" ":Y=Y-1
480 SOUND 0,DIR*10,10,DIR
490 NEXT DIR
510 SOUND 0,0,0,0
520 GOTO 590
530 IF NUM=32 THEN GOTO 230
535 Y=7:N(4)=32
540 FOR DIR=11 TO 15:POSITION DIR,Y:
    ? #6;".":FOR W=1 TO 5:NEXT W:POS
    ITION DIR,Y:? #6;" ":Y=Y+1
550 SOUND 0,DIR*10,10,DIR
560 NEXT DIR
580 SOUND 0,0,0,0
590 IF LASTNUM>NUM THEN 610:REM CHEC
    K FOR INCORRECT ANSWER
600 GOTO 620
605 REM **** ERROR ROUTINE FOLLOWS
610 SCORE=SCORE-NUM:POSITION 15,6:?
    #6;SCORE
613 FOR W=1 TO 125:SOUND 0,NUM,6,10:
    NEXT W:SOUND 0,0,0,0:FOR W=1 TO
    500:NEXT W:GOTO 140
615 REM **** CORRECT ANS ROUTINE
620 LASTNUM=NUM:SCORE=SCORE+NUM:POSI
    TION 15,6:? #6;SCORE:GOTO 230
625 REM **** TITLE ROUTINE FOLLOWS
630 GRAPHICS 17:SCRN=PEEK(88)+256*PE
    EK(89)
640 FOR I=1 TO 75
650 POKE SCRN+INT(RND(0)*480),INT(RN
    D(0)*26)+33:REM PRINT RANDOM LET
    TERS FOR INTRO
660 SOUND 0,I+75,10,8:NEXT I
670 FOR W=1 TO 50:NEXT W
672 POSITION 5,10:? #6;"___________"
    :POSITION 5,12:? #6;"___________
    "
675 REM **** CHARACTER BETWEEN 'a' A
    ND 'b' IS A CONTROL M
680 POSITION 5,11:? #6;"alpha{M}blas
    t":SOUND 0,0,0,0:POSITION 3,23:?
     #6;"please stand by":RETURN
685 REM **** REDEFINE CHARACTER SET
690 CHSET=(PEEK(106)-8)*256:FOR I=0
    TO 1023:POKE CHSET+I,PEEK(57344+
    I):NEXT I
700 RESTORE 740
710 READ A:IF A=-1 THEN RETURN
720 FOR J=0 TO 7:READ B:POKE CHSET+A
    *8+J,B:NEXT J
730 GOTO 710
740 DATA 1,192,224,112,56,31,15,14,1
    2
750 DATA 3,12,14,15,31,56,112,224,19
    2
760 DATA 4,3,7,14,28,248,240,112,48
770 DATA 5,48,112,240,248,28,14,7,3
780 DATA 6,126,126,126,126,126,126,1
    26,126
790 DATA -1
795 REM **** END OF GAME ROUTINE
800 ? #6;"{CLEAR}":SETCOLOR 4,6,0
810 FOR S=80 TO 250:SOUND 2,S,10,8:N
    EXT S:? #6;"{5 SPACES}gAmE  oVeR
    "
820 ? #6:? #6:? #6;"{3 SPACES}score
    was ";SCORE:IF SCORE>HIGH THEN H
    IGH=SCORE
830 ? #6:? #6;" high score is ";HIGH
840 ? #6:? #6:? #6;"  press fire but
    ton"
850 SOUND 2,0,0,0:IF STRIG(0)=0 THEN
     130
860 GOTO 850
```

Program 2: Alpha Blast – VIC

```
10 POKE55,0:POKE56,28:CLR:DIMN(3),P(3),J(
   3),D(3):GOSUB240:HI=0
20 RO=0:SC=0:TT=50
30 LA=0:PRINT"{CLR}{DOWN}":FORT=1TO10:PRI
   NT"{RED}{RVS}@{YEL}{OFF}!":NEXT
40 POKE7822,31:RO=RO+1:PRINT"{HOME}{GRN}
   {RVS}ROUND"RO;TAB(10)"{RVS}SCORE"SC
50 TT=TT-2
60 FORI=0TO3
70 N(I)=INT(RND(1)*26)+129:IFI=0THEN100
80 FORJ=0TOI-1:IFN(J)=N(I)THEN70
90 NEXT
100 POKEP(I),N(I):NEXT
110 JY=PEEK(37151)+PEEK(37152)
120 IFT=1THEN320
130 FORI=0TO3:IFJ(I)=JYTHENPOKE7822,27+I:
    NU=PEEK(P(I)):GOTO170
```

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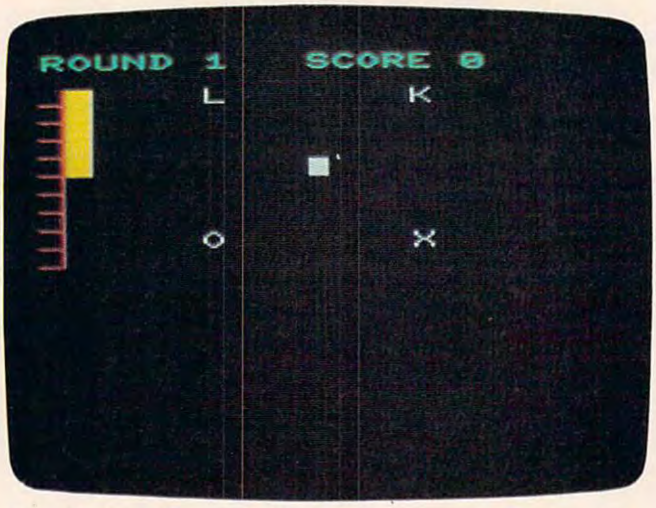

Round 1 is underway in the VIC version of "Alpha Blast."

```
140 NEXT:IFN(Ø)=32ANDN(1)=32ANDN(2)=32AND
    N(3)=32THEN3Ø
150 IFPEEK(162)>TTTHENPOKE36877,200:POKE1
    62,Ø:POKE7681+T*22,32:T=T-1:POKE36877
    ,Ø
160 GOTO11Ø
170 IFNU=32THEN11Ø
180 POKE36877,200:L=7822+D(I):FORJ=1TO4:P
    OKEL,174:FORW=1TO1Ø:NEXT:POKEL,16Ø
190 L=L+D(I):POKE36878,15-J*3:NEXT:POKEL-
    D(I),16Ø:N(I)=32:POKE36877,Ø:POKE3687
    8,15
200 IFLA<NUTHEN23Ø
210 SC=SC-NU:PRINT"{HOME}{RVS}{GRN}"SPC(1
    5)SC
220 POKE36875,23Ø:FORW=1TO25Ø:NEXT:POKE36
    875,Ø:FORW=1TO5ØØ:NEXT:GOTO3Ø
230 LA=NU:SC=SC+NU:PRINT"{HOME}{RVS}{GRN}
    "SPC(15)SC:GOTO11Ø
240 PRINT"{CLR}";:POKE36879,8:POKE36877,Ø
    :POKE36878,15:FORI=1TO75
250 POKE768Ø+RND(1)*5Ø6,RND(1)*26+1
260 POKE36874,I+18Ø:NEXT:POKE36874,Ø
270 FORW=1TO5Ø:NEXT
280 POKE214,9:PRINT:PRINTSPC(5)"{GRN}----
    --------":PRINT:PRINTSPC(5)"---------
    ---"
290 PRINTSPC(5)"{2 UP} ALPHABLAST "
300 FORI=7384TO7439:READA:POKEI,A:NEXT:FO
    RI=ØTO3:READP(I),J(I),D(I):NEXT
310 POKE37154,127:PRINT"{CLR}":POKE36869,
    255:RETURN
320 PRINT"{CLR}{GRN}":FORS=25ØTO129STEP-1
    :POKE36875,S:NEXT:POKE36875,Ø:PRINTSP
    C(5)"{RVS}GAME OVER"
330 PRINT"{2 DOWN}{RVS}{3 SPACES}SCORE WA
    S"SC:IFSC>HITHENHI=SC
340 PRINT"{DOWN}{RVS} HIGH SCORE IS"HI
350 PRINT"{2 DOWN}{RVS}{2 SPACES}PRESS
    {WHT}FIRE{GRN} BUTTON"
360 IF(PEEK(37151)AND32)THEN36Ø
370 GOTO2Ø
380 DATA192,224,112,56,31,15,14,12, 12,14
    ,15,31,56,112,224,192
390 DATA3,7,14,28,248,24Ø,112,48, 48,112,
    24Ø,248,28,14,7,3
400 DATA126,126,126,126,126,126,126,126
410 DATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø,255,255,255,255,2
    55,255,255,255
420 DATA773Ø,353,-23,79Ø6,349,21,7738,241
    ,-21,7914,237,23
```

Program 3: Alpha Blast – Color Computer

Version by Todd Koumrian, Programming Assistant

```
10 DIMA(156)
20 FORI=1TO156:READB:A(I)=B:NEXT
40 CLSØ:PRINT@1Ø,"ALPHA";:PRINT@16,
   "BLAST";
50 FORI=ØTO4:FORJ=ØTO2*I:SET(45-I+J
   ,1Ø+I,3):SET(46+I,1Ø+I,3):NEXT:N
   EXT
60 FORI=4TOØSTEP-1:FORJ=ØTO2*I:SET(
   45-I+J,15+4-I,3):SET(46+I,15+4-I
   ,3):NEXT:NEXT
70 FORI=ØTO1:SET(42+I,11+I,8):SET(4
   9-I,11+I,8):SET(42+I,18-I,8):SET
   (49-I,18-I,8):NEXT
80 FORI=1Ø34TO1Ø44:POKEI,32:NEXT
90 PRINT@1Ø,"ROUND";:PRINT@19,"SCOR
   E";
99 SC=Ø:TM=9
100 FORI=8TO25STEP2:SET(Ø,I,8):NEXT
    :BL=1Ø:QQ=Ø:FORI=1TO4:TT(I)=Ø:N
    EXT:TI=Ø:LM=Ø
110 N(1)=RND(26)
120 N(2)=RND(26):IFN(2)=N(1)THEN12Ø
130 N(3)=RND(26):IFN(3)=N(1)ORN(3)=
    N(2)THEN13Ø
140 N(4)=RND(26):IFN(4)=N(1)ORN(4)=
    N(2)ORN(4)=N(3)THEN14Ø
150 FORI=1TO4:S(I)=(N(I)-1)*6+1:NEX
    T:GOSUB2ØØ:GOSUB21Ø:GOSUB22Ø:GO
    SUB23Ø
160 R=R+1:R$=STR$(R):FORI=2TOLEN(R$
    ):RQ$=MID$(R$,I,1):POKE1Ø38+I,V
    AL(RQ$)+48:NEXT
162 IFR/3=INT(R/3)THENTM=TM-1
165 GOTO3ØØ
200 FORI=ØTO5:CR(I)=A(I+S(1))+144:N
    EXT
205 FORI=ØTO5:PRINT@(32*INT((I/2)+1
    )+(I AND 1))+16,CHR$(CR(I));:NE
    XT:RETURN
210 FORI=ØTO5:CR(I)=A(I+S(2))+2Ø8:N
    EXT
215 FORI=ØTO5:PRINT@(32*INT((I/2)+1
    )+(I AND 1))+28,CHR$(CR(I));:NE
    XT:RETURN
220 FORI=ØTO5:CR(I)=A(I+S(3))+224:N
    EXT
225 FORI=ØTO5:PRINT@(32*INT((I/2)+1
    3)+(I AND 1))+16,CHR$(CR(I));:N
    EXT:RETURN
230 FORI=ØTO5:CR(I)=A(I+S(4))+192:N
    EXT
235 FORI=ØTO5:PRINT@(32*INT((I/2)+1
    3)+(I AND 1))+28,CHR$(CR(I));:N
    EXT:RETURN
300 X=JOYSTK(Ø):Y=JOYSTK(1)
310 IFX<8ANDY<8THENT=1:GOTO37Ø
320 IFX>55ANDY<8THENT=2:GOTO37Ø
330 IFX<8ANDY>55THENT=3:GOTO37Ø
340 IFX>55ANDY>55THENT=4:GOTO37Ø
350 TI=TI+1:IF TI<TM THEN3ØØ
351 BL=BL-1:IFBL=ØTHEN1ØØØ
352 RESET(Ø,2*(BL-1)+8):TI=Ø:SOUND1
    ,1:GOTO35Ø
370 IFTT(T)=1THEN35Ø
380 FORI=ØTO5:CR(I)=128:NEXT
```

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```
385 NM=N(T):IF LM< NM THEN387
386 SC=SC-(NM+96):GOTO390
387 SC=SC+NM+96:LM=NM
390 ON T GOSUB400,410,420,430
395 LC=1048:GOSUB2000
396 IFLM> NM THENGOSUB205:GOSUB215:
    GOSUB225:GOSUB235:FORI=1TO4:TT(
    I)=1:NEXT
397 FORI=1TO4:QQ=QQ+TT(I):NEXT:IFQQ
    =4THEN100
398 QQ=0:GOTO350
400 FORI=41TO35STEP-1:SET(I,I-31,3)
    :NEXT:FORI=41TO35STEP-1:RESET(I
    ,I-31):NEXT:GOSUB205:GOTO440
410 FORI=50TO56:SET(I,60-I,3):NEXT:
    FORI=50TO56:RESET(I,60-I):NEXT:
    GOSUB215:GOTO440
420 FORI=41TO33STEP-1:SET(I,60-I,3)
    :NEXT:FORI=41TO33STEP-1:RESET(I
    ,60-I):NEXT:GOSUB225:GOTO440
430 FORI=50TO58:SET(I,I-31,3):NEXT:
    FORI=50TO58:RESET(I,I-31):NEXT:
    GOSUB235
440 TT(T)=1:T=0:F=0:RETURN
1000 CLS0:PRINT@46,"GAME";:PRINT@51
     ,"OVER";:PRINT@105,"YOUR";:PRI
     NT@110,"SCORE";:PRINT@116,"WAS
     ";
1010 LC=1142:GOSUB2000
1011 GOTO1011
2000 SC$=STR$(SC):FORI=2TOLEN(SC$):
     DD$=MID$(SC$,I,1):POKELC+I,VAL
     (DD$)+48:NEXT:POKELC+I,32:POKE
     LC+I+1,32:RETURN
10000 DATA 6,9,11,7,8,4,14,9,14,13,
      12,8,14,12,10,0,12,12,14,9,10
      ,5,12,8,14,12,14,8,12,12
10010 DATA 14,12,14,8,8,0,14,8,10,1
      3,12,12,10,5,14,13,8,4,13,14,
      5,10,12,12,4,14,2,10,4,8,10,6
      ,14,2,8,4
10020 DATA 10,0,10,0,12,12,9,6,10,5
      ,8,4,15,5,10,15,8,4,14,13,10,
      5,12,12,14,13,14,12,8,0
10030 DATA 14,13,10,6,12,4,14,13,14
      ,9,8,4,14,12,12,13,12,12,13,1
      4,5,10,4,8,10,5,10,5,12,12
10040 DATA 10,5,9,6,4,8,10,5,9,6,8,
      4,10,5,6,9,8,4,9,6,5,10,4,8,1
      2,14,6,0,12,12
```

TI-99/4A Version Notes

Pat Parrish, Programming Supervisor

The object of the TI-99/4A version of Alpha Blast (written in Extended BASIC) is to indicate within a certain time the alphabetical order of four scrambled letters appearing on the screen. In its present form, the game requires a joystick. Moving the joystick in the direction of any letter will cause that letter to disappear. At the same time, the order of this response is recorded.

After you have guessed the sequence of the first four letters, a new round begins with the appearance of four new letters. As the game continues, you are given less and less time to respond. The game ends when you can no longer provide four responses within the allotted time.

Scoring for the game is calculated in lines 470 and 480. It is based on three factors: the round number, the time that it took you to respond, and the order of your answers. The faster you can provide the correct answers, the higher will be your score. For an incorrect response, points are deducted at a rate one and a half times the number awarded for correct answers.

To convert this game to keyboard control, substitute the following lines:

```
330 CALL KEY(0,X,ST):: IF ST=0 THEN
     CALL HCHAR(ROW,6,32):: ROW=ROW
    -U :: IF ROW<5 THEN 400 ELSE 33
    0
340 IF (X=69)*(A)THEN CALL PATTERN(
    #2,32,#6,43):: V(T)=0 :: A=0 ::
     GOTO 390
350 IF (X=68)*(B)THEN CALL PATTERN(
    #3,32,#6,43):: V(T)=1 :: B=0 ::
     GOTO 390
360 IF (X=88)*(C)THEN CALL PATTERN(
    #4,32,#6,43):: V(T)=2 :: C=0 ::
     GOTO 390
370 IF (X=83)*(D)THEN CALL PATTERN(
    #5,32,#6,43):: V(T)=3 :: D=0 ::
     GOTO 390
```

Program 4: Alpha Blast – TI-99/4A

Extended BASIC Version by Pat Parrish, Programming Supervisor

```
100 GOSUB 510
110 RANDOMIZE
120 DIM N(3)
130 CALL CLEAR :: CALL SCREEN(16)
140 CALL HCHAR(8,5,120,24):: DISPLA
    Y AT(10,4):"A L P H A -- B L A
    S T" :: CALL HCHAR(12,5,120,24)
150 CALL MAGNIFY(2):: FOR L=1 TO 28
160 CALL SPRITE(#L,INT(RND*26)+65,I
    NT(RND*13)+3,INT(RND*24)*8+1,IN
    T(RND*32)*8+1,INT(RND*60)-30,IN
    T(RND*60)-30)
170 IF L=25 THEN DISPLAY AT(21,10):
    "GET READY!"
180 NEXT L :: CALL DELSPRITE(ALL)::
     CALL CLEAR :: HS=0
190 CALL COLOR(12,6,1)
200 DISPLAY AT(1,6):"HIGH SCORE:";H
    S :: U=0 :: R=0 :: SC=0
210 U=U+.03*SGN(1-U):: R=R+1 :: DIS
    PLAY AT(5,14):"ROUND #";R :: DI
    SPLAY AT(2,6):"SCORE:
    {5 SPACES}";SC
220 FOR I=6 TO 21 :: CALL HCHAR(I,6
    ,128):: NEXT I
230 FOR I=5 TO 7 STEP 2 :: CALL VCH
    AR(5,I,95,17):: NEXT I
240 FOR I=3 TO 9 STEP 6 :: CALL VCH
    AR(4,I,120,20):: NEXT I :: CALL
```

GWENDOLYN.

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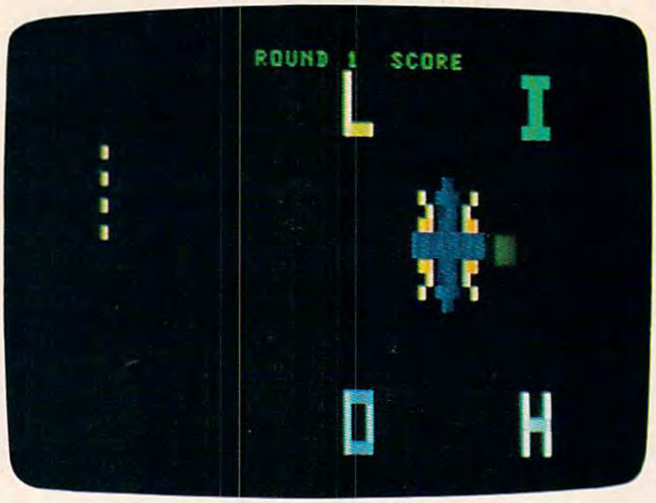

TI version of "Alpha Blast."

```
 HCHAR(4,4,120,5):: CALL HCHAR(
 23,4,120,5)
250 FOR I=0 TO 3
260 N(I)=INT(RND*26)+65
270 FOR J=0 TO I-1 :: IF N(J)=N(I)T
 HEN 260
280 NEXT J :: NEXT I
290 CALL SPRITE(#6,42,3,97,153)
300 CALL SPRITE(#2,N(0),14,57,153):
 : CALL SPRITE(#3,N(1),14,97,201
 ):: CALL SPRITE(#4,N(2),14,137,
 153):: CALL SPRITE(#5,N(3),14,9
 7,105)
310 ROW=21 :: A=-1 :: B=-1 :: C=-1
 :: D=-1
320 T=0
330 CALL JOYST(1,X,Y):: IF ABS(X)+A
 BS(Y)<>4 THEN CALL HCHAR(ROW,6,
 32):: ROW=ROW-U :: IF ROW<5 THE
 N 400 ELSE 330
340 IF (X=0)*(Y=4)*(A)THEN CALL PAT
 TERN(#2,32,#6,43):: V(T)=0 :: A
 =0 :: GOTO 390
350 IF (X=4)*(Y=0)*(B)THEN CALL PAT
 TERN(#3,32,#6,43):: V(T)=1 :: B
 =0 :: GOTO 390
360 IF (X=0)*(Y=-4)*(C)THEN CALL PA
 TTERN(#4,32,#6,43):: V(T)=2 ::
 C=0 :: GOTO 390
370 IF (X=-4)*(Y=0)*(D)THEN CALL PA
 TTERN(#5,32,#6,43):: V(T)=3 ::
 D=0 :: GOTO 390
380 CALL HCHAR(ROW,6,32):: ROW=ROW-
 U :: IF ROW<5 THEN 400 ELSE 330
390 CALL SOUND(-10,200,2):: CALL PA
 TTERN(#6,42):: T=T+1 :: IF T=4
 THEN 450 ELSE 330
400 DISPLAY AT(22,11):"YOUR TIME IS
  UP!"
410 CALL SOUND(800,110,5,120,5):: F
 OR I=1 TO 200 :: NEXT I
420 DISPLAY AT(24,10):"PLAY AGAIN(Y
 /N)?" :: IF SC>HS THEN HS=SC
430 CALL KEY(0,KEY,ST):: IF ST=0 TH
 EN 430
440 IF (KEY=89)+(KEY=121)THEN CALL
 CLEAR :: CALL DELSPRITE(ALL)::
 GOTO 200 ELSE 560
450 REM EVALUATE ANSWERS
460 FOR T=0 TO 2 :: IF N(V(T))<N(V(
 T+1))THEN 480
470 SC=SC-INT(1.5*R*ROW):: GOTO 490
480 SC=SC+INT(R*ROW)
490 NEXT T
500 CALL DELSPRITE(ALL):: GOTO 210
510 REM CHAR
520 CALL COLOR(14,9,1)
530 CALL CHAR(120,"007E7E7E7E7E7E00
 "):: CALL CHAR(128,"")
540 CALL COLOR(12,6,10):: CALL COLO
 R(13,1,9)
550 RETURN
560 END
```

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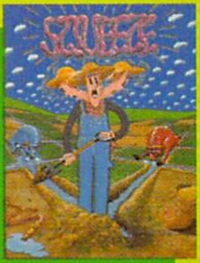
Christmas Special

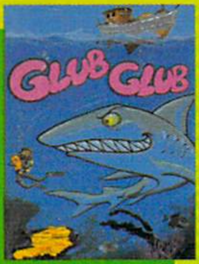
Get one game FREE when you buy any 2 Showcase Software games for the VIC-20® at $19.95 each. But hurry! Offer ends Dec. 25, 1983.

ASTRO PATROL
In space there are no guarantees...All your training and superb equipment—will it be enough to save you from the alien hordes?

CHICKEN
A pesky old fox has found Ma Hen's eggs and she's trying to save them from his deadly clutches. Play action intense enough to challenge the most experienced arcade player.

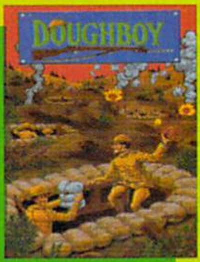
SQUEEZE
The fields are dry. You hafta dig a heap o' ditches! But you better be nimble 'cause the bulls they gonna chase you down. So pick up your shovel and start diggin' your way to fun and fast action!

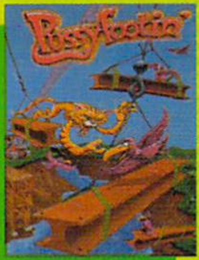




GLUB GLUB
The map was right! Under the boat the unmistakable glitter of gold. A king's ransom! But those dark forms can only be...sharks! Can you conquer your fear and avoid those dark marauders?

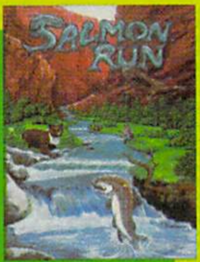
DOUGHBOY
The bugle call has sounded. It's time to hit the trenches for a fun-filled contest of bravery and tactics. Your mission: Recover the supplies that are scattered across the playfield while avoiding enemy troops.





PUSSYFOOTIN'
Meet Fearless Franklin the guard cat. His job: catching nasty grustlebirds and keeping things running smoothly for his hard hat buddies. But won't anything stand still?

SALMON RUN
Sammy the seafaring salmon is back to see his fishy fiancé. But he has to meet her upstream and there are waterfalls, hungry bears, anglers and bothersome birds at every bend. But Sammy is determined to give you hours of fishy fun!



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PATHWAY

George Trepal

"Pathway" is not a typical computer game. The computer is not an opponent – it simply keeps track of the game you play against another person. For VIC, 64, and Apple.

The rules of the game are simple, but there are a few catches. Each player (two or three can play) starts off with four tokens at the start of a path. The first player to get all four tokens to the end of the path is the winner.

To play, push the VIC's F7 key. The machine will return the number of spaces you can move. Each token is numbered 1, 2, 3, or 4. Press the appropriate number key for the token you want moved. If your token lands on another player's token, that token is sent back to the start of the path. If you land on your own token, that token becomes invisible until it is moved. As you play, you'll see that a wise strategy is required to win.

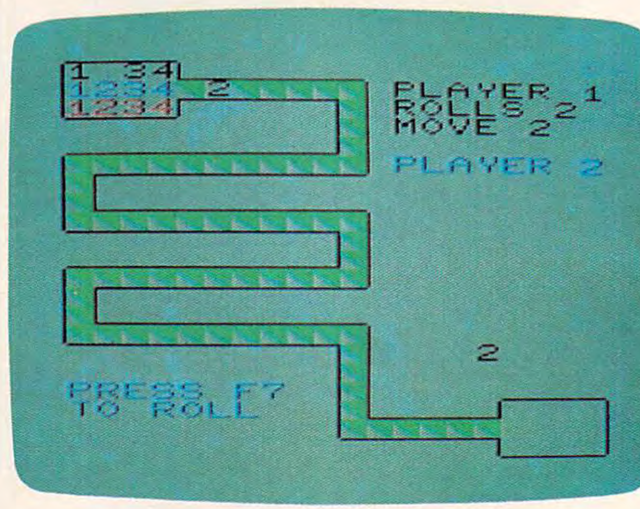
The VIC version is written for the unmodified VIC, so disconnect any extra memory (except for the Super Expander).

Game Movement Logic

The positions of the tokens are stored in arrays and updated as the tokens are moved. Once a move is made, the arrays are compared to see if a token should be sent back to the start. The position of a token is a number which represents how many cells away the token is located from the start of the path.

Each cell corresponds to a certain screen location, all of which are stored in DATA statements. For example, if a token were moved from cell 24 to cell 31, the machine would read the DATA from the start and put a path character in position 24 to erase the token. It would then return to the start of DATA and read to the thirty-first location, where the token is then printed to the screen.

The 64 version is almost identical in play to the VIC version, although the playing field is larger. The Apple version uses the space bar instead of the F7 key used by the Commodore versions.



Player 2 is about to roll the dice in the VIC version of "Pathway."

If you'd rather not type in the program (VIC version only), send $3, a blank tape or disk, and an SASE to:

George Trepal
2650 Alturas Road
Bartow, FL 33830

BEFORE TYPING...
If you're new to computing, please read "How To Type COMPUTE!'s Programs" and "A Beginner's Guide To Typing In Programs."

Program 1: Pathway For VIC

```
1 D$="{HOME}{12 DOWN}":CC=30720:E$="
  {HOME}{7 DOWN}":POKE36879,25
2 DIMA$(23)
3 PRINT"{CLR}{BLK}{5 DOWN}{2 SPACES}2 OR
   3 PLAYERS";:GOSUB88:IFM<>2ANDM<>3THEN
  3
4 P=M:PRINT"{CLR}":GOSUB56:GOSUB50
5 VO=36878:TN=36875
6 FORJ=1TO4:POKE38834+J,0:POKE38856+J,6:
  POKE38878+J,2:NEXT
7 PRINTD$+"{8 DOWN}{8 SPACES}";
8 DEFFNA(X)=INT(RND(1)*9)+1
```

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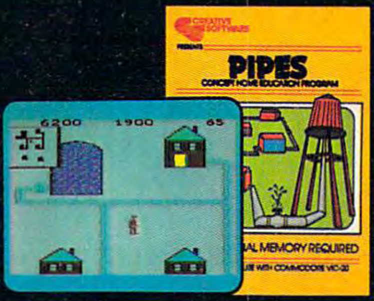
```
9 FORJ=1TO4:AA(J)=77Ø2+J:POKEAA(J),48+J:
  POKEAA(J)+CC,Ø:NEXTJ
1Ø FORJ=1TO4:BB(J)=7724+J:POKEBB(J),48+J
   :POKEBB(J)+CC,6:NEXTJ
11 FORJ=1TO4:CC(J)=7746+J:POKECC(J),48+J
   :POKECC(J)+CC,2:NEXTJ
12 GOSUB87:PRINT"{HOME}{2 DOWN}{BLK}"SPC
   (13)"PLAYER 1";
13 POKE7765,32:POKE7786,32
14 GOSUB77:PRINT"{HOME}{3 DOWN}{BLK}"SPC
   (13)"ROLLS";V
15 PRINT"{HOME}{4 DOWN}"SPC(13)"MOVE";
16 GOSUB88:IFM<1ORM>4THEN15
17 PRINTM:IFA(M)=ØTHENPOKEAA(M),32
18 IFA(M)>ØTHENCV=A(M):GOSUB84
19 IFV+A(M)>7ØTHENPOKE8114+M,48+M:A(M)=7
   1:GOTO24
2Ø A(M)=A(M)+V:RESTORE:FORJ=1TOA(M):READ
   X:NEXT:POKEX,M+48:POKEX+CC,Ø
21 FORJ=1TO4:IFB(J)<>ØANDB(J)=A(M)THENB(
   J)=Ø:POKEBB(J),48+J:GOSUB86
22 NEXT:FORJ=1TO4:IFC(J)<>ØANDC(J)=A(M)T
   HENC(J)=Ø:POKECC(J),48+J:GOSUB86
23 NEXT
24 GOSUB87:PRINT"{HOME}{6 DOWN}{BLU}"SPC
   (13)"PLAYER 2";
25 POKE7853,32:POKE7874,32
26 GOSUB77:PRINTE$SPC(13)"ROLLS";V
27 PRINTE$SPC(13)"{DOWN}MOVE";
28 GOSUB88:IFM<1ORM>4THEN27
29 PRINTM:IFB(M)=ØTHENPOKEBB(M),32
3Ø IFB(M)>ØTHENCV=B(M):GOSUB84
31 IFV+B(M)>7ØTHENPOKE8136+M,48+M:B(M)=7
   1:GOTO36
32 B(M)=B(M)+V:RESTORE:FORJ=1TOB(M):READ
   X:NEXT:POKEX,M+48:POKEX+CC,6
33 FORJ=1TO4:IFA(J)<>ØANDA(J)=B(M)THENA(
   J)=Ø:POKEAA(J),48+J:GOSUB86
34 NEXT:FORJ=1TO4:IFC(J)<>ØANDC(J)=B(M)T
   HENC(J)=Ø:POKECC(J),48+J:GOSUB86
35 NEXTJ
36 IFP<>3THEN12
37 GOSUB87:PRINTE$+"{3 DOWN}{RED}"SPC(13
   )"PLAYER 3"
38 POKE7941,32:POKE7962,32
39 GOSUB77:PRINTE$+"{4 DOWN}"SPC(13)"ROL
   LS";V
4Ø PRINTD$SPC(13)"MOVE";
41 GOSUB88:IFM<1ORM>4THEN4Ø
42 PRINTM:IFC(M)=ØTHENPOKECC(M),32
43 IFC(M)>ØTHENCV=C(M):GOSUB84
44 IFV+C(M)>7ØTHENPOKE8158+M,48+M:C(M)=7
   1:GOTO12
45 C(M)=C(M)+V:RESTORE:FORJ=1TOC(M):READ
   X:NEXTJ:POKEX,M+48:POKEX+CC,2
46 FORJ=1TO4:IFA(J)<>ØANDA(J)=C(M)THENA(
   J)=Ø:POKEAA(J),48+J:GOSUB86
47 NEXT:FORJ=1TO4:IFB(J)<>ØANDB(J)=C(M)T
   HENB(J)=Ø:POKEBB(J),48+J:GOSUB86
48 NEXT:GOTO12
49 GOTO49
5Ø DATA7729,773Ø,7731,7732,7733,7734,773
   5,7757,7779,78Ø1,7823,7822,7821,782Ø,
   7819,7818
51 DATA7817,7816,7815,7814,7813,7835,785
   7,7879,788Ø,7881,7882,7883,7884,7885,
   7886,7887
52 DATA7888,7889,7911,7933,7955,7954,795
   3,7952,7951,795Ø,7949,7948,7947,7946,
   7945,7967
53 DATA7989,8Ø11,8Ø12,8Ø13,8Ø14,8Ø15,8Ø1
   6,8Ø17,8Ø18,8Ø19,8Ø2Ø,8Ø21,8Ø43,8Ø65,
   8Ø87,81Ø9
54 DATA8131,8132,8133,8134,8135,8136
55 FORJ=1TO7Ø:READX:POKEX,95:POKEX+CC,5:
   NEXTJ:RESTORE:RETURN
56 A$(1)=" [4 @]"
57 A$(2)="[M]{4 SPACES}L[6 @]"
58 A$(3)="[M]{11 SPACES}[G]"
59 A$(4)="[M]{4 SPACES}O[4 T]P [G]"
6Ø A$(5)=" [4 T]{5 SPACES}[M] [G]"
61 A$(6)=" [9 @]@ [G]"
62 A$(7)="[M]{11 SPACES}[G]"
63 A$(8)="[M] O[9 T]"
64 A$(9)="[M] L[9 @]"
65 A$(1Ø)=A$(7)
66 A$(11)=" [9 T]P [G]"
67 A$(12)=" [9 @]@ [G]"
68 A$(13)=A$(7)
69 A$(14)=A$(8):A$(15)=A$(9):A$(16)=A$(1
   Ø):A$(17)=A$(11)
7Ø A$(18)="{1Ø SPACES}[M] [G]"
71 A$(19)="{1Ø SPACES}[M] [G]
   {4 SPACES}[4 @]"
72 A$(2Ø)="{1Ø SPACES}[M] L[3 @]@
   {4 SPACES}[G]"
73 A$(21)="{1Ø SPACES}[M]{1Ø SPACES}
   [G]"
74 A$(22)="{11 SPACES}[5 T]P{4 SPACES}
   [G]"
75 A$(23)="{17 SPACES}[4 T]"
76 FORJ=1TO19:PRINTA$(J):NEXT:FORJ=2ØTO2
   3:PRINTA$(J);:NEXT:RETURN
77 PRINTD$+"{6 DOWN} PRESS F7";
78 PRINTD$+"{7 DOWN} TO ROLL";
79 IFPEEK(197)=63THEN81
8Ø GOTO79
81 V=FNA(1):POKE198,Ø
82 FORJ=1TOV:POKE8Ø48,48+J:POKE38768,Ø:F
   ORT=1TO1ØØ:NEXT:POKEVO,15:POKETN,2ØØ:
   POKEVO,Ø
83 NEXT:RETURN
84 IFCV>7ØTHENCV=7Ø
85 RESTORE:FORJ=1TOCV:READX:NEXT:POKEX,9
   5:POKEX+CC,5:RETURN
86 POKEVO,15:POKETN,25Ø:FORT=1TO7ØØ:NEXT
   :POKEVO,Ø:RETURN
87 POKEVO,1Ø:POKETN,128:FORT=1TO2ØØ:NEXT
   :POKEVO,Ø:RETURN
88 GETM$:ON-(M$="")GOTO88:M=VAL(M$):RETU
   RN
```

Program 2: Pathway For The 64

```
1ØØ D$="{HOME}{12 DOWN}":CC=54272:E$="
    {HOME}{7 DOWN}":POKE53281,1:POKE5328Ø
    ,14:SO=CC
11Ø DIMA$(23):FORT=SOTOSO+24:POKET,Ø:NEXT
    :POKESO+24,15:POKESO+5,34:POKESO+6,24
    4
115 PRINT"{CLR}{7 DOWN}{15 RIGHT}PATHWAYS
    "
12Ø PRINT"{BLK}{4 DOWN}{1Ø RIGHT}
    {2 SPACES}2 OR 3 PLAYERS";
125 GOSUB96Ø:IFM<>2ANDM<>3THEN125
13Ø P=M:PRINT"{CLR}":GOSUB65Ø:GOSUB59Ø
14Ø VO=36878:TN=36875
15Ø FORJ=1TO4:POKE11Ø4+CC+J,Ø:POKE1144+CC
    +J,6:POKE1184+CC+J,2:NEXT
```

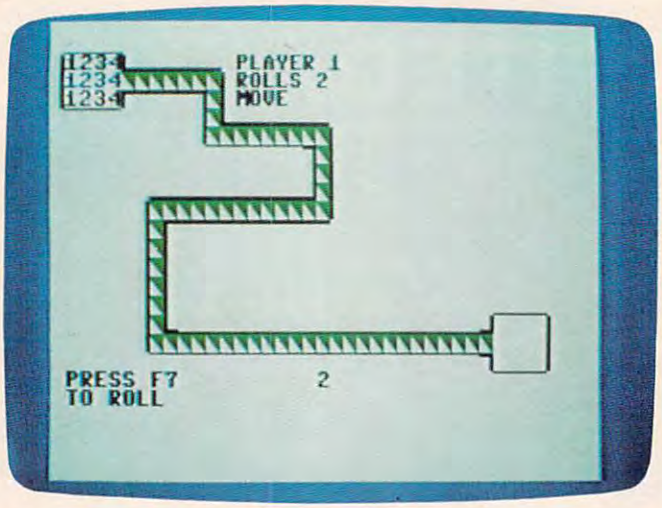
HELP WANTED:



Arlo is a hard-working plumber, but a touch absent-minded. He's building a water supply system for the whole neighborhood, and he really has his hands full. Help Arlo decide what kind of pipe to buy and where to put it... his limited budget doesn't leave him much margin for error. Figure out the shortest, most economical way to get everyone hooked up... and just hope poor Arlo has remembered to open and close the right valves. A marvelously entertaining and challenging exercise in planning, economics and spatial relationships for all ages.

PIPES. For the VIC-20 and Commodore 64.

CREATIVE SOFTWARE



64 version of "Pathway."

```
160 PRINTD$+"{8 DOWN}{8 SPACES}";
170 DEFFNA(X)=INT(RND(1)*9)+1
180 FORJ=1TO4:AA(J)=1104+J:POKEAA(J),48+J
    :POKEAA(J)+CC,Ø:NEXTJ
190 FORJ=1TO4:BB(J)=1144+J:POKEBB(J),48+J
    :POKEBB(J)+CC,6:NEXTJ
200 FORJ=1TO4:CC(J)=1184+J:POKECC(J),48+J
    :POKECC(J)+CC,2:NEXTJ
210 GOSUB950:PRINT"{HOME}{2 DOWN}{BLK}"SP
    C(13)"PLAYER 1";
220 POKE1163,32:POKE1163+CC,Ø:POKE1202,32
    :POKE1202+CC,Ø
230 GOSUB850:PRINT"{HOME}{3 DOWN}{BLK}"SP
    C(13)"ROLLS";V
240 PRINT"{HOME}{4 DOWN}{BLK}"SPC(13)"MOV
    E";
250 GOSUB960:IFM<1ORM>4THEN240
260 PRINTM:IFA(M)=ØTHENPOKEAA(M),32
270 IFA(M)>ØTHENCV=A(M):GOSUB920
280 IFV+A(M)>65THENPOKE1695+M,48+M:POKE16
    95+M+CC,Ø:A(M)=66:GOTO330
290 A(M)=A(M)+V:RESTORE:FORJ=1TOA(M):READ
    X:NEXT:POKEX,M+48:POKEX+CC,Ø
300 FORJ=1TO4:IFB(J)<>ØANDB(J)=A(M)THENB(
    J)=Ø:POKEBB(J),48+J:GOSUB940
310 NEXT:FORJ=1TO4:IFC(J)<>ØANDC(J)=A(M)T
    HENC(J)=Ø:POKECC(J),48+J:GOSUB940
320 NEXT
330 GOSUB950:PRINT"{HOME}{2 DOWN}
    {10 RIGHT}{BLU}"SPC(13)"PLAYER 2";
340 POKE1173,32:POKE1173+CC,6:POKE1212,32
    :POKE1212+CC,6
350 GOSUB850:PRINT"{HOME}{3 DOWN}
    {10 RIGHT}{BLU}"SPC(13)"ROLLS";V
360 PRINT"{HOME}{4 DOWN}{10 RIGHT}"SPC(13
    )"MOVE";
370 GOSUB960:IFM<1ORM>4THEN360
380 PRINTM:IFB(M)=ØTHENPOKEBB(M),32
390 IFB(M)>ØTHENCV=B(M):GOSUB920
400 IFV+B(M)>65THENPOKE1735+M,48+M:POKE17
    35+M+CC,6:B(M)=66:GOTO450
410 B(M)=B(M)+V:RESTORE:FORJ=1TOB(M):READ
    X:NEXT:POKEX,M+48:POKEX+CC,6
420 FORJ=1TO4:IFA(J)<>ØANDA(J)=B(M)THENA(
    J)=Ø:POKEAA(J),48+J:GOSUB940
430 NEXT:FORJ=1TO4:IFC(J)<>ØANDC(J)=B(M)T
    HENC(J)=Ø:POKECC(J),48+J:GOSUB940
440 NEXTJ
450 IFP<>3THEN210
460 GOSUB950:PRINT"{HOME}{2 DOWN}
    {19 RIGHT}{RED}"SPC(13)"PLAYER 3"
470 POKE1182,32:POKE1182+CC,2:POKE1221,32
    :POKE1221+CC,2
480 GOSUB850:PRINT"{HOME}{3 DOWN}
    {19 RIGHT}{RED}"SPC(13)"ROLLS";V
490 PRINT"{HOME}{4 DOWN}{19 RIGHT}{RED}"S
    PC(13)"MOVE";
500 GOSUB960:IFM<1ORM>4THEN490
510 PRINTM:IFC(M)=ØTHENPOKECC(M),32
520 IFC(M)>ØTHENCV=C(M):GOSUB920
530 IFV+C(M)>65THENPOKE1775+M,48+M:POKE17
    75+M+CC,2:C(M)=66:GOTO210
540 C(M)=C(M)+V:RESTORE:FORJ=1TOC(M):READ
    X:NEXTJ:POKEX,M+48:POKEX+CC,2
550 FORJ=1TO4:IFA(J)<>ØANDA(J)=C(M)THENA(
    J)=Ø:POKEAA(J),48+J:GOSUB940
560 NEXT:FORJ=1TO4:IFB(J)<>ØANDB(J)=C(M)T
    HENB(J)=Ø:POKEBB(J),48+J:GOSUB940
570 NEXT:GOTO210
580 GOTO580
590 DATA 1149,115Ø,1151,1152,1153,1154,11
    55,1195,1235,1275,1276,1277,1278,1279
600 DATA128Ø,1281,1282,1283,1323,1363,14Ø
    3,1443,1442,1441,144Ø,1439,1438,1437
610 DATA 1436,1435,1434,1433,1432,1431,14
    71,1511,1551,1591,1631,1671,1711,1712
620 DATA 1713,1714,1715,1716,1717,1718,17
    19,172Ø,1721,1722,1723,1724,1725
630 DATA 1726,1727,1728,1729,173Ø,1731,17
    32,1733,1734,1735
640 FORJ=1TO65:READX:POKEX,95:POKEX+CC,5:
    NEXTJ:RESTORE:RETURN
650 A$(1)=" [4 @]"
660 A$(2)="[M]{4 SPACES}L[6 P]"
670 A$(3)="[M]{11 SPACES}[G]"
680 A$(4)="[M]{4 SPACES}O[4 Y]P [G]
    "
690 A$(5)=" [4 T]{5 SPACES}[M] L
    [7 P]"
700 A$(6)="{1Ø SPACES}[N]{9 SPACES}
    [G]"
710 A$(7)="{11 SPACES}[7 T]P [G]"
720 A$(8)="{18 SPACES}[M] [H]"
730 A$(9)="{7 SPACES}[11 P]@ [H] "
740 A$(1Ø)="{6 SPACES}[M]{13 SPACES}
    [G]"
750 A$(11)="{6 SPACES}[M] O[11 Y] "
760 A$(12)="{6 SPACES}[M] [G]"
770 A$(13)="{6 SPACES}[N] [H]
    {2 SPACES}"
780 A$(14)="{6 SPACES}[M] [G]"
790 A$(15)="{6 SPACES}[M] [G]
    {23 SPACES}[4 @]"
800 A$(16)="{6 SPACES}[M] L[22 @]@
    {4 SPACES}[G]"
810 A$(17)="{6 SPACES}[M]{29 SPACES}
    [G]"
820 A$(18)="{7 SPACES}[24 T]P{4 SPACES}
    [G]"
830 A$(19)="{32 SPACES}[4 T]"
840 FORJ=1TO19:PRINTA$(J):NEXT:PRINT"
    {HOME}":RETURN
850 PRINTD$+"{7 DOWN} PRESS F7";
860 PRINTD$+"{8 DOWN} TO ROLL";
870 IFPEEK(197)=3THEN890
880 GOSUB970:GOTO870
```

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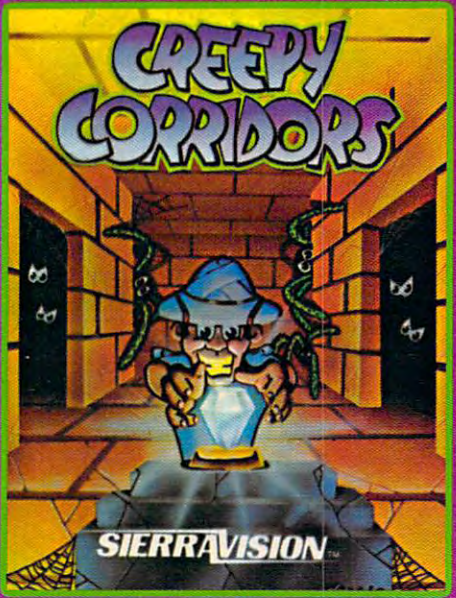

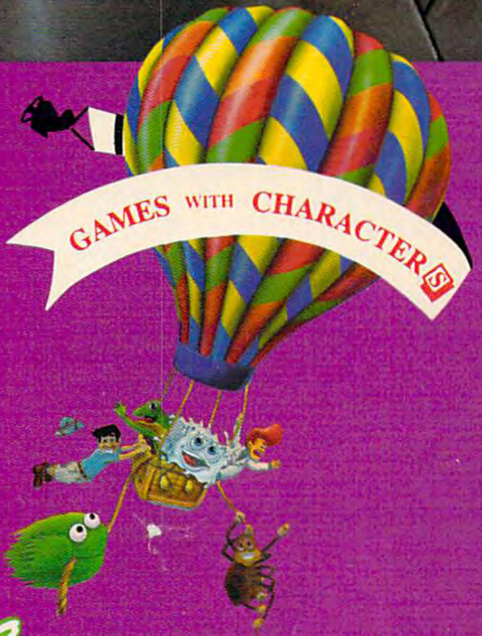

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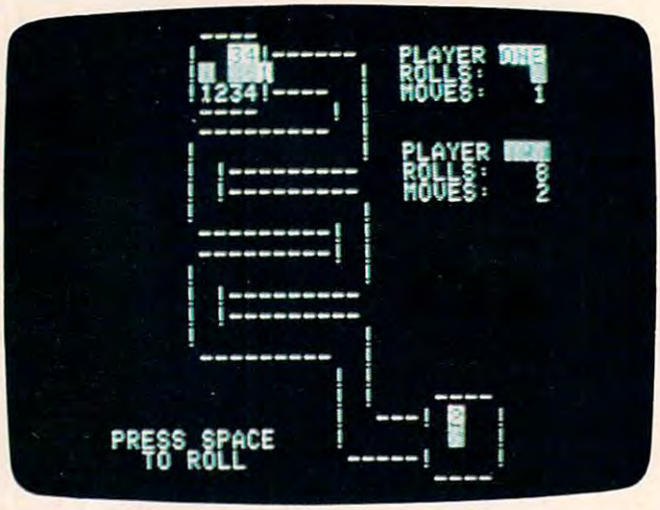
```
890 V=FNA(1):POKE198,0:POKESO+1,20
900 FORJ=1TOV:POKE1803,48+J:POKE1803+CC,0
    :POKESO+4,17:FORT=1TO10
910 POKESO+1,J*10:NEXT:NEXT:POKESO+4,16:R
    ETURN
920 IFCV>65THENCV=65
930 RESTORE:FORJ=1TOCV:READX:NEXT:POKEX,9
    5:POKEX+CC,5:RETURN
940 POKESO+1,10:POKESO+4,33:FORT=1TO700:N
    EXT:POKESO+4,32:RETURN
950 POKESO,80:POKESO+1,80:POKESO+4,33:FOR
    T=1TO200:NEXT:POKESO+4,32:RETURN
960 GETM$:ON-(M$="")GOTO960:M=VAL(M$):RET
    URN
970 D1=0:FORT=1696TO1699:Z1=PEEK(T):D1=Z1
    +D1:NEXT:IFD1=202THEN WI=1:GOTO1010
980 D2=0:FORT=1736TO1739:Z2=PEEK(T):D2=Z2
    +D2:NEXT:IFD2=202 THENWI=2:GOTO1010
990 D3=0:FORT=1776TO1779:Z3=PEEK(T):D3=Z3
    +D3:NEXT:IFD3=202 THENWI=3:GOTO1010
1000 RETURN
1010 PRINT"{CLR}{12 RIGHT}PLAYER";WI;" WI
     NS"
1020 PRINT"{2 DOWN}{10 RIGHT}PLAY AGAIN Y
      OR N ?"
1030 GET A$:IF A$<>"Y"AND A$<>"N"THEN1030
1040 IF A$="Y"THENRUN
```

Program 3: Pathway – Apple II Version

```
100  TEXT : HOME : VTAB 2: HTAB 16: INVERSE
     : PRINT "PATHWAY": NORMAL
110  VTAB 6: HTAB 8: PRINT "TWO OR THRE
     E PLAYERS? ";: GET A$:P =  VAL (A$
     ): IF P < 2 OR P > 3 THEN 110
120  DIM A$(23),P(70),A(3,4):GV =  - 16
     336: HOME : GOSUB 460
130  FOR I = 1 TO 70: READ P(I): NEXT
140 NM$(1) = "ONE":NM$(2) = "TWO":NM$(3
     ) = "THREE":OU(1) = 63:OU(2) = 127
     :OU(3) = 255
150  VTAB 2: HTAB 11: INVERSE : PRINT "
     1234": FLASH : HTAB 11: PRINT "123
     4": NORMAL : HTAB 11: PRINT "1234"
160  FOR I = 1 TO P: PRINT
170  VTAB 21: PRINT "    PRESS SPACE":
     HTAB 7: PRINT "TO ROLL"
180  VTAB (5 * I - 3): HTAB 25: PRINT "
     PLAYER ";: POKE 50,OU(I): PRINT NM
     $(I): NORMAL : HTAB 25: PRINT "ROL
     LS:     ";: HTAB 34
190  GET A$: IF A$ <  > " " THEN 190
200 V =  INT ( RND (1) * 9) + 1: FOR J =
     1 TO V: HTAB 34: PRINT J;: FOR K =
     1 TO 200: NEXT : NEXT
210  PRINT : VTAB 21: PRINT "    WHICH
     PIECE": HTAB 7: PRINT "TO MOVE"
220  VTAB (I * 5 - 1): HTAB 25: PRINT "
     MOVES:     ";: HTAB 34
230  GET A$:M =  VAL (A$): IF M < 1 OR
     M > 4 THEN 230
240  IF A(I,M) > 70 THEN 230
250  PRINT A$
260  IF A(I,M) = 0 THEN  POKE 1033 + 12
     8 * I + M,160: GOTO 290
270 QQ = 160: FOR K = 1 TO 4: IF A(I,K)
      = A(I,M) AND K <  > M THEN QQ = K
      + 64 * I - 16
280  NEXT : POKE P(A(I,M)),QQ
290 A(I,M) = A(I,M) + V: IF A(I,M) > 1
     THEN 350
300 A =  PEEK (P(A(I,M)))
310  IF A = 160 THEN 340
320  FOR J = 1 TO 3: FOR K = 1 TO 4: IF
     A(J,K) = A(I,M) AND J <  > I THEN
     A(J,K) = 0: POKE 1033 + 128 * J +
     K,A: PRINT  CHR$ (7) CHR$ (7);
330  NEXT : NEXT
340  PRINT  CHR$ (7);: POKE P(A(I,M)),M
      + 64 * I - 16: GOTO 400
350  POKE 1385 + M + I * 128,I * 64 + M
      - 16:C(I) = C(I) + 1: FOR K = 1 TO
     25:AG = AG +  PEEK (GV): NEXT : IF
     C(I) < 4 THEN 400
360  VTAB 17: HTAB 25: PRINT "PLAYER "N
     M$(I)"!": INVERSE : VTAB 21: HTAB
     5: PRINT "PRESS SPACE": HTAB 4:
     PRINT"TO PLAY AGAIN";: NORMAL
370  VTAB 7: HTAB 32
380  GET A$: IF A$ <  > " " THEN  HOME
     : END
390  RUN
400  NEXT : GOTO 160
410 :
420  DATA  1294,1295,1296,1297,1298,129
     9,1300,1428,1556,1684,1812,1811,18
     10,1809,1808,1807,1806,1805,1804,1
     803,1802
430  DATA  1930,1074,1202,1203,1204,120
     5,1206,1207,1208,1209,1210,1211,12
     12,1340,1468,1596,1595,1594,1593,1
     592,1591,1590,1589,1588,1587,1586
440  DATA  1714,1842,1970,1971,1972,197
     3,1974,1975,1976,1977,1978,1979,19
     80,1124,1252,1380,1508,1636,1637,1
     638,1639,1640,1641
450 :
460 A$(1) = " ----"
470 A$(2) = "!     !------"
480 A$(3) = "!              !"
490 A$(4) = "!     !----   !"
500 A$(5) = " ----        !  !"
510 A$(6) = " ---------    !"
520 A$(7) = "!              !"
530 A$(8) = "! !---------"
540 A$(9) = "! !---------"
550 A$(10) = A$(7)
560 A$(11) = " ---------!  !"
```



Two game pieces have successfully traversed the maze in the Apple version of "Pathway."

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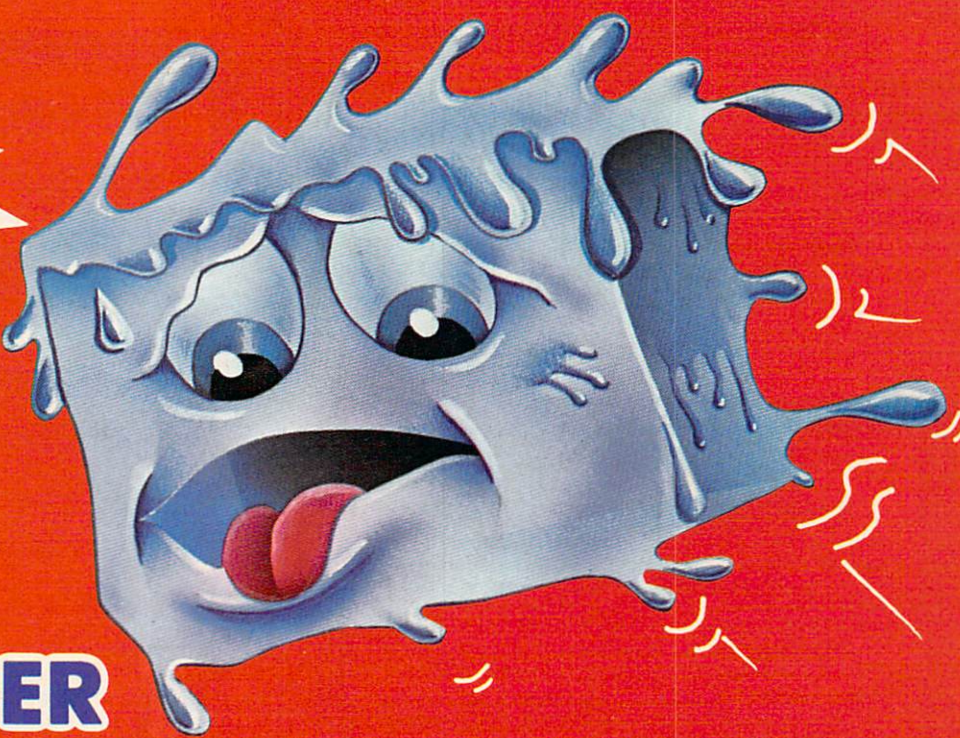

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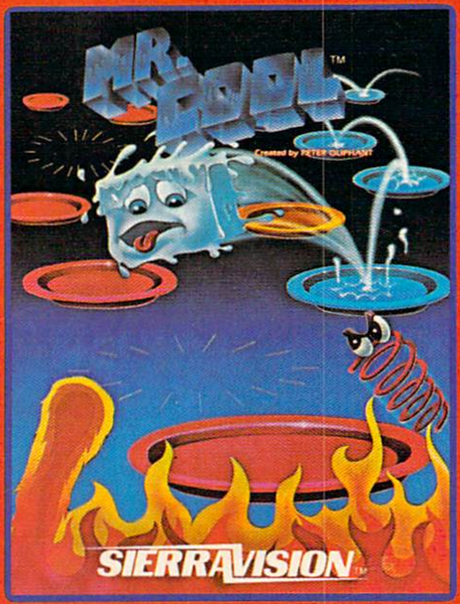

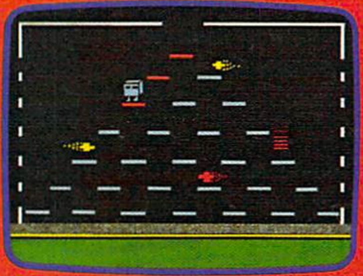

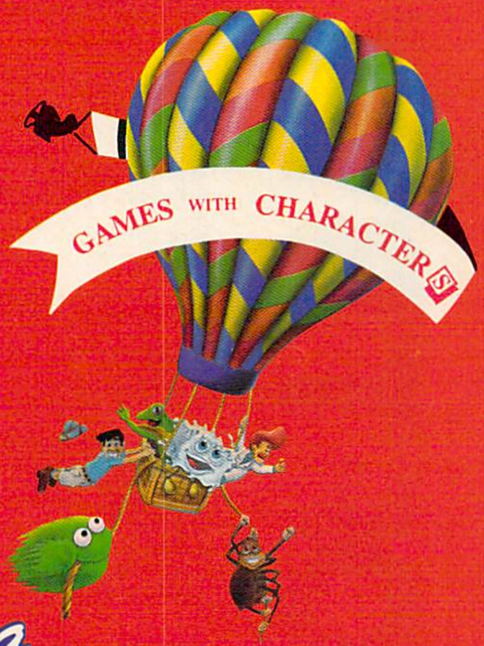

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```
570 A$(12) = " ---------! !"
580 A$(13) = A$(7):A$(14) = A$(8):A$(15
     ) = A$(9):A$(16) = A$(10):A$(17) =
     " ---------   !"
590 A$(18) = "          ! !"
600 A$(19) = "          ! !    ----"
610 A$(20) = "          !  ---!     !"
620 A$(21) = "          !           !"
630 A$(22) = "           -----!     !"
640 A$(23) = "                 ----"
650  FOR J = 1 TO 23: HTAB 10: PRINT A$
      (J): NEXT : RETURN
```

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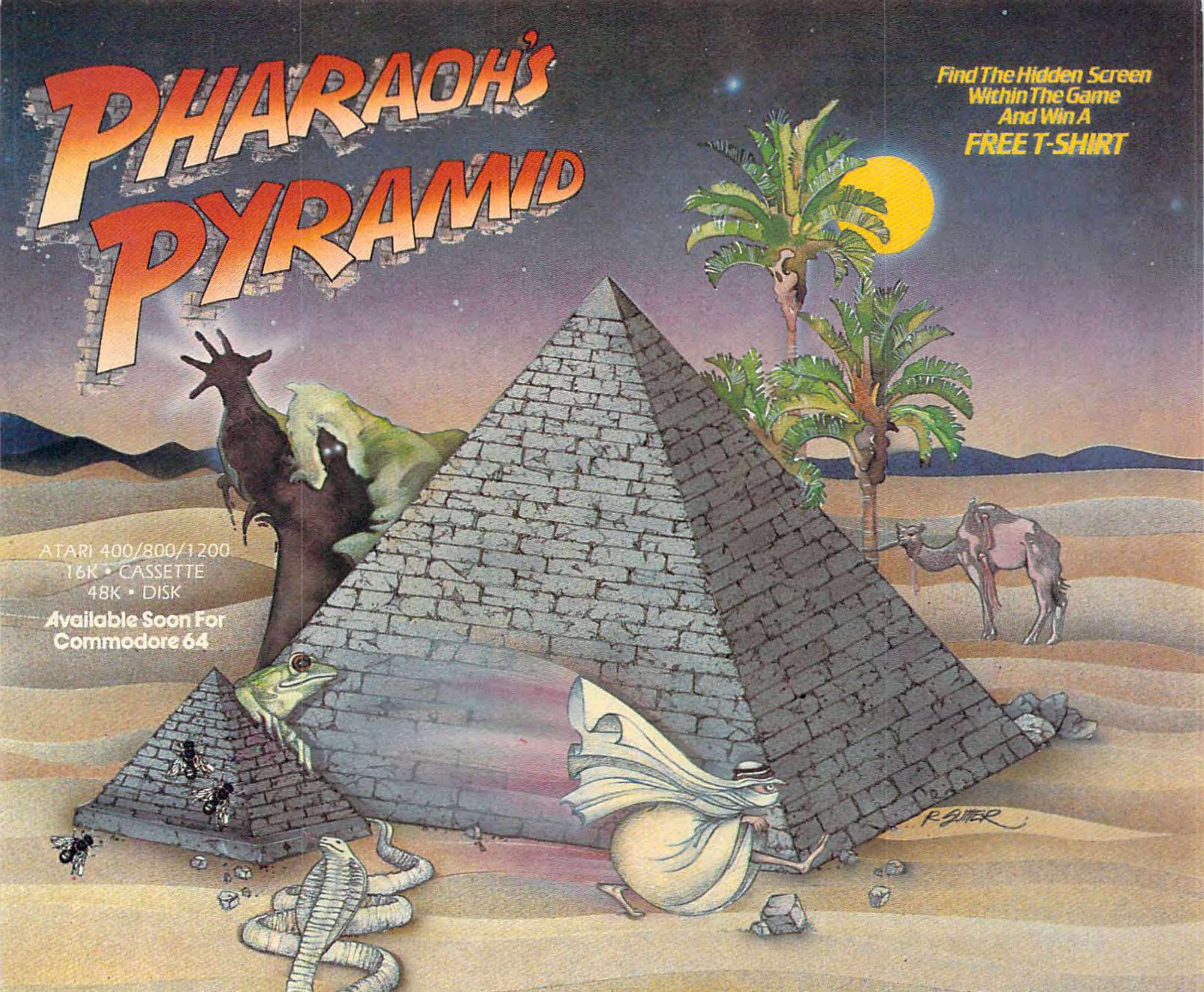

It sits on the sands of Egypt–silent, foreboding; the blue waters of the Nile sliding silently by. Pharoah's Pyramid beckons to us across millennia; mysterious, alluring. Where did the stones come from? How were they laid one on top of another? How many lives were lost under hot suns and cool moons to provide a resting place for the pharoahs of Egypt? Now you can have a personal stake in its completion. Match wits with the ancient Egyptian God, Osiris. Take advantage of gifts given you by the beautiful Isis. Fight through the plagues of Moses as brick by brick you build one of the wonders of the world. There hasn't been a greater challenge since the original Pharoah's Pyramid!

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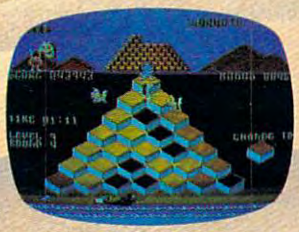

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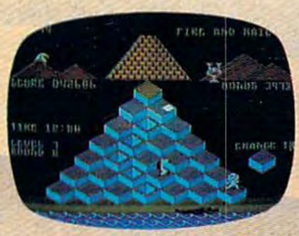

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Learning With Computers

Glenn M. Kleiman

The stack of new books and magazines on my desk fell over yesterday. I took that as a sign that I should write about some of them in this month's column. I've selected four publications that will be useful to many teachers, parents, and students. The first two concern educational software, and the other two are new dictionaries of computer terms. In future columns, I will review new books on Logo, teaching computer literacy, and other topics.

Courseware Report Card

Each issue of the *Courseware Report Card* contains comprehensive reviews, written by experienced educators, of a variety of educational software packages. All types of educational programs are reviewed, including drill-and-practice, tutorials, simulations, games, authoring systems, classroom management systems, and versions of Logo and turtle graphics. The programs are for Apple, Radio Shack, Atari, and Commodore computers.

Each review begins with a listing of the relevant subject areas, grade level, type of program, hardware requirements, price, and publisher's address. Then there is a brief summary of the program, followed by a very detailed description complete with pictures of the screen displays. Finally, there is an evaluation, divided into ratings of the program's overall performance and content, ease of use (for both students and teachers), error handling, appropriateness as a computer activity for students, documentation, and educational value. In each category, the program is given an A to F grade, and the reviewer explains why. A summary box displays the grades on each of the six criteria.

I find the reviews in the *Courseware Report Card* to be more useful than any others I have seen. I like having a description of the program separate from the evaluation, and the screen pictures help me get a better idea of how the program looks. I also like the fact that the reviewers explain the grade they give the program on each of the criteria, so you can determine whether you agree with their views. This is especially important for the appropriateness and educational value criteria, since educators disagree about the educational value of different activities and about which types of programs take best advantage of computers.

Courseware Report Card publishes two different sets of reviews – one for programs for elementary school students and the other for secondary school students. Each set can be purchased separately. Reviews are published five times during the school year, with at least 20 reviews each time. Each review is self-contained and three-hole punched, so you can conveniently file your copies by subject area, grade level, hardware compatibility, or however you choose.

Courseware Report Card is published by Educational Insights, Inc., 150 West Carob Street, Compton, CA 90220.

Courseware In The Classroom

Courseware in the Classroom: Selecting, Organizing and Using Educational Software, by Ann Lathrop and Bobby Goodson (published by Addison-Wesley, 1983), would be useful to anyone concerned with finding and evaluating educational software. This book is divided into six sections.

Section 1 presents an overview of how computers can be used in all areas of the curriculum.

Section 2 discusses six categories of software: (1) reinforcement and remediation (that is, drill-and-practice); (2) tutorials; (3) simulations and demonstrations; (4) problem-solving (for example, Logo, logic games); (5) program development aids (PILOT, shell games); and (6) tools for teachers (for example, classroom management and material preparation programs).

Section 3 focuses on criteria for evaluating courseware. The authors begin by discussing the most important general questions to ask: "Does the software meet specific instructional objectives?" and "Does it take good advantage of the computer's capabilities?" They emphasize that there is no point in using computers for activities that could be done just as well without them. They go on to discuss other criteria for content; screen formats; ease of use for students and

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teachers; types of feedback the program supplies; use of motivational devices such as graphics, sound, and competition; technical quality; instructions; and printed documentation. They point out that the reviewer must decide which criteria are most important for particular types of programs, groups of students, and classroom situations.

Three evaluation forms are given, with examples of how they can be used. These forms were developed by the Northwest Regional Laboratory in Portland, Oregon; the National Council of Teachers of Mathematics; and the California Library Media Consortium for Classroom Evaluation of Microcomputer Courseware.

Section 4 covers the details of organizing and running a courseware library.

Section 5 contains a directory of recommended courseware. The authors give a brief description of each program, with the information necessary to obtain it. They do not provide their own reviews, but give references to reviews that have appeared in magazines and other publications. Only programs that have received positive reviews are listed.

Section 6 consists of appendices containing copyright regulations; sources of evaluation guidelines, courseware reviews and courseware directories; and policies and procedures for selecting instructional materials.

The *Courseware Report Card* and *Courseware in the Classroom* are mutually complementary. The former provides detailed reviews, and the latter provides information about doing your own reviews and finding other published reviews. Both publications will help educators find the software they need to make good use of computers with their students.

Dictionaries Of Computer Terms

A great many dictionaries of computer terms are available. Some are intended for children, some for adults who are novice computer users, and some for computer science professionals.

My pet peeve about computer dictionaries is what I call "recursive definitions." These define technical terms by using other technical terms. You look up a word, and the definition contains several words that you don't know. You look up each of these in turn, but their definitions contain more words you don't know. For example, one dictionary defines *instruction* as follows:

> Data which causes a computer to carry out an operation and specifies the values or *locations* of all *operands*. A *program controller* examines each instruction and initiates the specified action. An instruction usually contains an *operator* (indicating the type of command) and one or more *address* parts, and sometimes a *tag*.

The italicized words are defined elsewhere in the dictionary. How many people who looked up the meaning of "instruction" in a computer dictionary would know the computer jargon meanings of "locations," "operands," "address," and the other terms? If you are dedicated, you might look up each of these words and then look up the technical terms used in defining them. You might keep pursuing this through several levels of definitions and then try to finally figure out the meaning of the original word in which you were interested. However, I'd prefer a trip to the bookstore in search of a new dictionary.

By the way, for those of you who are not familiar with the concept of *recursion*, a recursive procedure is one that can "call itself." Think of yourself as using a *find-the-meaning-of-a-word* procedure. One part of this procedure would tell you that if a definition contains a word you do not know, you put the original word on hold and apply your find-the-meaning procedure to the new word. That is, the procedure reapplies itself to a new word – an example of recursion. When you find the meaning of the new word, you return to trying to understand the meaning of the original one.

I have recently obtained two dictionaries that have mostly accurate and understandable definitions. Both are careful to provide clear examples and minimize the use of technical terms in definitions. For example, here are the definitions of "instruction" from the two dictionaries:

> A single operation to be executed by the computer. Instructions may move data, perform arithmetic and logic functions, control I/O devices, etc. A sequence of instructions forms a program.

> A single order that tells the computer to carry out some specific task. An instruction in a program might tell the computer to operate a line printer, add two numbers together, store information in memory, or to perform any one of a number of other functions. Each instruction must be retrieved from memory, decoded and executed by the computer's central processing unit. A *program* is simply a series of instructions designed to solve a problem or accomplish a task.

The first definition is from the *Illustrated Computer Dictionary*, by the editors of *Consumer Guide* (Exeter Books, 1983). This dictionary is intended for computer novices. The second definition is from *A Dictionary of Computer Words*, by Robert W. Bly (Dell Publishing Company, 1983). This one is designed for students and contains many good analogies and humorous illustrations. ©

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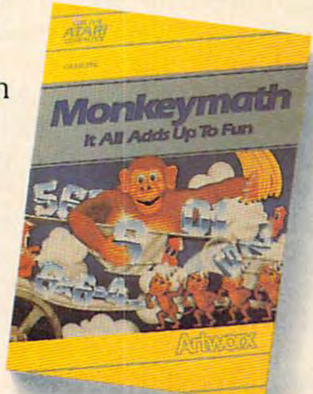

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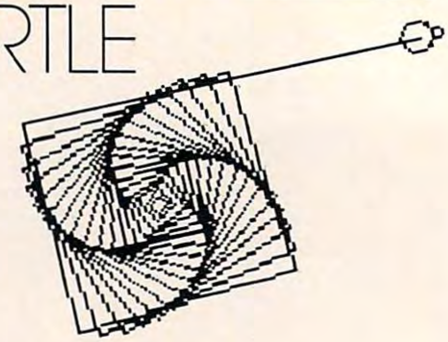


David D Thornburg, Associate Editor

Bucky And The Turtle:

Exploring The Geometry Of Thinking

The philosopher, mathematician, inventor, and citizen of the whole earth – R. Buckminster Fuller – died this past July at the age of 86. Bucky influenced many people through his mathematical discoveries, and delighted millions more through his designs resulting from these discoveries. The geodesic dome stands as the most easily recognized of his creations.

While we can appreciate the results of his thought, it is especially valuable for readers of this column to acquaint themselves with his "geometry of thinking" – a philosophy called "Synergetics."

Synergetics is a mathematical formalism that, according to Fuller, embodies the design principles of the physical universe. His exposition of these principles formed the subject of two books, *Synergetics* and *Synergetics 2* (Macmillan, 1975 and 1979, respectively). While many people marvel at the beautiful simplicity of the geodesic dome or of the tensegrity structures Fuller discovered, few have taken the time to understand the underlying mathematical principles that led to the creation of these structures.

It so happens that the principles of Fuller's geometry are easily grasped once one realizes that Synergetics is identical to the mathematical formalism of turtle geometry.

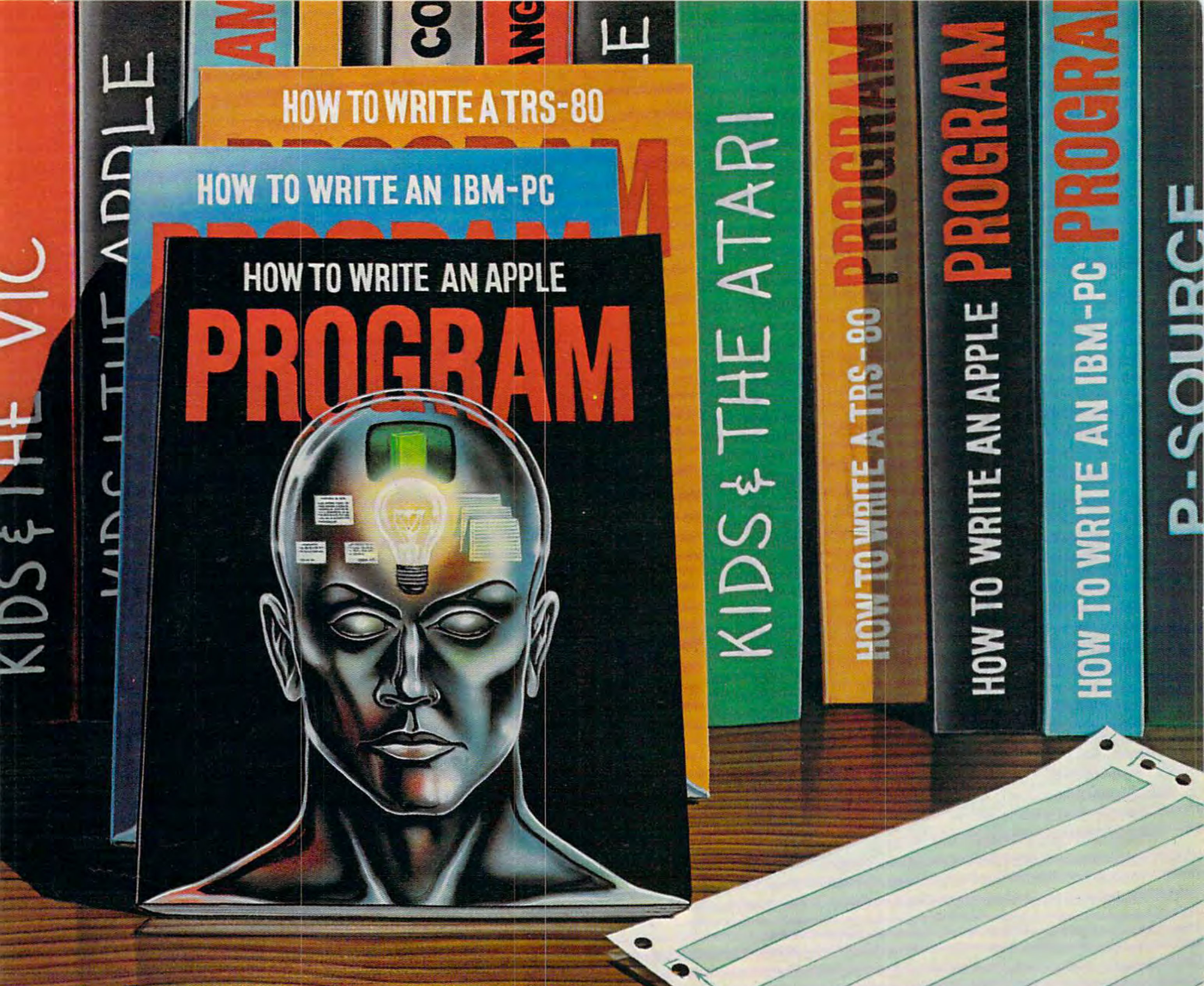
Process Descriptions

In turtle geometry one deals with process descriptions rather than with static descriptions of geometric figures. The two operators (FORWARD and RIGHT) change the state of the turtle and can be used to move it anywhere on a surface. As a result, any static figure can be equivalently described by the process that created it. Process-based descriptions are central to Synergetics as well.

While it is impossible to do justice to the formalism of Synergetics in the short space of this article, several key concepts (and their equivalent expressions in turtle geometry) will be described. Each concept will be presented first from the perspective of Synergetics and then from the perspective of turtle geometry.

1. *There is no continuum.* There are no solid surfaces in the universe, no flat or smooth areas. Wherever scientists have looked, they have only uncovered localized energy fields which we perceive as discrete countable atoms. These atoms establish spatial relationships with other atoms through mutual optimization of their energy fields. The idea that the universe is composed of countable parts, that it is somehow granular, has an interesting expression in turtle geometry. Since the turtle responds to one command at a time, either it can move or it can turn. The fact that the turtle cannot turn while moving means that, in common with Synergetics, turtle geometry does not allow continuous curved surfaces.

2. *Measurements in geometry need only two parameters – frequency and angle.* These two parameters are sufficient to describe the location and placement of the nodes associated with the discrete quantized atoms which comprise the matter of our physical universe. The process by which one can move between any two nodes in the universe is capable of being expressed in terms of a combination of linear movements along nodes



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and angular reorientations.

In turtle geometry, this central concept is expressed by the fact that combinations of the commands FORWARD and RIGHT are capable of repositioning the turtle to any desired location. Fuller's use of frequency instead of distance is a result of his desire to remove absolute scale from his geometry.

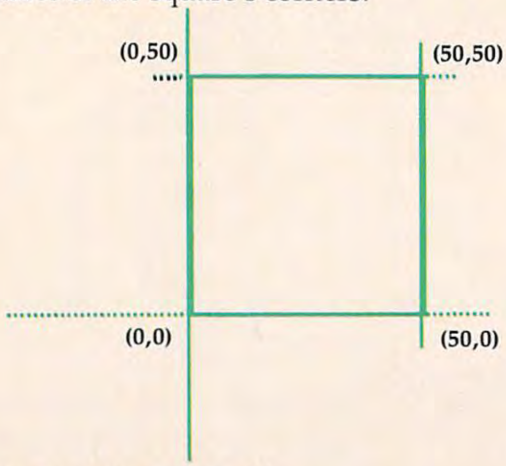
3. *There is no simultaneity*. The physical universe is an unfolding scenario of nonsimultaneous (but partially overlapping) energy events. The finite speed of light governs our perception of the physical universe. A pair of events that appear to be simultaneous to one observer will appear to be nonsimultaneous to a second observer at another location. Since nothing happens "all at once," then all events and structures are the result of a *process* which created them. Traces of completed events resulting from separate and distinct processes may appear similar to each other.

Simple Is Powerful

A problem with static descriptions of systems is that they do not preserve the details of the processes which created them. Since the process contains more information than the static trace of its result, a process description is inherently more fundamental. Furthermore, process descriptions are often more compact than static descriptions. This surprising result lends force to the idea that simpler descriptions are more powerful.

Turtle geometry *defines* objects through the description of the processes that create them. Computer-based implementations of turtle geometry allow the explicit creation of *procedures* that describe the steps needed to create various geometrical shapes. These procedures can often be treated as extensions of the computer language itself. Logo is a prime example of a language that does this.

There are many advantages of process-based descriptions. In conventional coordinate geometry, for example, the static description of a square located on a grid consists of specifying the coordinates of the square's corners.



To create a new square at another location, one must create a new set of coordinates for each corner. In turtle geometry, once one has defined a procedure which creates a square, additional squares can be created by moving the turtle to a new location and using the "square" procedure at that point.

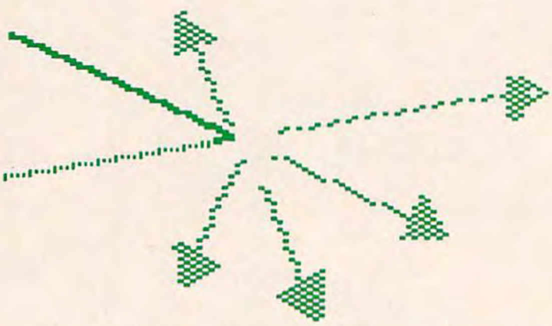
4. *No two events can occupy the same space at the same time*. Two energy events that are in close temporal and physical proximity will interact with each other in one of several ways, including:

a. *tangential avoidance*. One event can cross over or under another event.

b. *modulated noninterference*. If the energy events consist of a train of pulses and spaces, their paths can cross in a fashion similar to that displayed by two rows of cars which are changing lanes on a freeway.

c. *reflection*. Two events can reflect from each other and acquire new paths.

d. *refraction.* Two events can, on achieving close proximity, perturb each other's path to avoid a collision.

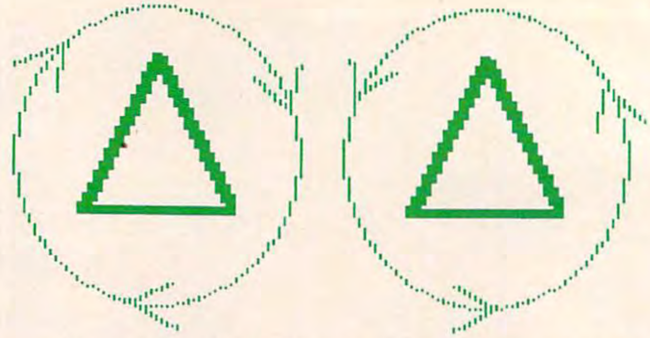


e. *collision.* When two energy events come into sufficiently close proximity, they may collide and smash into several other energy events which go off in a multitude of new paths.

f. *attainment of critical proximity.* When two energy events become sufficiently close, they may go into orbit around each other. As a result of this coupling, they form a new system.

There are six ways in which two energy events can interact. There is *no* way two energy events can occupy the same place at the same time. The concept of a dimensionless point resulting from the intersection of two lines is thus meaningless in the physical universe.

In turtle geometry a secondary consequence of this concept is that different procedures can be used to create figures which appear to be identical. A triangle, for example, can be created by following a left- or right-handed path.

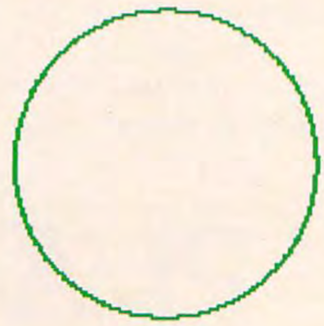


Even though the finished figures are identical (such paths are called *state change invariant*), the fact that they result from different procedures can have important consequences. For example, an assembly-line robot that moves parts between three work stations will only perform its job properly for one path description.

5. *Irrational numbers are unnecessary.* Synergetics involves a system of measurement based on discrete angles and countable frequency increments. Space-filling structures are formed from polyhedra, the minimum configuration of which is the tetrahedron. As the frequency of a structure is increased (by constructing polyhedra with greater numbers of nodes), one approaches the construction of objects that appear nearly round.

These objects are composed of a vast (but countable) number of discrete chords. Since such surfaces can be formed with any complexity desired, and since each surface is still bounded by chords, there is no need in Synergetics for irrational numbers such as pi.

This is easily demonstrated in turtle geometry. To send the turtle on a circular trip, one might instruct it to take 360 steps, turning by one degree after each step.



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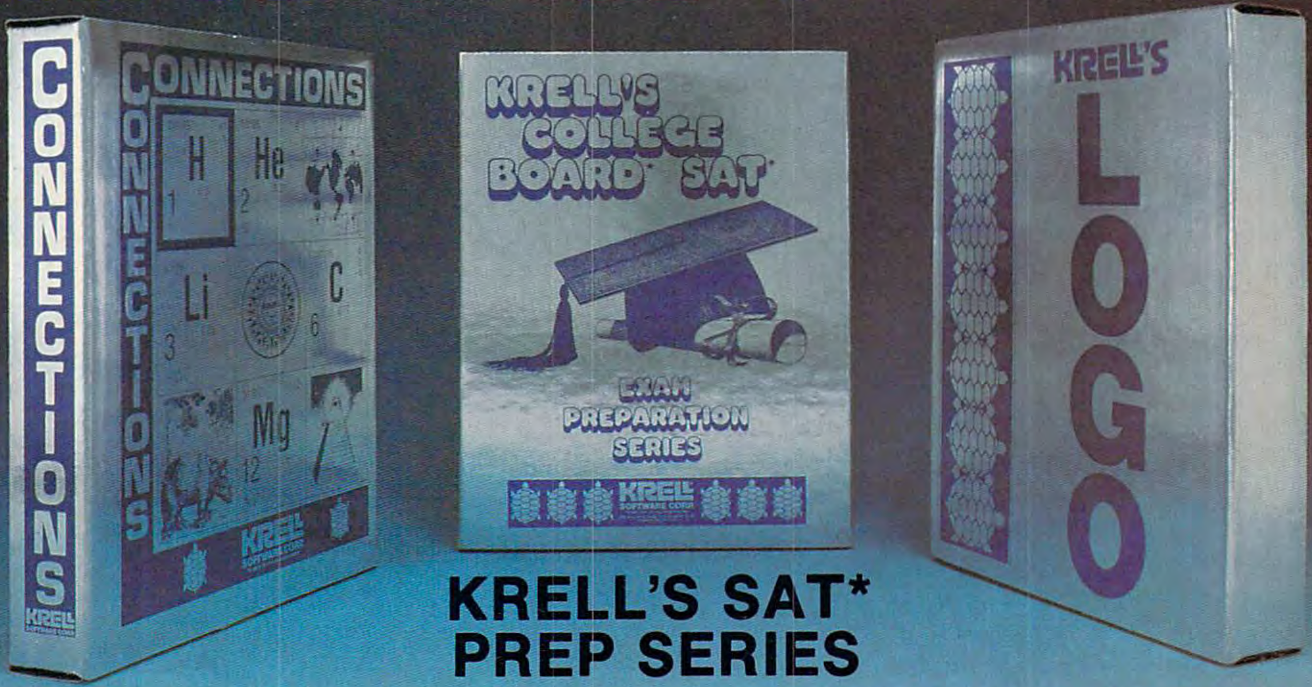

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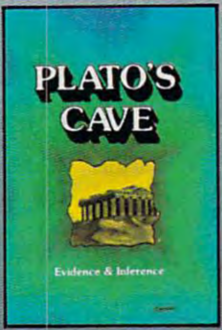

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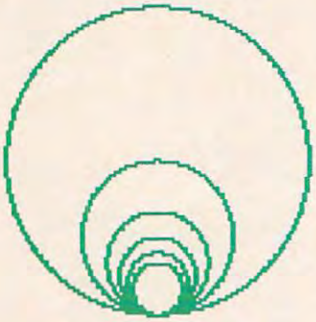
Circular paths with different sizes can be created by changing the size of the step or by changing the amount turned at the end of each step. Instead of dealing with the concepts of diameter and area, turtle geometry creates circles through the concepts of perimeter and curvature.



6. *Meaningful descriptions of processes are local.* Every celestial object is in motion with respect to every other object. These motions, viewed as a set, are nonsimultaneous.

Furthermore, the interactions of these various motions vary widely over the eons of time. As a result, any meaningful system of geometry must describe local processes without reference to an absolute origin. A description of a triangle must describe only the triangle itself and not be dependent on the reference frame in which the triangle is being envisioned.

The concept of local descriptions of geometrical figures is central to turtle geometry. In contrast to conventional coordinate geometry, turtle procedures provide *intrinsic* descriptions of objects. As mentioned before, a coordinate representation of a square applies to that one square only. The points on this one square are fixed in relationship to the origin of the coordinate system. In turtle geometry, on the other hand, a square is defined by the local steps that are needed to create it. A procedure such as:

```
TO SQUARE
    REPEAT 4 [FORWARD 25 RIGHT 90]
END
```

will always create a square path regardless of the turtle's location and orientation.

If, as Fuller believed, Synergetics provides the proper geometric framework with which to view the universe, then the incorporation of turtle geometry in various popular and user-friendly computer languages promises to help expand the awareness and creativity of all its users. The fact that many of the users of turtle geometry are children suggests that the child's view of the physical universe might have more power than we ever expected. ©

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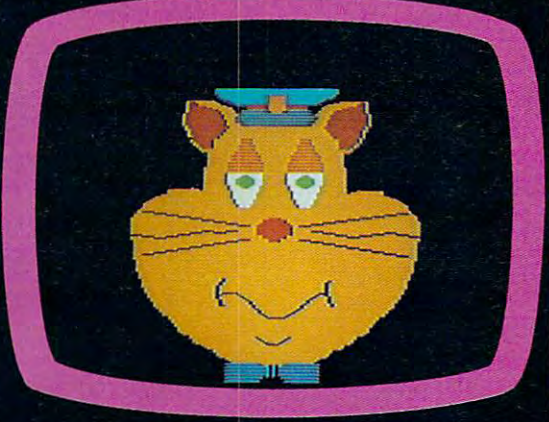

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Atari Key Panic

John Fackrell

This rapid-fire game tests your speed and hand-eye coordination. You must defend your home base against the increasingly fast character "bombs." Three skill levels, as well as final score and rank, are included.

"Key Panic" is a multilevel, fast-action game in which you must shoot descending characters that threaten your protective shields at the bottom of the screen.

Written on an Atari 800, the program has been condensed so it can run on an 8K Atari. It was originally designed to improve typing speed and key recognition (which it does), but it also turned out to be enjoyable as a game, too, with lots of player options.

Choose Your Bombs

After typing in the program, be sure to SAVE it. When you run Key Panic, you will be given several options.

First, use the SELECT key to choose one of three skill levels. You will probably have to play the game a few times to find the best level for you. Next, use the OPTION key to choose letters, numbers, or letters and numbers. This will determine what kind of "bombs" you'll have to contend with.

Now you're ready to play. Press START and the panic begins. As each character scrolls down, you must identify it and quickly press the corresponding key.

At the bottom of the screen, you'll have three protective shields. If you miss the right key or hesitate, the character bomb will strike and destroy your shield with a loud explosion. If you lose all three shields, the game ends and you will receive a score and rank.

If you're able to fend off all the characters in the first wave (approximately 50), there will be a short pause before the speedier second wave begins. There is a total of five waves, each progressively faster. Make it through all five waves and you win. You'll then receive a score and rank. Press START for another game.

Atari Key Panic

```
10 GOTO 510
20 ON OPT GOTO 30,40,50
30 CHR(Z0)=65+INT(RND(Z0)*26):RETURN
40 CHR(Z0)=48+INT(RND(Z0)*10):RETURN
50 CHR=INT(RND(Z0)+0.5):IF CHR=Z1 TH
   EN GOTO 30
60 GOTO 40
70 POSITION X,Y:? #Z6;CHAR$:RETURN
80 POSITION X,Y:? #Z6;CHR:RETURN
90 GOSUB 20:FOR Y=Z6 TO Z1 STEP -Z1:
   CHR(Y)=CHR(Y-Z1):POSITION Z9,Y:?
   #Z6;CHR$(CHR(Y)):NEXT Y
100 POKE 540,103-(SEL*25)-(WAVE*Z5):
    SOUND Z0,255-(COUNT*30),Z2,Z4+CO
    UNT
110 IF PEEK(540)=Z0 THEN 230
120 IF PEEK(764)=255 THEN 110
130 GET #Z1,KCHR:IF KCHR<>CHR(COUNT)
     THEN 110
140 POSITION Z9,COUNT:? #Z6;" ":CHR(
    COUNT)=32:SCR=SCR+(CINW*SEL):POS
    ITION Z1,Z3:? #Z6;SCR:CINW=CINW+
    Z1
150 IF CINW<>50 THEN 190
160 SOUND Z0,Z0,Z0,Z0:X=Z9:FOR Y=Z1
    TO Z6:CHAR$=" ":GOSUB 70:NEXT Y
170 WAVE=WAVE+Z1:IF WAVE=Z6 THEN 320
180 GOTO 760
190 IF PEEK(540)<>Z0 THEN 210
200 GOTO 90
210 IF COUNT<>Z1 THEN COUNT=COUNT-Z1
    :GOTO 110
220 GOTO 190
230 IF COUNT<>Z6 THEN COUNT=COUNT+Z1
    :GOTO 90
240 SOUND Z0,Z0,Z0,Z0:X=Z9:FOR Y=Z1
    TO Z6:CHAR$=" ":GOSUB 70:NEXT Y
250 COL=48:FOR X=Z1 TO 200 STEP 10:P
    OKE 712,COL:POKE 710,COL:FOR Y=Z
    1 TO Z2:SOUND Z0,X+Y,8,15:COL=IN
    T(RND(Z0)+0.5)
```

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VIC Typo Invaders

Kent S. Brewster

This game, similar in concept to "Atari Key Panic," was written for the unexpanded VIC. It not only plays fast, but also improves typing skills.

The Protection Of QWERT

Your mission in "Typo Invaders" is to protect the city of QWERT from the fatal alphabet bombs. As each letter drops, press the appropriate key before the bombs explode in the city.

With each pass, the bombs drop from an increasingly lower altitude. At the start of the game, you must choose a difficulty level (0 to 9). Points are awarded according to this level as well as the distance from the city when a bomb is destroyed. The game ends when QWERT is destroyed.

The program uses approximately 2700 bytes, which, of course, works fine with an unexpanded VIC. However, if your VIC has 8K or more expansion, change line 100 to:

```
100 SC=4095:CC=37887
```

Repeated exposure to Typo Invaders may have certain positive educational effects, such as a drastic increase in typing speed. My top score is 3641, but I expect that to be beaten handily by any competent touch-typist.

If you'd rather not type in this VIC program, send $3, a blank tape, and a SASE to:

Kent S. Brewster
1152 Snowberry Ct.
Sunnyvale, CA 94087

VIC Typo Invaders

```
1 REM ***********************
2 REM *{3 SPACES}TYPO{2 SPACES}INVADERS
  {3 SPACES}*
7 REM ***********************
8 :
9 REM *** STARTUP ***
1Ø PRINT"{CLR}":POKE36879,25:PRINT"NEED I
   NSTRUCTIONS(Y/N)"
2Ø GETA$:IFA$=""THEN2Ø
3Ø IFA$="Y"THEN53Ø
4Ø IFA$="N"THEN6Ø
5Ø GOTO2Ø
6Ø PRINT"{CLR}":PRINT"ENTER DIFFICULTY LE
   VEL{1Ø SPACES}Ø-9"
7Ø PRINT"(Ø=HARDEST, 9=EASIEST)
8Ø GETDI$:IFDI$=""THEN8Ø
88 :
89 REM *** INITIALIZE VARIABLES ***
9Ø D=VAL(DI$):CP=495:DL=21:CS=486:CE=5Ø6:
   S1=36876:V=36878:WN=36877:S=Ø
98 :
99 REM *** MEMORY-DEPENDENT VARIABLES ***
1ØØ SC=7679:CC=38399
1Ø8 :
1Ø9 REM *** SET UP SCREEN ***
11Ø POKEV,15:PRINT"{CLR}"
12Ø GOTO33Ø
128 :
129 REM *** PICK A RANDOM LETTER ***
13Ø NL=CS-(DL*22)-1:OL=NL
14Ø R=INT(RND(Ø)*25+2)
15Ø OL=OL+1:NL=OL:IFNL=CE-(DL*22)THEN38Ø
158 :
159 REM *** MAIN LOOP ***
16Ø POKESC+NL,R:POKECC+NL,6:POKES1,255-NL
    /22
17Ø FORI=1TOD*5+1:NEXT
18Ø POKESC+NL,32:POKECC+NL,1
19Ø NL=NL+22
2ØØ IFNL>484THEN34Ø
21Ø GOTO23Ø
22Ø GOTO16Ø
228 :
229 REM *** GET PLAYER'S KEY ***
23Ø GETA$:IFA$=""THEN22Ø
24Ø IFCHR$(R+64)=A$THEN26Ø
25Ø GOTO16Ø
258 :
259 REM *** EXPLODE LETTER ***
26Ø POKESC+NL,R+128:POKECC+NL,1
27Ø POKES1,Ø:POKEWN,255
28Ø FORX=15TOØSTEP-1:POKECC+NL,2
29Ø POKEWN,255-X:FORI=1TO25:NEXTI:POKECC+
    NL,1:FORI=1TO25:NEXTI:NEXTX
3ØØ POKEWN,Ø:POKEV,15:POKESC+NL,32
3Ø8 :
31Ø S=S+1Ø-D+(22-INT(NL/22))+22-DL:GOSUB4
    4Ø
318 :
32Ø GOTO14Ø
329 REM *** SET UP CITY ***
33Ø FORI=CSTOCE-1:POKESC+I,127:POKECC+I,6
    :NEXT:GOTO13Ø
338 :
339 REM *** EXPLODE CITY BLOCK ***
34Ø POKES1,Ø:POKESC+NL,255:POKECC+NL,5:FO
    RX=1ØTO1STEP-1
35Ø POKEWN,18Ø+X*5:POKESC+NL,127:POKECC+N
    L,4:FORI=1TO5Ø:NEXT:POKESC+NL,255:POK
    ECC+NL,3
36Ø FORI=1TO5Ø:NEXTI:NEXTX:POKESC+NL,32:P
    OKEWN,Ø
37Ø GOTO14Ø
378 :
379 REM *** END THIS PASS, SET UP NEXT PA
    SS ***
38Ø NH=Ø:FORI=CSTOCE:P=PEEK(SC+I):IFP=32T
    HEN4ØØ
39Ø NH=NH+1:IFI=CETHEN41Ø
4ØØ NEXTI
41Ø IFNH=ØTHEN48Ø
42Ø DL=DL-1:IFDL=3THENDL=4
43Ø N=INT(NH/2):CS=CP-N+1:CE=CS+NH:PRINT"
    {CLR}":GOSUB44Ø:GOTO33Ø
438 :
439 REM *** PRINT SCORE ***
44Ø PRINT"{BLK}{HOME}";
45Ø S$=STR$(S):LS=INT(LEN(S$)/2)
46Ø FORI=1TO1Ø-LS:PRINT"{RIGHT}";:NEXT
```

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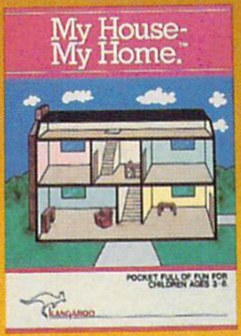

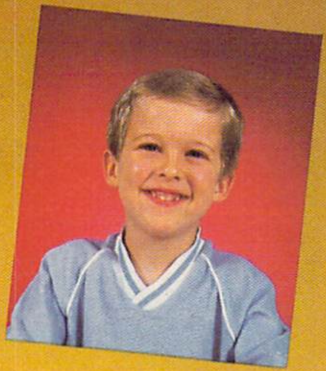

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```
470 PRINTS$:RETURN
478 :
479 REM *** END GAME ***
480 PRINT"WANNA PLAY AGAIN?(Y/N)"
490 GETA$:IFA$=""THEN490
500 IFA$="Y"THEN10
510 IFA$="N"THENPRINT"BYE!":END
520 GOTO490
528 :
529 REM *** INSTRUCTIONS ***
530 POKE36865,130:PRINT"{BLK}{5 SPACES}TY
    PO INVADERS"
540 PRINT:PRINT"{RED}TYPOGRAPHICAL ERRORS
     ARE FALLING FROM ANOTHER GALAXY."
550 PRINT:PRINT" {BLU}DESTROY AS MANY AS
    {SPACE}POSSIBLE BY HITTING THE PROPER
     KEY."
560 PRINT:PRINT"{PUR}AS THE INVASION CONT
    INUES, LETTERS WILL DROP FROM LOWER L
    EVELS."
570 PRINT:PRINT"{RED}THE GAME ENDS WHEN T
    HE ENTIRE CITY IS WIPED{2 SPACES}OUT.
    "
580 PRINT:PRINT" {BLK}PRESS A KEY TO GO O
    N "
590 FORI=130TO25STEP-1:POKE36865,I:FORX=1
    TO5:NEXT:NEXT
600 GETA$:IFA$=""THEN600
610 GOTO60
```

```
260 IF COL=Z0 THEN 280
270 COL=48
280 NEXT Y:NEXT X:POKE 712,Z0:POKE 7
    10,Z0:SOUND Z0,Z0,Z0,Z0
290 Y=SHY:X=Z0:CHAR$="{20 SPACES}":GO
    SUB 70:SHY=SHY-Z1
300 IF SHY<>Z6 THEN 760
310 GOTO 350
320 X=Z2:Y=Z5:CHAR$="YOU":GOSUB 70:X
    =14:Y=Z5:CHAR$="WIN!":GOSUB 70
330 FOR X=Z1 TO 25:FOR Y=Z1 TO 20:NE
    XT Y:PT=50+INT(RND(Z0)*100):COL=
    Z6+16*INT(RND(Z0)*16)
340 SOUND Z0,PT,10,8:POKE 710,COL:PO
    KE 712,COL:NEXT X:SOUND Z0,Z0,Z0
    ,Z0:POKE 710,Z0:POKE 712,Z0
350 IF SCR<HSCR THEN 380
360 X=13:Y=Z1:CHAR$="HIGH":GOSUB 70:
    Y=Z2:CHAR$="SCORE:":GOSUB 70
370 Y=Z3:HSCR=SCR:CHR=HSCR:GOSUB 80
380 IF SCR<4000 THEN RANK$="EVE
    {3 SPACES}":GOTO 440
390 IF SCR<6125 THEN RANK$="OPWJDF":
    GOTO 440
400 IF SCR<12250 THEN RANK$="GBJS  "
    :GOTO 440
410 IF SCR<17000 THEN RANK$="HPPE  "
    :GOTO 440
420 IF SCR<18375 THEN RANK$="HSFBU "
    :GOTO 440
430 RANK$="FYQFSU"
440 ? "{5 SPACES}HBNF{6 SPACES}RANK:
    {6 SPACES}NEW GAME"
450 ? "{5 SPACES}PWFS{6 SPACES}";RAN
    K$;"{5 SPACES}PUSH TUBSU"
460 POKE 540,100
470 IF PEEK(540)<50 THEN X=Z1:Y=3:CH
    AR$="{5 SPACES}":SOUND Z0,Z0,Z0,
    Z0:GOSUB 70
480 IF PEEK(53279)=Z6 THEN X=Z2:Y=Z5
    :CHAR$="{3 SPACES}":GOSUB 70:X=1
    4:Y=Z5:CHAR$="{4 SPACES}":GOSUB
    70:GOTO 600
490 IF PEEK(540)=Z0 THEN CHR=SCR:GOS
    UB 80:SOUND Z0,105,12,Z4:GOTO 46
    0
500 GOTO 470
510 Z0=0:Z1=1:Z2=2:Z3=3:Z4=4:Z5=5:Z6
    =6:Z9=9:SEL=Z1:OPT=Z1:HSCR=Z0
520 DIM RANK$(10),CHR(8),CHAR$(20),S
    EL$(10),OPT$(18)
530 OPEN #Z1,Z4,Z0,"K:":POKE 82,Z0
532 GRAPHICS 18:X=Z6:Y=Z2:CHAR$="'PA
    NIC'":GOSUB 70:Y=Z4:CHAR$="REV.
    0.0":GOSUB 70:Y=Z6:CHAR$="06/28/
    82":GOSUB 70
534 FOR X=Z1 TO 750:NEXT X
540 GRAPHICS Z2:POKE 708,136:POKE 70
    9,202:POKE 710,Z0:POKE 711,54:PO
    KE 712,Z0
545 I=PEEK(16):IF I>127 THEN I=I-128
    :POKE 16,I:POKE 53774,I
550 Y=Z6:X=Z0:CHAR$="{7 TAB}
    {5 SPACES}{8 TAB}":GOSUB 70
560 X=Z0:Y=Z0:CHAR$="{20 TAB}":GOSUB
     70
570 X=7:FOR Y=Z1 TO Z6:CHAR$="{UP}
    {3 SPACES}{LEFT}":GOSUB 70:NEXT
    Y
580 X=Z1:Y=Z2:CHAR$="SCORE:":GOSUB 7
    0
600 SOUND Z0,Z0,Z0,Z0:FOR Y=7 TO Z9:
    X=Z0:CHAR$="{20 K}":GOSUB 70:NEX
    T Y
610 X=Z1:Y=Z3:CHAR$="{5 SPACES}":GOS
    UB 70
620 WAVE=Z1:SHY=Z9:SCR=Z0:X=Z1:Y=Z3:
    CHR=SCR:GOSUB 80
630 X=53279:POKE X,8:POKE 752,Z1
640 SOUND Z0,40,Z4,Z4
650 IF SEL=Z4 THEN SEL=Z1
660 ON SEL GOSUB 2000,2010,2020
670 IF OPT=Z4 THEN OPT=Z1
680 ON OPT GOSUB 2030,2040,2050
690 ? "{CLEAR}TFMFDU; ";SEL$;" PQUJP
    O; ";OPT$:? :? "{11 SPACES}PUSH T
    UBSU TO BEGIN"
700 FOR Y=Z1 TO 100:NEXT Y
710 IF PEEK(X)=Z6 THEN 750
720 IF PEEK(X)=Z5 THEN SEL=SEL+Z1:GO
    TO 650
730 IF PEEK(X)=Z3 THEN OPT=OPT+Z1:GO
    TO 670
740 GOTO 710
750 SOUND Z0,Z0,Z0,Z0
760 ? "{CLEAR}":? :? "{7 SPACES}ENTE
    RING WAVE NUMBER: ";WAVE:GOSUB 3
    000:? "{CLEAR}"
770 POKE 764,255:CINW=Z1:COUNT=Z1:X=
    Z9:FOR Y=Z0 TO Z6:CHR(Y)=32:NEXT
     Y
780 GOTO 90
1000 POSITION X,Y:? #6;CHR$(CHR):RET
     URN
1200 ON OPT GOTO 1210,1220,1230
2000 SEL$="BEGINNER ":RETURN
2010 SEL$="AVERAGE ":RETURN
2020 SEL$="EXPERT ":RETURN
2030 OPT$="LETTERS":RETURN
2040 OPT$="NUMBERS":RETURN
2050 OPT$="LETS.& NUMBS.":RETURN
3000 FOR X=1 TO 450:NEXT X:RETURN
```

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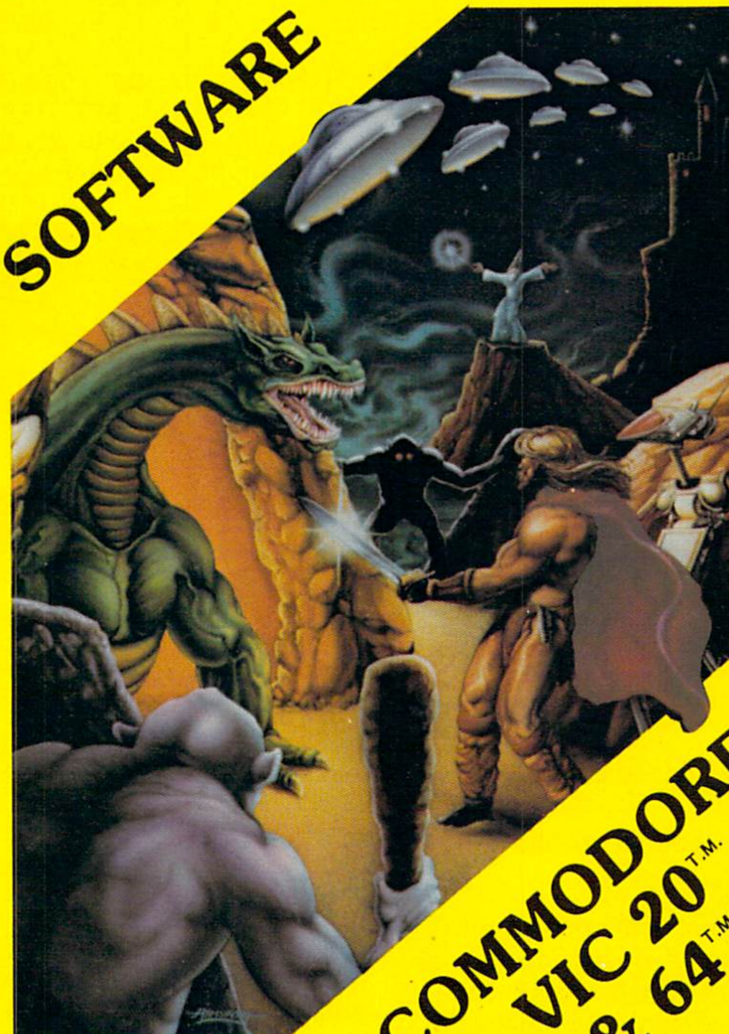

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Computers And Society

David D Thornburg, Associate Editor

This two-part series on program/languages began in last month's column with a discussion of VisiCalc *and* Rocky's Boots. *The concluding column examines the program* Dancing Bear *as a language and explores the potential impact of these types of languages.*

That's Not A Program, That's A Language

In last month's column, I explored the idea that some software offerings that we might consider application programs are, in reality, computer languages. In order for me to conclude that a program is a language, it must have the following characteristics:

1. A computer language must allow the user to create computer-based activities that are custom-tailored to the user's needs.

2. The language must have a vocabulary and a grammar.

3. The user should be able to edit and save his or her program.

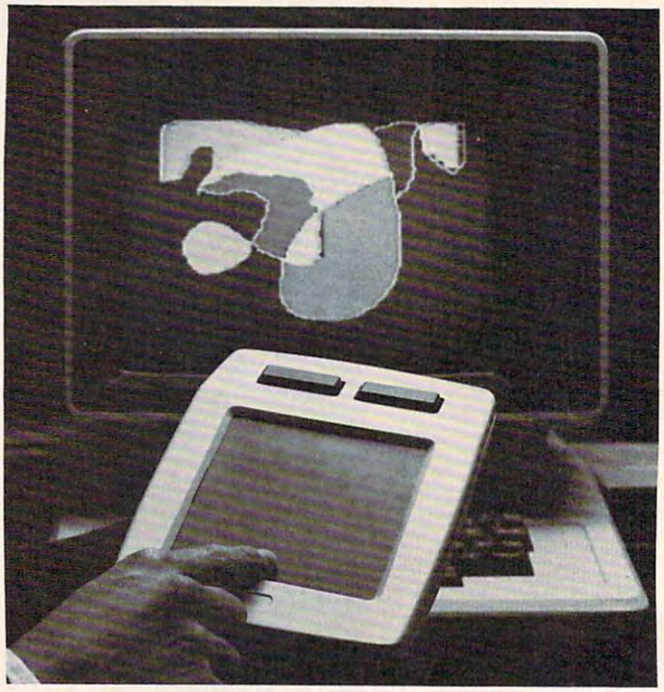
4. The user should be able to run the program.

I have read recently that some people think of word processing programs as languages. I disagree with this assessment of word processors since the word processor doesn't use the user's text to control the computer's activities. A word processor is simply a program designed to let users create text files that can be printed out. Admittedly, there are word processors that allow the creation of user-defined "macros" to perform complex formatting functions. But, while these macros are computer programs, this function is not a pivotal part of most word processing systems.

Dancing Bear As A Language

One program that is most definitely a language is *Dancing Bear* from Koala Technologies.

Koala is the manufacturer of the low-cost KoalaPad Touch Tablet which allows the simple use of a finger or stylus to convey position information to the computer.



One of the features of this device is its use of overlays that let the tablet be used both as a graphics or position input device and as a special-purpose keyboard.

Dancing Bear (currently available for the VIC) is a program which lets the user make an animated bear do a dance on the display screen. The stage on which the bear dances can be decorated with props by the user, and the bear can dance to user-defined music. This program (developed by Audio Light) uses the KoalaPad for all its input.

To see why this program is a language, we will briefly examine how it is used.

Creating A Dance Program

Dancing Bear uses the tablet overlay shown below.

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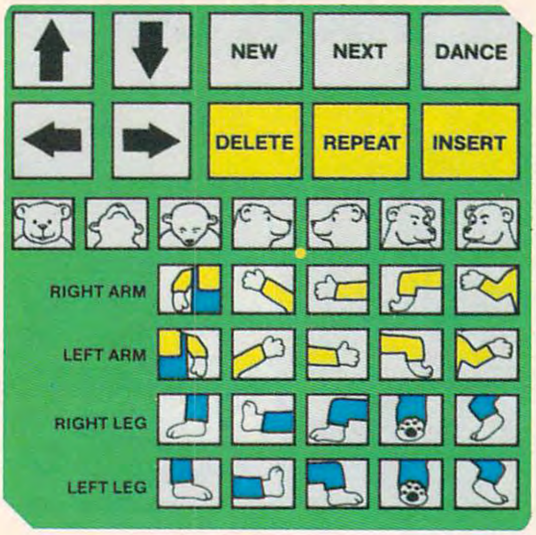
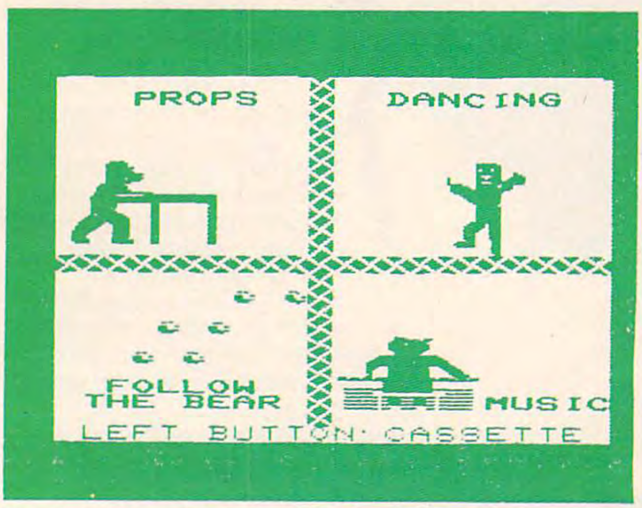
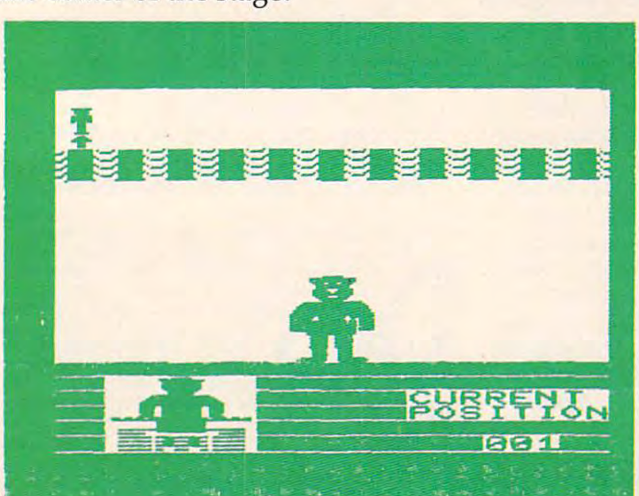


This overlay divides the tablet into three regions: bear position (upper left corner), body orientation (lower two-thirds), and program control (upper right).

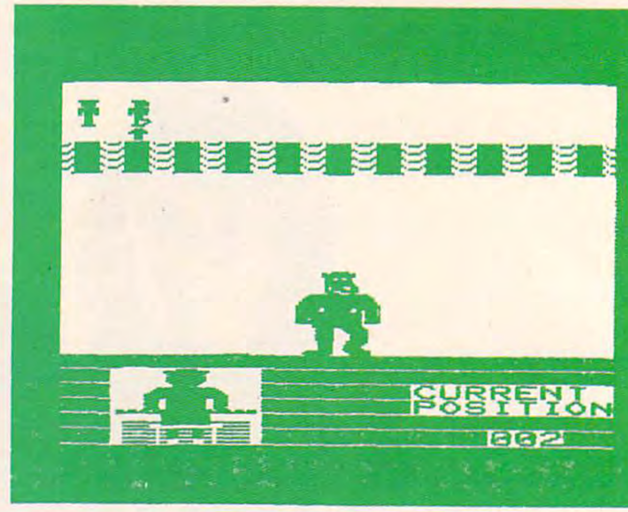
To create a new dance program, the user selects the DANCING option from the startup menu and presses NEW on the tablet overlay.



The bear is then shown in its starting position in the center of the stage.

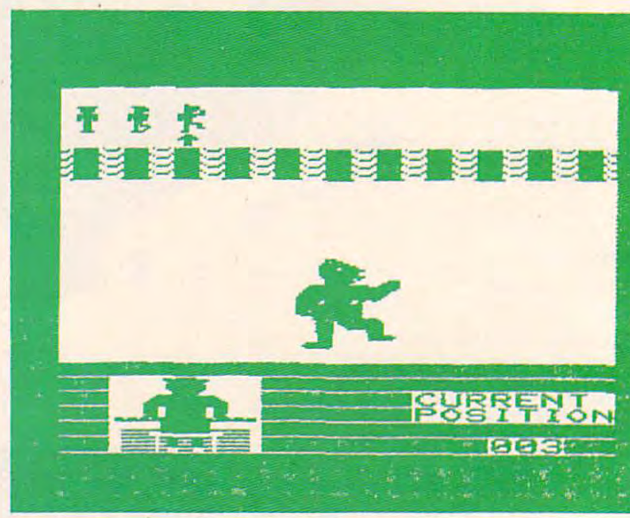


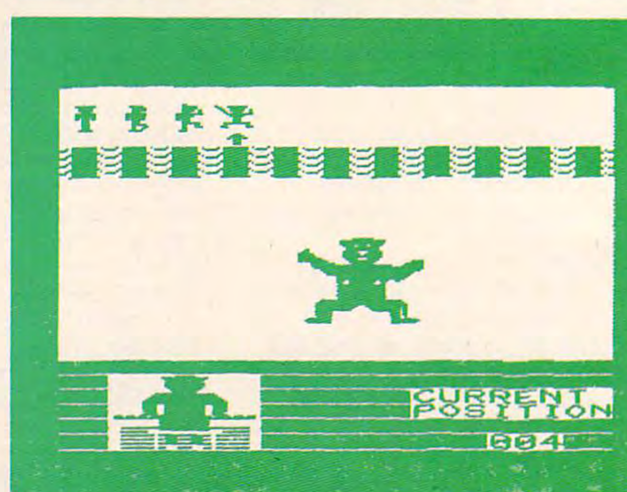
In the upper-left part of the screen you can see a small bear icon with an arrow underneath it. This is the program listing. To create the next step of the dance, we might press NEXT and turn the bear's head a little to the left and lift its left leg.



As you can see, these changes are reflected in the listing.

The next few figures show other steps in the sequence of this dance.





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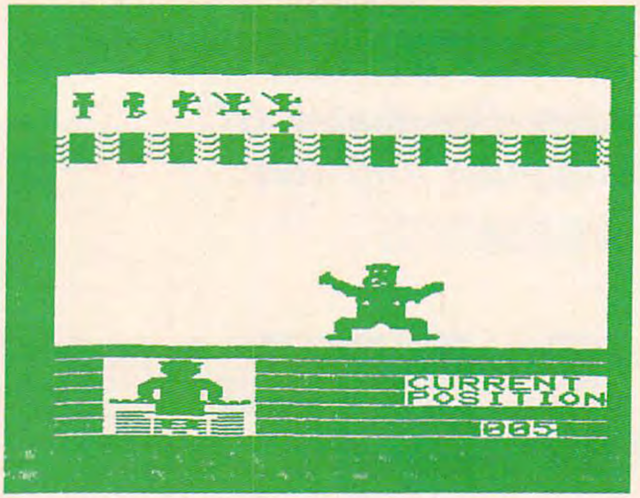
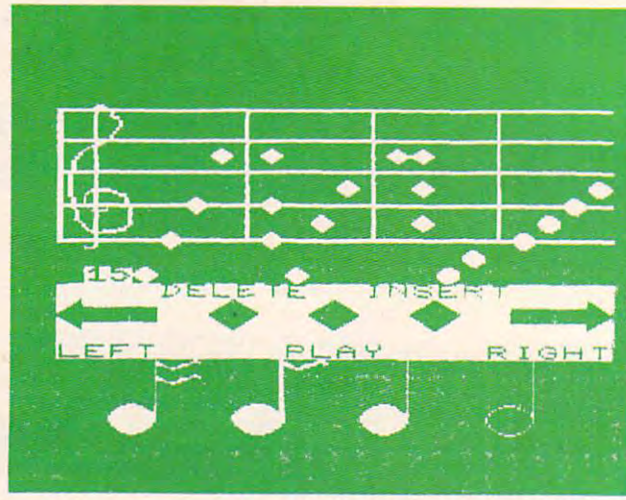


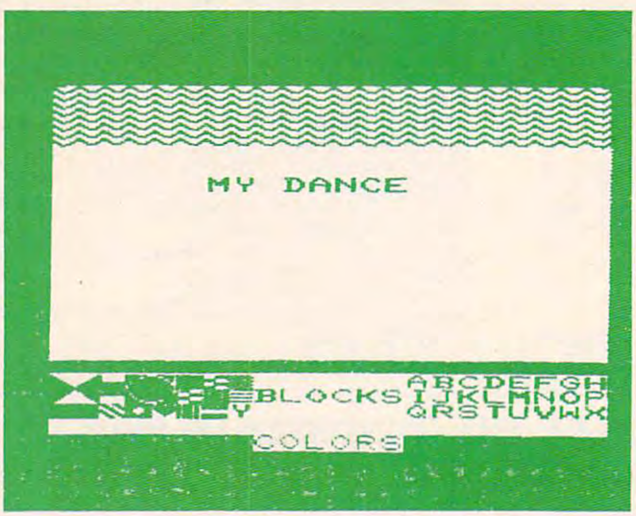


Language Adaptability

The top of the last figure shows the listing for this dance program. This listing can be edited, saved, or run. A REPEAT function allows any portion of the dance to be repeated as many times as desired.

The finished dance can be tested, edited, merged with user-defined (or predefined) music, and the stage can be outfitted with props.

The prop room lets you outfit the stage with blocks and labels. The set can be as elaborate or as simple as you desire.



The music editor uses the KoalaPad to pick up notes and place them on a stave. As with the dance itself, the music can be tested and edited if desired.

The entire dance program (props, music, and bear motions) can be saved on tape for later use.

If we accept that *Dancing Bear* is, in fact, a programming language (along with *VisiCalc* and *Rocky's Boots*), one might legitimately ask "Who cares?"

I guess the point is that languages are fundamentally more powerful than application programs because they let the user gain control over the computer system. Admittedly, *VisiCalc*, *Rocky's Boots*, and *Dancing Bear* don't offer the degree of access to the computer found in languages such as PILOT and Logo, but they offer far more control than fixed-function application programs.

The personal computer is unlike any other appliance to ever grace the home. Where the washer, stove, or television has fixed functionality, the computer is, by design, a general-purpose machine. Ultimately, effective use of this machine will only come when each user feels comfortable in molding the computer's applications to his or her own needs. This molding process requires programming skills on the user's part.

Since the beginning of the personal computer industry, we have been trained to believe that computer programs were linear strings of text. In this regard, the only differences between BASIC, Pascal, and Logo are grammatical.

VisiCalc, *Rocky's Boots*, *Dancing Bear*, and other languages of this sort point to another type of language – one that is more parallel than serial in its programming style. It is significant that these three programs (and others that have similar characteristics) are designed for nonprogrammers to use.

I see the continued development of languages of this type as a revolutionary force that will finally make programming a natural activity for *every* user of a personal computer. ©

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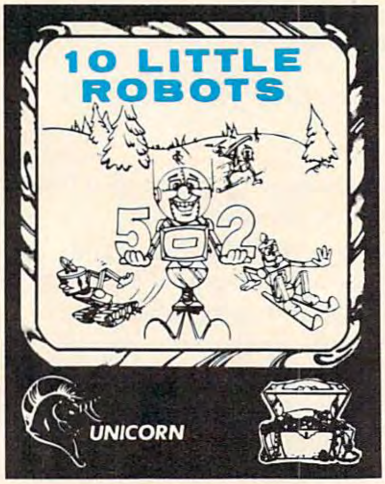

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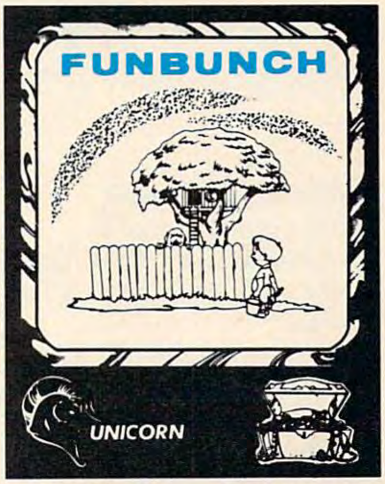

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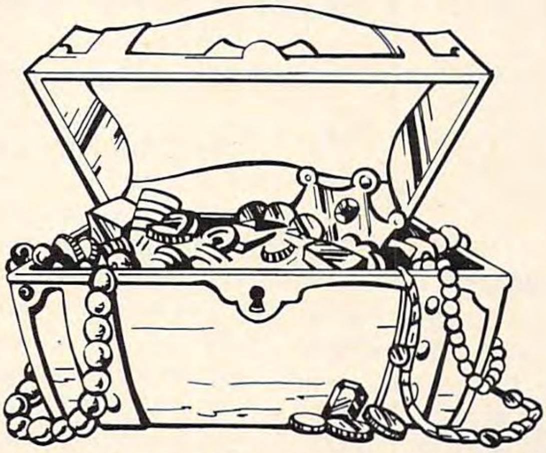

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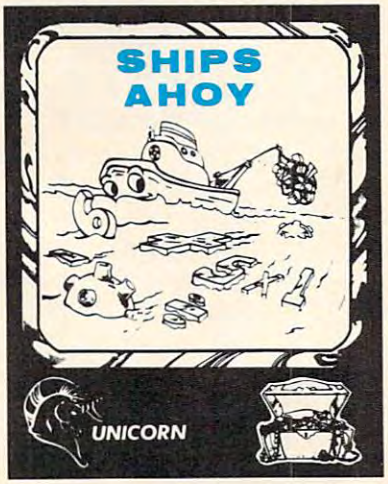

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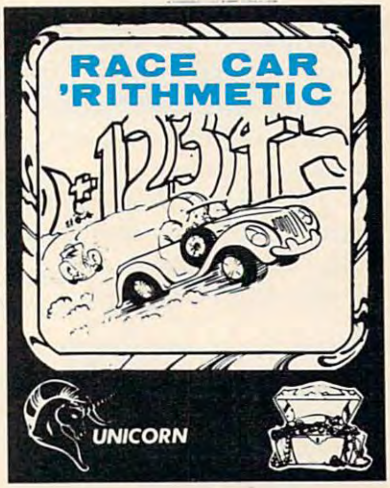

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How To Get Intimate With Your Computer

Part 2

Closer To Home

After my whirlwind travels across the United States and England, I'd like to take a break for a month and look at an important issue that is closer to home.

Elsewhere in this issue (in my "The World Inside The Computer" column) I begin a discussion about the difference between computer literacy and computer intimacy. I'd like to continue that discussion in this column.

Let's look at the myths that make adults so anxious and fearful about computers. We'll see how most adults who want to know more about computers should become intimate with computers before they try to become computer literate.

The Myth Of The Klutzy Adult

A pervasive and pernicious myth is being spread unthinkingly throughout our society. The myth is that our children are whizzes with computers, but we adults are klutzes. This myth is almost completely ungrounded in fact. Why are children so good with computers? They are good because they see only the colorful, musical, exciting side of computers. The first time they meet a computer, it is wearing a smile.

Children are spurred to master computers because they are so attractive. When we adults see this side of computers, we, too, can master computers just as fast, just as happily as our children.

Trust Your Feelings

What is computer intimacy? What is intimacy? Intimacy is a gut feeling. You know you have become intimate with your computer when you are totally comfortable and relaxed with it, when using it becomes a pleasure rather than a chore, and when you develop excuses just to spend more time with it. When you begin to think your computer is lovable, that's when you know the two of you are becoming intimate.

Getting to know a computer can be like getting to know an attractive yet intimidating member of the opposite sex. I think there is a great similarity between my first experiences with girls and dating, and the average person's first experience with computers. When the average person first looks at computers, he or she feels the same sense of fear and anxiety that I felt when I gazed across the gymnasium floor at the girls clustered on the opposite side of the room. That was my first school dance. Computers evoke the same sense of shyness, yet they can also be tremendously attractive, even seductive.

A New Love Affair

For almost 75 years, Americans have had a love affair with their cars. Computers will soon be like cars. Like cars, they will remain machines, and our servants, yet they will also have an emotional, gut-level appeal that will turn people on and bind them to them.

The kind of car we drive depends on the kind of person we are or would like to be. Our car's appearance, model, and year often accurately reflect our values and the kind of image we want to project to our fellow human beings. Cars project all sorts of images. They can be inconspicuous, efficient, and sedate, or they can be clunky ragamuffins. They can be flamboyant, garish, and ostentatious, or they can be sensual and adventurous.

Computers, too, will soon reflect our lifestyles, values, and self-image. They will also reflect our needs. Like cars, computers will come with model names pulled from the animal kingdom. Depending on our needs, we'll buy a Cobra (fast as lightning), or a Hippopotamus (it digests huge quantities of information), the St. Bernard (it saves your life in tight situations), the Peacock (it really struts its stuff), or the Donkey (slow and stubborn, but real dependable).

Computers, like cars, can evoke a passionate attachment, a rush of affection. But to inspire real intimacy they must throb to life at the turn of a key, and they must get us where we're going – the faster the better.

A computer can be seductive and lovable, but it is not an end in itself. Many people can get excited about a computer for its own sake. Many

more, however, can get excited about using a computer to have fun, get work done, and communicate with other people.

In the future, computers will promise even more than they do today. But let's make sure they keep those promises.

More Than Tools

Computers are only machines, but they are more than tools. A hammer is a tool. So is a broom. But can you get intimate with a hammer or a broom? Not easily. Yet it's easy to get intimate with a computer, because computers are more than workhorses and tools. Computers obey our commands. They carry on conversations. They listen to us. They are infinitely patient. They can be friendly, playful, even silly.

Friendly computers? Playful computers? Silly computers? Where do you find them? Just ask a child. Children love computers because they use computers to learn and have fun. But why can't adults learn on computers, too? And why should kids have all the fun? Adults who peek over kids' shoulders at their programs find that the programs are challenging, enjoyable, and enlightening. Adults can use these programs, overcome their fears about computers, and relieve their computer anxiety. Adults can get to be just as good with computers as kids, and they can have just as much fun.

Computers That Frown And Look Mean

Most adults still think that computers are dry, cold, and unfriendly. No wonder! Most computers in the past were number crunchers, bill collectors, and tax watchdogs. Even today's computers, in their heart of hearts, do nothing more than juggle ones and zeros. But computers don't have to be technical and boring. They can be funny – if you just add people. The relationship between computers and people is often hilarious, if we keep a sense of humor. It pays to look at the lighter side of this relationship, and if we do, we find it helps to break down the barrier of fear separating us from the computer.

Coming Out Of The Closet

In recent years all sorts of groups have come out of the closet and have honestly revealed who they are and what they stand for. It's time that computer lovers do the same.

As a person who is on extremely intimate terms with his computer (it follows me into my bathroom and into my bed), I'd like to confess here and now one of the most closely guarded secrets of our relationship:

My relationship with computers is not rational.

This is a shocking revelation, but it is true. My relationship with my computers is emotional, quirky, and antic. It is infuriating, enlightening, and silly. It is happy, frustrating, and ecstatic. But it is rarely rational. And I contend that this is true throughout our society among the millions of computers and computer users. A rational relationship between a human being and a computer is the exception rather than the rule.

Take today. My assistant and I were working on a personal computer. We were sailing along, turning out letters, articles, and forms at a swift, productive pace. The world looked bright, and we were happy.

Then disaster struck. The computer made a mistake. The computer's mistake was only a little one. It wouldn't save any of our text files on disk so that we could print them out on the computer printer.

Until it made its mistake, the computer had been behaving itself. I felt very close to the computer and was extremely fond of it.

After the computer made its mistake, I had a change in heart. No matter what I did, the computer wouldn't save or print my files. So I hated the computer. I called it names. I threatened to walk out on it, abandon it, put it up for adoption.

Now I ask you, does this sound like a rational relationship?

A rational relationship must have at least two parties who are rational. First we look at the first partner – the human being. Occasionally, philosophers have proposed that humans are rational, but most of us know otherwise.

Next let's look at computers. This is more of a problem. Computers are incredibly complex machines, composed of millions of interacting circuits and thousands upon thousands of operating instructions, rules, and conditions. Computers are too complex to be simple, too complex to be totally rational.

Nevertheless, people think they are rational. For example, the popular wisdom now contains two catchy phrases that most people unquestioningly believe:

> First: Computers don't make mistakes. Only people make mistakes.
>
> Second: Computers do only what you tell them to.

As I mentioned, I am extremely intimate with computers. Since I am in this privileged position (along with two or three million children), you would think that I would be able to see through the popular wisdom and realize that the two catchy phrases above are pure hogwash – myths and nothing more.

Alas! I am as much a victim of these myths as the next human being, at least when I am working with my assistant. Whenever anything goes wrong while she is using the computer, whenever


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the computer acts strange, whom do I blame? Why, her, of course.

Take the other day. I was upstairs in my study and Darshi, my assistant, was downstairs in the office. All of a sudden, she yelled, "Fred! Come quick! The computer's going crazy!"

Sure enough, the cursor was rolling across the screen wiping out the words almost like Ms. Pac-Man rushing around devouring dots. I pushed every button on the keyboard, but nothing worked. The cursor was determined to eat the whole file.

Finally, in desperation, I turned off the computer. Then I turned toward Darshi. "What did you do?" I said, in a not very friendly voice. "The computer was fine just a few minutes ago. You must have done something to mess it up."

Sadly, this was the last thing Darshi needed to hear. She was already extremely timid around the computer and afraid that the next button she typed might blow the computer up. When I accused her of her worst fear, she looked ill and ran out of the office.

Why had I blamed Darshi? I blamed her because she was a beginning user and a human being. Those two facts alone were enough evidence to convict her.

Sometimes computers are agreeable, responsive, and meek. They do everything you tell them to. But then, a moment later, without any warning, they turn on you. They suffer amnesia. They pout and get sullen and write gobbledygook all over your lovely files. Or they act crazy and start doing awful things like eating up the words on your picture screen. And they get out of control. Then the only way to get their attention is to switch off their power. This, of course, is an undesirable and drastic solution. But, sometimes, it's the only way to make them come to their senses.

A Little Breathing Room

When you are in the middle of a squabble with your computer, it doesn't seem very funny. However, after things have quieted down, and you look back, you might be able to put things into perspective, and maybe even laugh about them.

But one thing you should not do is pretend that you and your computer have a rational relationship. It is anything but that. It may be quiet, sedate, and low key. Or it might be wild and boisterous. But it is not rational. It can't be. You're not rational. The computer's not rational. So how can your relationship be rational?

The sooner people stop looking at their relationship with computers as rational, the sooner they will become intimate with computers and learn to accept them for what they are. Computers are moody and complex creatures. But they try hard to please you. They really do. ©

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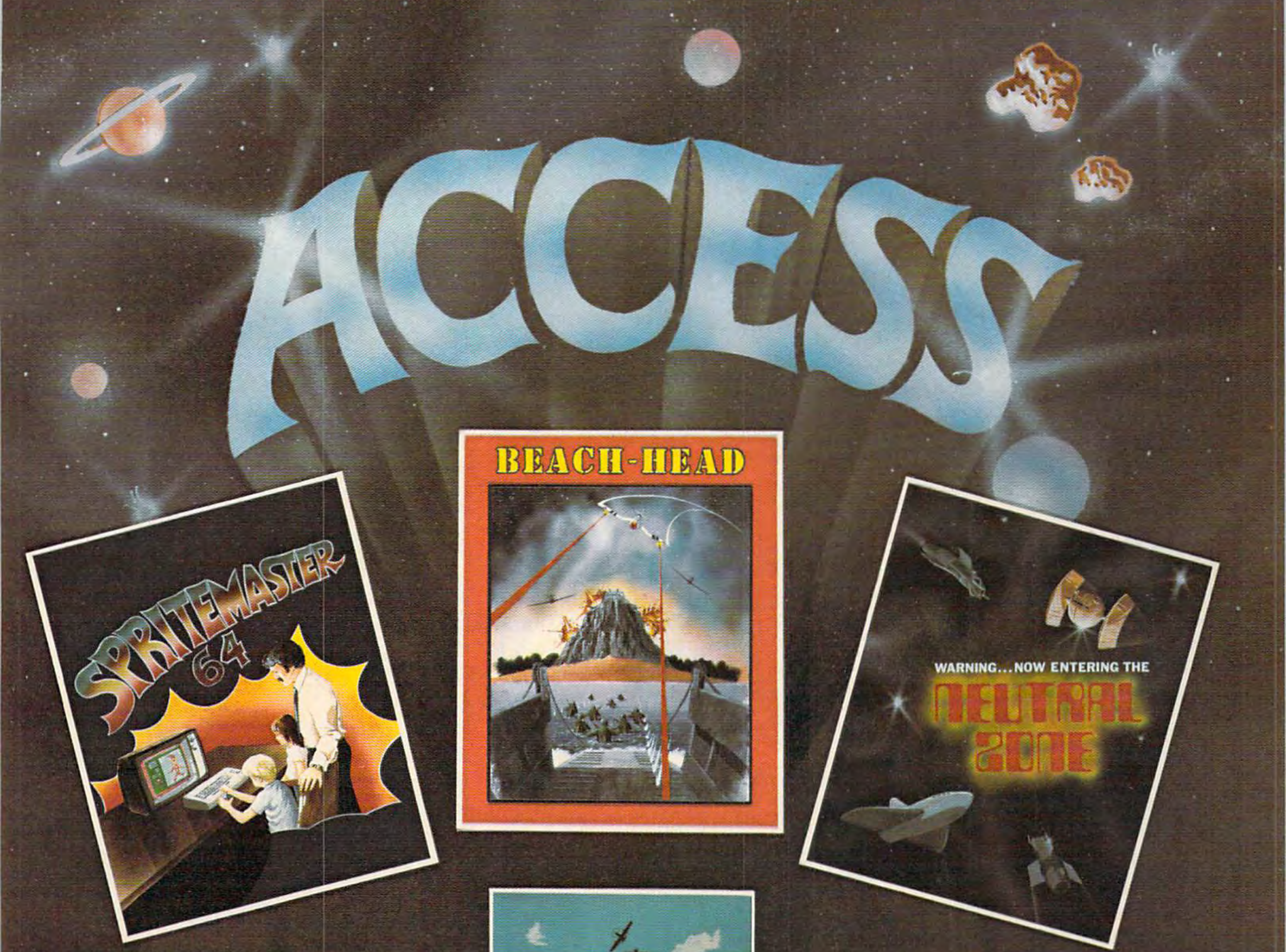

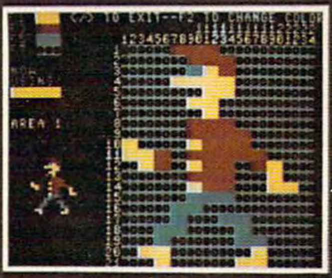

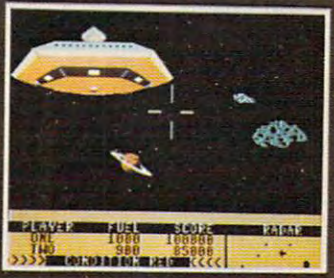

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Richard Mansfield, Senior Editor

Zones Of Unpredictability

What's the most random thing you can think of? Lightning? A tossed coin? Teen love? No matter what you come up with, one thing that will not be on the list is your computer.

Few things made by man are designed to be more logical and predictable than computers. And yet computers must sometimes work with the unexpected, the irrational. If one of the uses of a computer is to imitate reality, they'll have to be able to come up with odd, random events from time to time. This is where the BASIC word RND comes in. Its job is to surprise us. We should never be able to predict how it will react.

Say you want to write a guessing game program. You want it to provide addition problems for a child to solve. There are two ways to go about it. You could construct a huge list of problems and answers, and then have the computer remember them in a massive series of DATA lines in the program. This solution has two big drawbacks: it takes a lot of time to type in the problems, and the game will ask the same questions each time it's played.

A better way would be to have the computer randomly pick the numbers for each problem. Take a look at our sample program. Line 120 establishes that we are going to ask ten questions in this quiz. Line 120 works in partnership with line 200 and means that what's enclosed between those lines will operate ten times. The NEXT word causes a counter to raise itself once each time NEXT is encountered while the program runs. So, when NEXT causes the I variable to raise up to 11, the program "falls through" to line 210 which informs the player of the score. There's nothing beyond line 210, so the program ends.

RND is at the heart of this program in lines 130 and 140: variables X and Y each receive a different random number between zero and nine. If you type ? RND (1) * 10 several times, you'll see various numbers, but all will be lower than 10. (To get numbers between zero and ten, you'd use: RND(1)*11.) Typing ? RND (1) without any multiplier will give random fractions between zero and one. So, to get a useful integer for the purposes of our quiz, we have to multiply the fraction by ten and then round off the result by using INT( ).

The rest of the program is straightforward. Line 150 prints the problem, and line 160 accepts the answer from the player. Line 170 sends the computer to the "correct answer" response in line 190. If the answer is incorrect, we "fall through" to line 180 to announce the error. The score (T) is kept in line 190.

It would be easy to make this a more difficult quiz by changing the 10 in lines 130 and 140 to, say, 100 to allow larger numbers in the quiz problems. Also, it could be transformed into a test of division, multiplication, or subtraction by changing the + symbol (to / or * or −) in lines 150 and 170.

The Most Random Thing In The Room

But how "random" can something actually be, considering that it's coming out of the fiercely logical world of the computer? We won't go into heavy duty philosophy here, but there are some arguments that there isn't *any* way to generate truly random numbers. In any event, there's one aspect of RND which affects our quiz program and other games.

Inside the computer is a little engine designed to produce random numbers. It's called the random number generator and it's got to start with something. That something is called the *seed* and, in some computers, the same seed is put into the generator each time the computer is turned on. So, you will get the *same sequence* of random numbers each time you start a game after powering up your computer. We haven't solved the "same quiz each time" problem at all. Try it with our program here.

On the Atari, this isn't a problem because RND (0) results in nonrepetitive sequences. On the TI, you can use the word RANDOMIZE at the start of a program. That solves the problem. (Note too that TI BASIC uses the word RND without

anything in parentheses.) But on Commodore computers, you need to find a way to make the sequences of numbers different.

The solution is to introduce a random seed. On Commodore machines, you can use RND (-TI) instead of RND (1). RND (-TI) takes its seed from the computers' internal timers and results in sequences which will not repeat. How? The timers are very fast. If the seed is coming from the timers, then the exact seed will depend on when you, the human, type RUN. Since it's unlikely that you'll ever turn on the computer, LOAD the game, and type RUN in precisely the same amount of time, the timer value will be different for each game. Therefore, to randomly seed the random generator, we can rely on the most random thing in the room, you.

Math Quiz

```
100 PRINT" MATH QUIZ"
120 FORI=1TO10:PRINT:PRINT "PROBLEM NUMBE
    R" I
130 X = INT(RND(1)*10)
140 Y = INT(RND(1)*10)
150 PRINT" ";X:PRINT"+";Y
160 INPUT ANSWER
170 IF ANSWER = X + Y THEN GOTO 190
180 PRINT"NO, IT WAS" X + Y: GOTO 200
190 PRINT" CORRECT!": T = T + 1
200 NEXT I
210 PRINT"YOU GOT" T "OUT OF 10 RIGHT."
```
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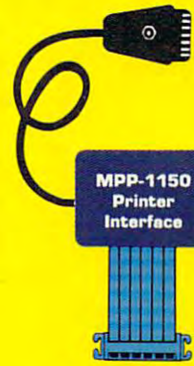

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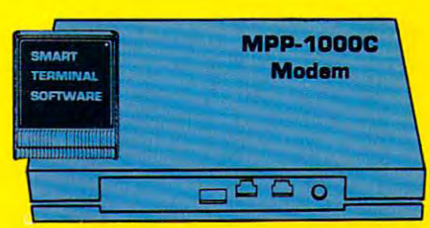

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How To Get Intimate With Your Computer

Part 1

Fred D'Ignazio, Associate Editor

In my September column I proposed that we move beyond computer literacy – to computer *intimacy*. I have done some thinking since then, and I have concluded that we shouldn't abandon our push for computer literacy, especially among young people. But we should encourage computer intimacy *before* computer literacy.

Computer Intimacy First

If you are intimate with your computer you are comfortable, cozy, even attached to it. You know enough to put the computer to work, but you don't have to know *how* it works. Computer intimacy is a totally new relationship between people and computers, one made possible by the new developments in computer hardware and, especially, software. Once we are intimate with our computers, many of us will also want to become computer literate. But not all of us. Nor will we need to.

Many adults envy children's relations with computers. The myth is that children are computer whizzes, that they are computer literate. But this is untrue. Most children are no more computer literate than most adults. What they are is computer *intimate*. They like computers. They have a warm, affectionate, and playful relationship with computers. They don't fear computers. They aren't overawed. To them the computer is just a snazzy appliance or toy, a cross between the TV set, the typewriter, the piano, and building blocks.

Children move rapidly toward computer literacy because they become intimate with computers first. This is the same path adults should follow. Adult computer courses make the mistake of skipping the intimacy part and moving right into computer literacy. But, in most circumstances, this strips computers of all their fun.

The first impression the average adult has of a computer is just as he or she imagined: the computer is technical, dry, and complicated. Adults know that it is for their own good to become computer literate, but that doesn't mean they want to. No wonder the adults look enviously at the children. The children look like they are having fun. For them, learning about computers is exciting, hilarious, and very rewarding.

But why should children have all the fun? For many adults, computer literacy is a huge roadblock that separates them from learning more about computers. We should clear away this roadblock and start adults in the right direction, and introduce them to programs modeled after children's programs, programs that promote computer intimacy.

Establishing A Balance

In the job market of the 1990s and the twenty-first century, very few people will be computer literate, if by literacy we mean having the ability to create real, nontrivial computer programs. Yet most

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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!.

people will need to be computer intimate. They will need to be able to work with computers – confidently, comfortably, efficiently, and sometimes even joyously.

But this doesn't mean we should abandon computer literacy. Computer literacy is not just a technical skill for a few mechanics and specialists. It is a doorway that many should enter. Then they can begin using the computer to its fullest potential. For people who are computer intimate and literate, the computer can become a medium for self expression, a "new age" culture for creativity and communication, and an environment for invention.

Children, especially, should be encouraged to move beyond computer intimacy to a higher level of computer literacy (appropriate to the sophisticated software tools that will be running on computers of the future). Many will not want to go, and they shouldn't be forced. *They will not need to be computer literate to live happy, productive lives in the future. Computer intimacy will suffice.*

However, as a social goal, computer intimacy is not enough, not if our culture is to keep evolving, changing, and responding to the challenges of the present and the future.

The Magician's Top Hat

How do we see computers? Today most children and more and more adults see computers as a magician's top hat. All the new software cartridges, disks, and tapes are stuffed inside the hat, like white doves, flaming scarves, brilliant-colored parrots, and soft, fuzzy bunnies. You can reach into the computer "hat" and pull out almost anything you can imagine – word processors, adventure games, file managers, video paintkits, turtles, and electronic pianos.

And the software industry is growing like a colony of healthy bacteria. In the future we will be able to pull a thousand times as much out of the magic hat.

But what fuels the software industry? What is its source of dynamic power and energy?

Computer literacy. Not among a handful of computer scientists and experts, but spread across millions of computers and millions of users. Computer literacy is the training ground for computer invention. And computer invention makes computer intimacy possible – at higher and higher levels.

Mass-produced microcomputers and increasingly sophisticated software tools have unleashed the imaginations and enlivened the ambitions of an army of youthful, would-be inventors. The inventors are firing off their software inventions like fish launched from a host of catapults

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Millions Of Computer Inventors

The personal computer is more than a magician's hat. It is also a miniature toolshed, workshop, or laboratory. And as personal computers become less isolated, and enable their users to communicate with each other, they will become a *roundtable*, a forum for people to bounce ideas off each other and then implement those ideas, jointly, as new computer software.

Computer literacy – appropriate to new, higher-level computer tools – is needed in the future, not just among a few experts but among thousands and millions of young inventors with fresh ideas and with the energy and self-confidence to turn them into computer inventions. And computer inventions will be woven into the fabric of our economy, our society, and our lives.

So computer literacy is necessary. All children should get a crack at becoming computer literate, at the youngest possible age.

Yet computer literacy still does not come first. Computer intimacy comes first, especially for the majority of adults who are scared to death of computers, yet realize that computers are the wave of the future. The strident cries for universal computer literacy only increase these adults' fears. For these adults, computer literacy is not the answer – at least not yet.

A New Religion

Computers are powerful new machines, so powerful that they are treated by many people as a new "religion." Computer enthusiasts are the evangelists for this religion, and they are winning converts by the millions.

Most adults, however, have mixed feelings about computers. They see computers for what they are. Computers are valuable tools and servants, but they are not the most important thing in life. Computers are not an end. They are merely a means to more important, human-defined ends.

Also, computers, like any other powerful and pervasive technology, are valueless in themselves. Whether their impact is good or evil depends on how they are used.

Most adults have a very healthy skepticism and distrust of computers, especially when the "true believers" market them as a necessity and tout them as a new religion.

Most adults do not need a startling plunge into the icy waters of computer literacy. First they need to get their feet wet. They need to follow in their children's footsteps. They need to play with computers, learn with computers, and have fun.

See "On The Road," page 140, for part 2 of "How To Get Intimate With Your Computer." ©

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Androbot's Topo

Michael A. Tyborski

Robots are rapidly becoming part of our life. You cannot read a magazine or newspaper without hearing about them. Although robots were once laboratory curiosities, they are now within anyone's reach.

Yes, *you* can own a robot. Mechanical servant? Not yet. Entertaining companion, yes.

Androbot, Inc., of Sunnyvale, California, has recently released its Topo robot. It will provide hours of entertainment for any Apple owner. Although not a true robot, it demonstrates many of the important fundamentals of robotics.

Your Computer Controls It

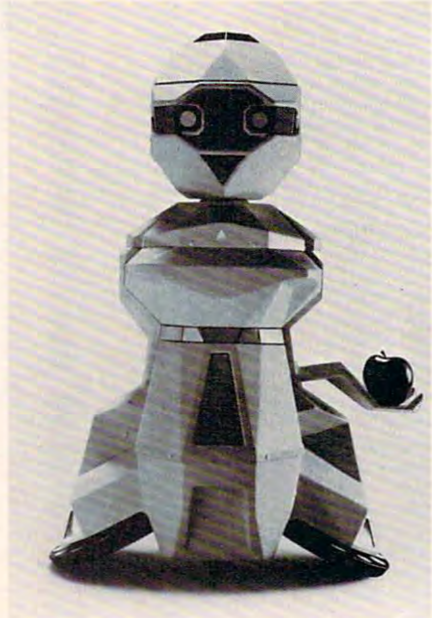
Topo is a radio-controlled platform that looks like a robot. It includes a user's manual, transmitter, and plug-in control card for the computer. It also includes TopoBASIC on disk, which allows it to be used within a few minutes.

An Apple computer controls Topo; this simplifies programming and reduces the selling price. It also eliminates the need to learn a new operating system or programming language. Unfortunately, your computer does not receive sensor information, a limitation that makes it possible for Topo to run into walls or down the stairs.

The robot is made of high-impact plastic and is three feet tall. Its friendly appearance attracts small children like ice cream, an effect consistent with Androbot's belief that robots should be "friendly looking, inviting companions."

Topo has a head and arms. Unfortunately, they are not functional. The head is permanently attached to the body and does not turn, which makes the robot less lifelike. It has a decorative face grill and eyes. An emergency stop switch is mounted on top of the head which turns off the robot.

The arms, plastic flaps that can be extended as needed, are made from relatively thin plastic and cannot hold heavy loads. They attach to the body with plastic pins.



Androbot's Topo robot.

Two-Wheel Drive System

Topo has a unique drive system called Andromotion. Androbot claims that this provides "maximum stability and safety with optimum maneuverability and control." It also gives the robot an individual personality.

Just what is Andromotion? It is a two-wheel drive system that relies on angled wheels for stability. This design is patterned after the rocking chair. As a result, the robot remains stable because the effective roll center is above the center of gravity. The principle is clearer when the robot is viewed from the side. The side projection of the wheels looks like an ellipse, and the long sides resemble the rail of a rocking chair.

Because of Andromotion, Topo sways from front to back as it moves. This sway can become violent during a fast stop, making Topo look like a fishing bobber.

Androbot states that Topo has industrial-grade batteries and a fabricated steel superstructure, and claims that high-torque motors and cast aluminum gear boxes assure structural integrity. These features place the robot above the toy category.

The robot's back panel holds the power switches, indicator lights, and a charger jack. Yes, switches. For some reason, Androbot decided to use a separate ON and OFF switch, a design possibly based on a control circuit restriction. The red and green switches may also indicate STOP and GO to children.

The indicator lights show when Topo is on and what the battery status is. When a low voltage condition occurs, a red indicator light turns on. The wheel supports also contain indicator lights for showing direction.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You are responsible for plugging in the charger – a simple AC adapter. You must also prevent the robot from being turned on while charging. If it is, you may soon need a new charger. Finally, you must not leave the charger connected for more than 24 hours at a time.

Topo receives commands over a radio link. This link uses a 100-milliwatt, 4-channel AM transmitter that operates at 27.145 megahertz, and transmits the control card data. Although the antenna is short, a 90-foot range is possible. The transmitter has its own power switch to prevent interference when Topo is not being used.

The control card provides power and serial data for the transmitter. It plugs into slot five on the Apple computer. The unit has three integrated circuits and one regulator. This allows a 3-inch-square board to hold all the circuitry. An AMD 9513 chip generates the serial data for the transmitter.

The Documentation

The Topo manual is easy to read and understand. It comes in a small ring binder and includes dividers for future chapters. A plastic holder protects the program disk and warranty card. Interestingly, the manual was printed on a dot matrix printer, but this does not decrease its readability.

After an introduction to Androbot and Androbots, the user is shown how to unpack and check Topo. The first section also includes control card installation and battery charging instructions.

The important calibration procedure, which insures accurate movement and turning, is covered next. Finding calibration values for each surface Topo will move on will minimize errors from wheel slippage.

Finally, the last section describes TopoBASIC, and has material for the beginning and advanced programmer. This section includes a listing of the machine language and BASIC routines. It also provides a glossary of BASIC routines.

Topo In Motion

After charging the batteries, we began to use Topo under program control. This proved to be an interesting experience. Topo just did not like repeating its path. While drawing a square, for example, it turned about 15 degrees each repetition. This made the square rotate about its center.

Proper calibration improved its performance. In our case, the procedure took about ten minutes. It had to be repeated, however, for other surfaces.

The transmitter could control Topo throughout a house. It did have some annoying dead spots, however, which made Topo act erratically or stop.

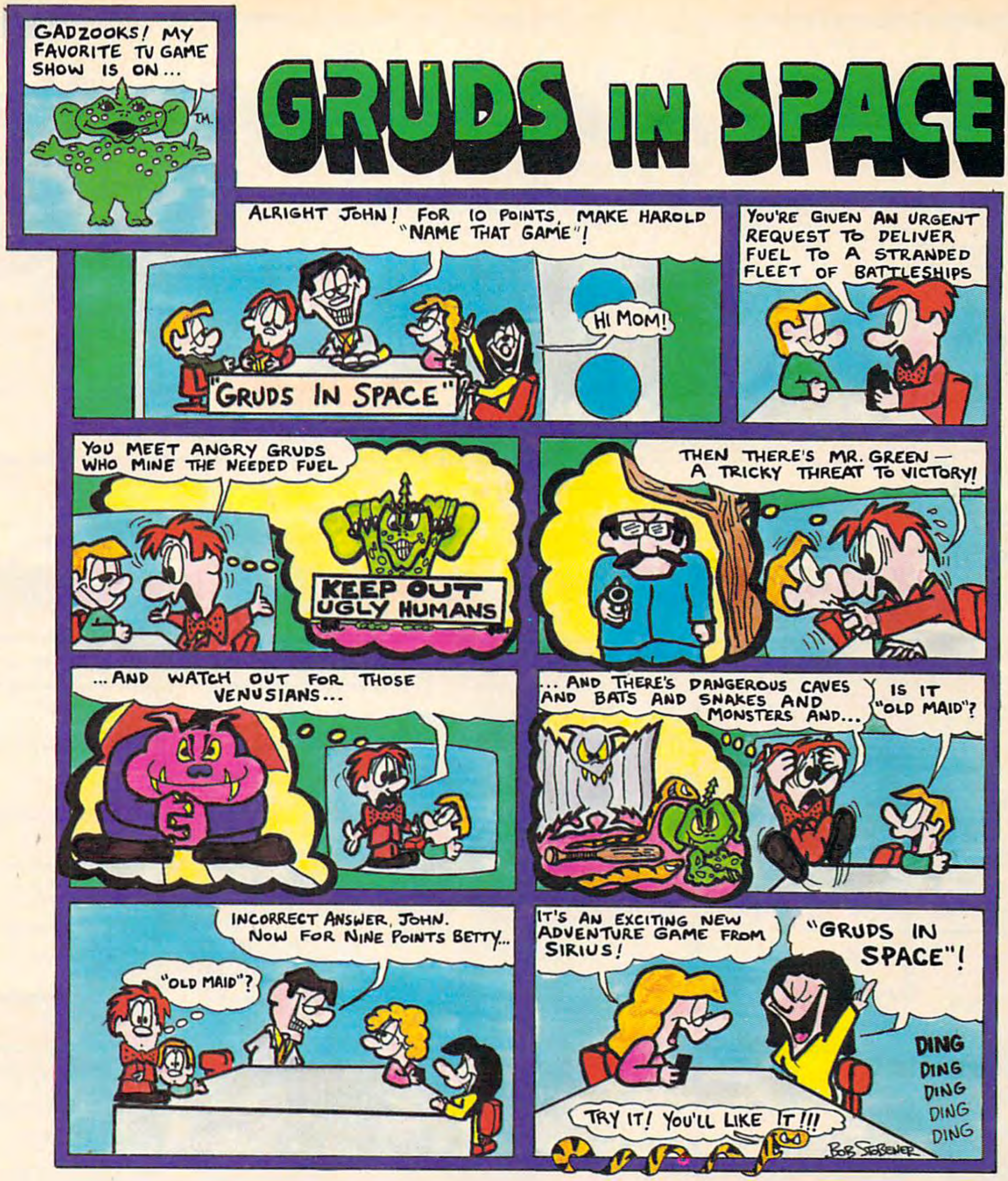
Topo cannot detect obstacles. As a result, it often ran into people or furniture. This, in turn, changed its path or completely stopped it. Whenever this happened, it had to be stopped and moved to its starting point. The program was then restarted.

Spectator reactions varied. Adults and teenagers were either amused or skeptical. Many wondered what Topo could be used for. Young children, naturally, were a captive audience. They would try touching Topo whenever it stopped. Some even talked to it.

Having already seen Heathkit's Hero robot, many people missed voice and head movement, claiming that these features make robots interesting and lifelike. A few people also wanted the arms to move. Despite these objections, they all gave Topo a favorable rating.

Future Enhancements

Androbot will offer a number of accessories for Topo, including a voice module and Androwagon.



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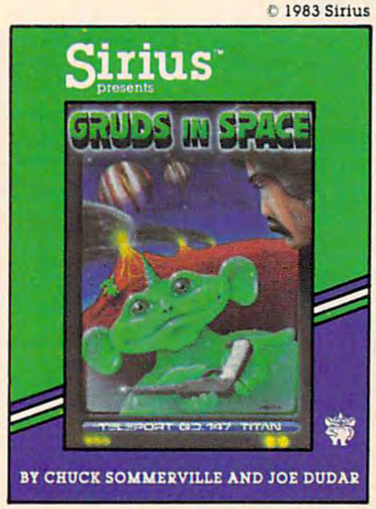

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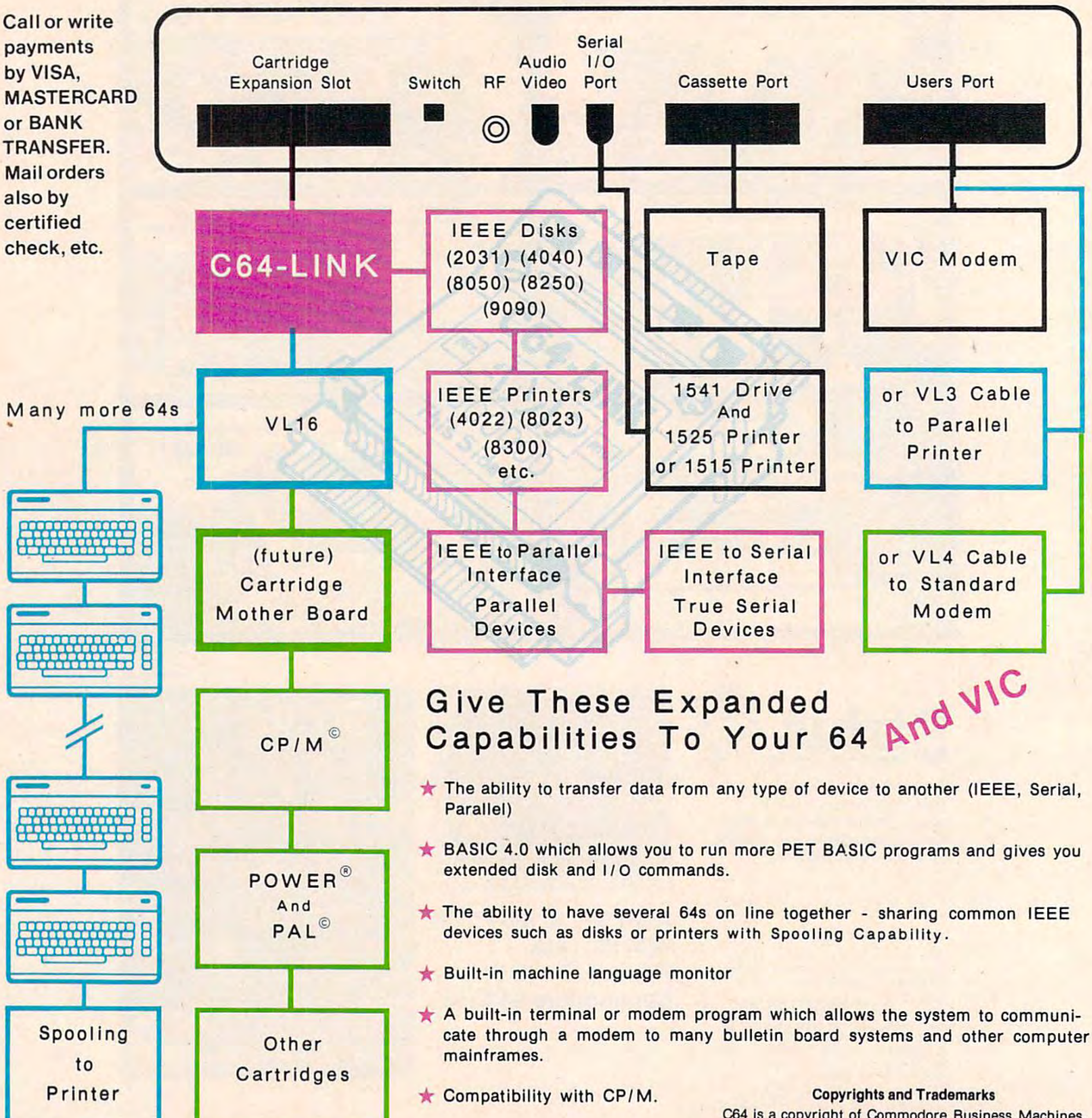

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The voice module will use a tape recorder for high-quality, low-cost speech. It will be controlled by a spare transmitter channel and should help attract spectators and hold their attention.

The Androwagon compensates for the cosmetic arms. It allows Topo to carry beverages and other heavy objects. When combined with speech, this accessory could turn Topo into a party host.

Programmers should look forward to working with TopoLogo and TopoForth. These languages simplify program development and allow commands such as GO KITCHEN. They also draw the path Topo is currently following. A TEACH mode saves time by allowing command sequences to be created and saved on disk for future recall.

TopoLogo consists of extensions to Terrapin and Krell Logos for the Apple II computer, and includes calibration and demonstration programs. This package provides the most powerful way to control Topo.

Finally, interface boards will soon be available for Atari, Commodore, and Radio Shack computers. This will undoubtedly make Topo more visible. Despite its limitations, Topo provides an excellent introduction to robotics.

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Paper Porter

Betsy and Stefan Burr

There's something particularly attractive about a simple, inexpensive device that claims to do the work of complicated hardware. That's what intrigued us about a piece of plastic called the Paper Porter, which is designed to give friction-feed capability to a tractor-feed printer such as the Epson MX-80. Since friction feed can add as much as $100 to the cost of a printer, this alternative, at less than $5, is worth considering.

The Paper Porter is a 9½-by-17-inch sheet of clear plastic with holes punched in the side so that it can be driven by tractor pins. Near the top is a pocket formed by another sheet, which can hold by friction an ordinary piece of paper, such as letterhead. Once the top of the paper is inserted into the pocket, the Paper Porter is easily loaded and run through the printer. The procedure is repeated with each page in a multipage document. With practice, we found that the whole operation takes only a few seconds – quite comparable to the time needed to run each separate sheet through a printer with friction feed.

Print On Letterheads Or Ditto Masters

Although printing on letterhead stationery may be its primary use, the Paper Porter can come in handy in other ways. For example, we use it to make ditto masters.

A minor difficulty arises in trying to print close to the top of a page. The plastic pocket overlaps the top of the paper by one inch, making it impossible to print above that point. We solve this problem by putting two small loops of masking tape, sticky side out, in the pocket. This holds the page so that printing can start within half an inch or so of the top. After you put the tape in place, you may need to reduce the stickiness a bit. Double-stick tape works, too, but it's a trifle harder to adjust the stickiness. Once the tape is properly placed and adjusted, the fix lasts for months.

On letterhead stationery, of course, there is no need to come near the top of the page, so it can be useful to have one Paper Porter with the tape and one without it. We've ended up acquiring two of each type, so we can be slipping one page into a Paper Porter while the other is printing – a timesaver on multipage jobs.

The 17-inch length is just enough to prevent the out-of-paper switch on the Epson MX-80 from terminating printing before the bottom of an 11-inch page. An earlier version of the Paper Porter was too short, making it impossible to print to the bottom of a page unless the switch had been defeated. With paper longer than 11 inches, and perhaps with some other printers, the alarm may still be activated. And, just as with some platen feed arrangements, the alarm may come on when pages are being changed. For these reasons, it may be desirable to defeat the switch, which is not usually difficult. On the MX-80 it can be done by taping a small piece of paper over the switch.

Business Envelopes Not Compatible

The Paper Porter does have one significant drawback: it can't print on a standard business envelope. Any paper that is even slightly wider than 8½ inches will interfere with the tractor pins.

There is at least one trick which is actually easier with the Paper Porter than with a typical friction (platen) feed printer – printing two or more columns in perfect alignment. The standard procedure is to print one column, then back up the paper and print the second column. With friction feed, the alignment is tricky, but with tractor feed, the pins guarantee that the backed-up page can be perfectly aligned with no trouble.

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Home Computer Games Grow Up

Orson Scott Card, Editor, COMPUTE! Books

I must admit it took me by surprise. After months of observing that almost no one was making true home computer games, suddenly I find myself with a fistful of games that are everything I could ask for.

And I do ask for a lot:

1. A home computer game should not be designed to minimize playtime – it should not be designed to take away quarters by making the game impossible to beat.

2. It should use the full power of the computer – it should do things that only the computer can do well, and it should use all the appropriate resources the computer provides.

3. It should be an excellent *game,* not just excellent *programming* – the play itself should be exciting and not serve merely as an excuse to show off the programmer's expertise.

4. Above all, the game should be designed so the player controls and, to some degree, creates the game as he plays – I have little patience with games that play *me,* forcing me to follow only one possible track or learn one mechanical skill if I hope to win.

If those requirements sound like what you want, too, I have good news for you: there are finally some software companies making a serious effort to create exactly this kind of game.

The software firm Electronic Arts has added a fifth requirement for itself: The game must be truly original. No *Donkey Kong* or *Pac-Man* clones in this group of games. Even though each of their games has roots in gaming traditions, the object has not been to recreate a favorite board game, or duplicate a sport, or translate an arcade game.

A Colony In Space

After years of spaceships blasting away at each other, Electronic Software's *M.U.L.E.* (for Atari and Commodore 64) is a refreshing change. In this game by Dan Bunten, Bill Bunten, Jim Rushing, and Alan Watson, you and three other colonists (human- or computer-controlled) have been left to mine for Smithore. However, you also have to produce enough food and energy to survive until your ship comes back in six months. To help you, you have an all-purpose robot called a M.U.L.E. – which can be as stubborn as its flesh-and-blood namesake.

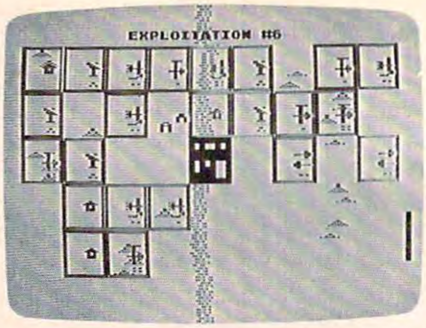
This leaves you with some complex decisions to make. While you are competing with the other players, trying to make a killing in food production, Smithore, or energy, you also have to cooperate with them, so you don't overproduce one commodity and lower the price – and so you don't neglect to produce enough food and energy to keep the colony alive.

In other words, it's a game that faces the fundamental ethical dilemma of humanity, while teaching you, firsthand, the principles of economics. Sounds deadly, doesn't it?

It's Serious Fun

But deadly it is *not.* From the opening cartoon and the funky theme music, you know that *M.U.L.E.* is going to be fun. At the start of the game, you get to choose a creature that will be your player-figure. Your choice of creature can challenge advanced players and give a boost to beginners – and the descriptions and pictures of the creatures are fun.

Once play begins, each



In M.U.L.E., *from Electronic Arts, you try to get your plots to grow as much as possible.*

"month" you and the other players each select a plot of land to develop. Then you take a trip into town, buy a M.U.L.E., and outfit it for the type of production you're planning. Then you get it back to your property and install it, hoping the M.U.L.E. doesn't malfunction and run away during the trip.

When the month ends, you have produced a supply of food, energy, and Smithore. All the players go to the company store to buy and sell. There you bargain until you agree on a price for your commodities. If something is in short supply, the price will probably rise; if there's a lot of it, you can only sell it at minimum. If you mined Smithore and Smithore is selling low, and you need to buy food, which is in short supply, you lose money. The player with the food, however, does rather well. After the auction is over, the computer tells you your current net worth, and you go on and add a new plot of land to your holdings.

There are other elements to play. Wampus hunting and pub crawling can use up the idle moments after your M.U.L.E. has been installed; natural disasters like acid rain, pest attacks, planetquakes, and a fire in the company store can complicate things.

In all this, you never touch anything but the joystick. Going to town and getting your M.U.L.E. outfitted is all joystick-controlled animation; natural disasters happen on

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screen, with well-done graphics; and the auctions are choreographed like a Virginia reel, with buyers and sellers stepping forward and back, forward and back, raising and lowering their price until they finally come together and agree. Even your supplies and M.U.L.E. installations are graphically represented.

And your shambling, lazy, stubborn M.U.L.E. is a masterpiece of animation with style.

Fantasy Chess

Strategy and conflict games, in the days before computers, always had a problem: time and realism. The more realistic the game is, the more tedious it gets, moving little army pieces or keeping track of how many wounds your character has sustained. And the less realistic the game is, the more frustrating it is when your well-planned attack is wrecked by a streak of unbelievably bad rolls of the dice.

Some games, like chess, simply ignore realism: in each individual battle, the attacker always wins. Others, like *Diplomacy,* ignore tactics and move the game to the level of negotiations, where you quickly find out how untrustworthy your friends are.

With *Archon: The Light and the Dark,* by Anne Westfall, Jon Freeman, and Paul Reiche III, the computer lets the gamer have it all. The game is played on a chessboard – but *this* board isn't all light and dark squares. About half the squares cycle through various colors, from light to dark and back again. If you're the dark player, your icons (pieces) have much more power on dark squares, and are weaker on the light ones; this gives you a powerful advantage when the majority of the squares on the board are dark.

The icons each have different powers, and move in different ways. Your leading icon is either a wizard (light) or a sorceress (dark), which has a repertoire of powerful spells, each of which can be cast only once. Other icons can walk, fly, or teleport a certain number of squares in each turn.

When your icon moves onto an enemy square, you don't just take the square. You have to fight for it. The square immediately expands to fill the entire screen, and your two icons meet in mortal combat. Some are infighters, and must move in close; others fire missiles at various speeds; others have an aura which wards off enemy blows and damages the enemy when it gets too close. If the battle is fought on a dark square, the dark icon has much greater endurance; on a light square, the light icon has the advantage. The action in the battle is as exciting as any arcade game.

And when the battle is over, the victor has the square – unless evenly matched icons destroyed each other.

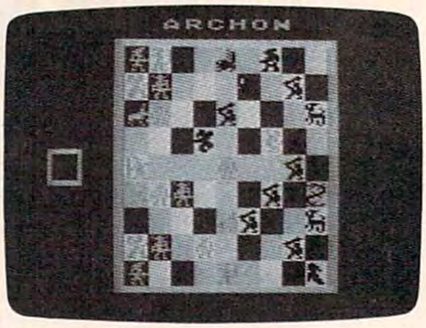
As with chess, it takes a while to learn all the icons and their various strengths, and it takes more than a little agility and practice to master the techniques of battle. But if it were too easy, it wouldn't be fun.

The computer player is very, very good. I suggest you learn this game with an evenly matched friend – it'll be a while before you can give the computer a run for its money. *Archon* is available for the Atari, Apple and Commodore 64.

Training Your Pieces

Worms, by David S. Maynard, is that rare thing: an entirely new game, which is not only fun to play, but fascinating, often beautiful to watch. The idea of winning is almost secondary to the sheer pleasure of watching the game play out on the screen. Versions are available for Atari and Commodore 64.

Four "worms" of different colors are at the center of a dot-filled screen. The worms are really lines, spanning the gap between two dots. Each dot can have up to six lines radiating from it. When all six possible positions are filled, that dot and all the lines radiating from it become the color of the worm that finished filling it. You only get points for the dots you fill. When your worm runs into a place from which there is no escape – no unfilled dot to move to – it dies. When all worms have died, the game is over, and the winner is the player whose worm has finished the most dots.



Archon, *from Electronic Arts, is a fantasy chess game with fast-action battles between pieces.*

The best feature of *Worms,* though, is that instead of controlling every choice your worm makes, you actually *train* your worm. There are dozens of possible configurations for each dot your worm might come to – different numbers of lines already drawn, in different places, combined with the six possible angles from which your worm might have approached the dot. When you are training a new worm, each time it reaches a configuration it hasn't seen before, the game stops for a moment while you decide what direction the worm should go. Once you've decided, from then on it will *always* make that choice whenever it sees that identical configuration.

After a very short time, your worm doesn't stop at all – it is fully trained, and continues to do everything you trained it to do. If your training was good, it will finish many dots; if your training wasn't so good, it will either tie itself in a knot and die,

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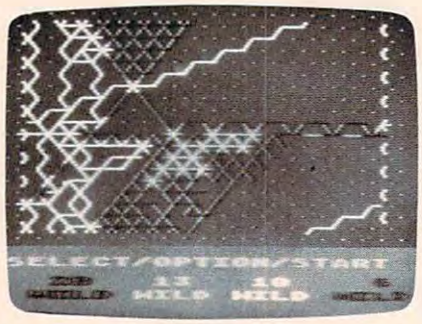

Train your worm and watch it compete for survival in Worms, *from Electronic Arts.*

or string itself out all over the screen, never finishing dots at all, just leaving long trails for better-trained worms to come in and finish.

In other words, you create a creature that seems to be alive. You can save worms, too, and use them again. The computer can also generate worms according to several possible parameters. And when the worms are fully trained, you can sit back and watch them make their patterns on the screen. At the fastest speed setting it's as exciting as a hotly contested race; at the slower speeds, it is fascinating to study the geometric patterns as the designs unfold.

Seeds and Spacewalking

Jaron Lanier's *Moondust* Creative Software cartridge for the Commodore 64, like *Worms*, is a highly original game concept that could not exist without the computer. With a single joystick, you control a spacewalker *and* several "moondrop ships" with the same motion. When you make them turn, they move in gradual curves rather than sudden angles, and since they leave a trail of gradually fading moondust behind them, the screen display is graceful and strange – a world you have never visited before. Add to this the haunting music, and *Moondust* is fascinating to play for the sheer beauty of it.

It's also fun. You must maneuver your spacewalker away from the center of the screen, where he leaves a single seed at the spot you choose. After that, you must maneuver the ships to pass over the seed. Each time they pass over the seed, they draw a trail of seed squares after them. You must try to draw the trail of seed squares until they reach the center of the screen; when they do, the energy field dances. However, the seed can only be drawn out into a limited number of squares, and if you haven't reached the center in time, the game ends. And each time the spacewalker collides with a ship, he gets bashed; too many collisions and he is knocked right out of the game.

Like the Electronic Arts games, this is a home computer game. It would never make it in the arcades. The very things that make it so good – the smooth and ballet-like movement, the gentle mood of the music, the original, challenging, thoughtful play system – would all be lost next to razzle-dazzle games. This game will make you glad you bought a home computer.

A Musical Toy

When children start playing around with music, the results can be awful. Endless scales and practice songs, sawing at a violin, pounding at a piano, blasting down walls with a trumpet – parents of children who are learning music deserve medals.

Wes Horlacher's *The Magic Melody Box*, available for Atari from APX, takes all the pain out of a child's first experiments with music, and helps children learn to visualize pitch and duration.

At the beginning of each new tune, you are asked to decide how *fast* and *slow* you want your tune to be. Those words are deceptive – you aren't choosing speed so much as you are choosing a rhythm, a pattern of note durations ranging from whole notes to eighth notes, with some more complex rhythms in between.

Once you have chosen, an orange box appears on the screen, with the rhythm graphically represented below it. You start at the left side of the box and, with the joystick, draw a line to the right. You can move the joystick up or down to raise or lower the pitch; the longer your line stays on one pitch, the longer your finished tune will play that note.

When you reach the right-hand edge of the screen, your tune is finished. While you listen, the program makes several quick, soft passes through your tune. The wait is worth it. When your tune plays again, the program has added harmonies that turn it into a full four-voice arrangement, four measures long. Your tune plays twice; then a computer-generated interlude varies your theme for four measures; then your tune plays again.

Musical purists will probably scream about "manufactured" harmonies. I can only answer that the results here are not tin-can standard progressions: the harmonies are fully responsive to the notes of your tune. The variation in the interlude is mathematically, and musically, derived from your melody. And the result is truly enjoyable music which is nevertheless under your control to a surprising degree. And the two-dimensional method of *drawing* a melody helps children visualize pitch much more effectively than does the confusing musical staff.

The Magic Melody Box isn't good just because it makes children's experiments endurable, though that is certainly a virtue. In fact, while I enjoyed my children's music and the hours of delight they got from it, I got even more pleasure from experimenting with it myself. I've composed music and played several instruments, and *The Magic Melody Box* certainly doesn't replace the orchestra, but it *does* use the computer to remove many layers of theory and many hours of practice which usually stand between the creative impulse and the aesthetically pleasing sound.

I wish other programmers would learn from Horlacher's deceptively simple virtuoso music program: the value of computer sound is not confined to sound synthesis. In fact, the computer can and should be used to remove barriers between the would-be musician and his music. This program reminds you why producing music is called "playing."

What do these games have in common that makes them excellent? They are original; they do what they set out to do very, very well; they allow the player to take part in the creativity; they do things that only computers can do.

Above all, though, is the fact that I didn't want to stop playing. And when I wasn't playing, I didn't want to stop watching other people play. That's as good a definition of *fun* as I can think of.

M.U.L.E.
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The Timex/Sinclair 2040 Printer

Seth McEvoy

When Clive and Ian Sinclair designed the $99 computer, the world was truly amazed. Sometimes lightning does strike twice, because they've done it again, with a $99 printer.

As you would expect from Timex, the company that markets Sinclair's computer in America, this printer is small, inexpensive, and works perfectly when you take it out of the box.

What will the Timex/Sinclair 2040 Printer do? First of all, you can make a printed copy of your own BASIC programs. This can save you hours of trying to read your program off the TV screen, no easy task since the screen can handle only 22 lines at a time. Second, if you have created a picture on your screen with Timex/Sinclair's graphics, you can make a copy of that picture on the printed page. Third, it will print individual characters on the page, for simple word processing programs.

The 2040 is a particular kind of *dot matrix* printer. Each letter is printed by little wires that move, creating the letters by electrical charges that "burn" holes in a special paper. Each letter is made from a grid of dots, eight dots high and eight dots wide. The line length of the printed page is 32 characters across.

Setting It Up

After unpacking the printer, all you have to do is plug the printer cable into the back of the computer. If you have a RAM pack, you can plug the cable in between the computer and the RAM pack. The printer comes with its own 24-volt power supply, which plugs into any 110-volt wall socket.

Be careful, however, when connecting the printer. If you plug in the printer *while the computer is on*, the sudden rush of electricity could overload one of the integrated circuits. Also, if you attempt to print anything before you load the paper, it could damage the printing mechanism.

The printer has simple controls – an ON key and an OFF key. You can also test the printer by pressing the OFF button while pressing the ON button. If the printer is working correctly, it will print rows of 1's and 8's until you stop it by pressing OFF again. Furthermore, you can advance the paper by pressing ON, if the printer is already ON.

Unfortunately, the printer does not have a light to warn you when the power switch is on. The motor heats up a great deal, and if the printer is left on a long time, it may wear out some of the components.

Timex supplies one 82-foot roll of paper, 4 inches wide. Further rolls of this special thermal paper should be available from Timex dealers at $2 a roll. Timex cautions you not to buy any other kind of paper, but the HP-85 computer from Hewlett-Packard uses the same kind of paper. Since the paper from Timex has a red strip to warn you when you are near the end of the roll, you're safest using Timex paper. (Perhaps you could ink the inner part of one end of a non-Timex roll with a red felt-tip pen.)

Making It Work

Using the printer is easy. You can use three special commands already built into Timex/Sinclair BASIC: COPY, LLIST, and LPRINT.

COPY is used to transfer whatever is on the computer screen to the printer. You may type it directly (by pressing the Z key) or it may be part of a program.

The figure shows what a digitized apple looks like on the printer. The picture was first "printed" on the screen (using the PRINT command) and then copied to the printer using the COPY command.

That apple was printed by using inverse spaces (Graphics key and Space) and shaded squares (Graphics key and Shift H).

If you look closely, you will notice that the tiny squares that make up the picture, such as the top of the apple stem, are not exactly square. You can also see the individual wire tracks across the picture. However, for $99, this is quite acceptable. The person who buys a Timex/Sinclair computer is not likely to want to spend $1000 for a high-resolution dot matrix printer.

Here is the program that was used to print the apple picture to the TV screen. We can make a copy of the program (listing) by typing LIST (Shift G).

Apple Picture by Laurie Smith

LLIST will print out whatever BASIC program is currently in memory. If you have a long program, it will print out the whole thing in one long roll.

Suppose you have a different application, say a simple word processor. You can use the LPRINT command to print individual letters on the printer. The computer waits until the entire line is ready, and then it prints your line.

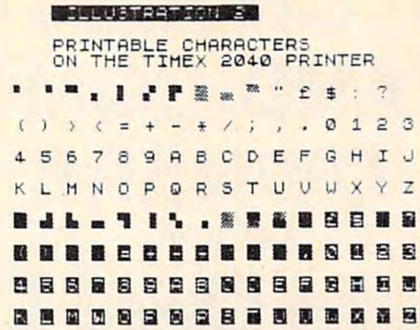
The following program

prints all the letters, numbers, punctuation, and graphics characters that the Timex/Sinclair computer has available:

```
   4 REM
   5 LPRINT "
.."
   6 LPRINT
   7 LPRINT "    PRINTABLE CHARAC
TERS"
   8 LPRINT "    ON THE TIMEX 204
0 PRINTER"
   9 LPRINT
  10 LET A=1
1000 LPRINT CHR$ A;" ";
1010 LET A=A+1
1020 IF A>63 AND A<128 THEN GOTO
 1010
1030 IF A/16=INT (A/16) THEN GOT
O 1100
1040 IF A>191 THEN GOTO 1090
1050 GOTO 1000
1090 STOP
1100 LPRINT
1110 LPRINT
1120 GOTO 1040
1130 STOP
```

This program is fairly simple. The only odd part is in lines 1020 and 1040. Since the Timex/Sinclair stores all its BASIC commands as single numbers, we want to make sure that those commands (RUN, GOTO, etc.) are not printed. We already know what their letters look like.

When you run the program, this is what it should print out:



Other Features

The Timex/Sinclair printer is relatively fast, printing at a rate of 50 to 80 characters per second. It will COPY a full 24-line screen to the printer in less than 11 seconds. It is much quieter than most dot matrix printers, making a whirring noise not much louder than a tape recorder rewinding.

This printer will be greeted with enthusiasm by serious Timex/Sinclair computer users. Writing programs without being able to print out listings has been a problem, since you could only view 22 lines of your program at a time. In a very long program, it seemed to take hours to find a particular line. Also, being able to print out the unique graphics of the Timex/Sinclair is a plus.

An earlier version has been available in England for quite some time, but the new 2040 has been changed to work with American voltages and it uses a better grade of thermal paper.

Once again, Sinclair is to be congratulated for inventing something smaller and less expensive than anyone else. Timex is to be congratulated for bringing it to America, and for energetically supporting their products. This printer fits in well with the Timex/Sinclair philosophy – it does the job without frills and without great expense to the consumer.

Timex/Sinclair 2040 Printer
Timex Computer Corporation
Waterbury, CT 06725
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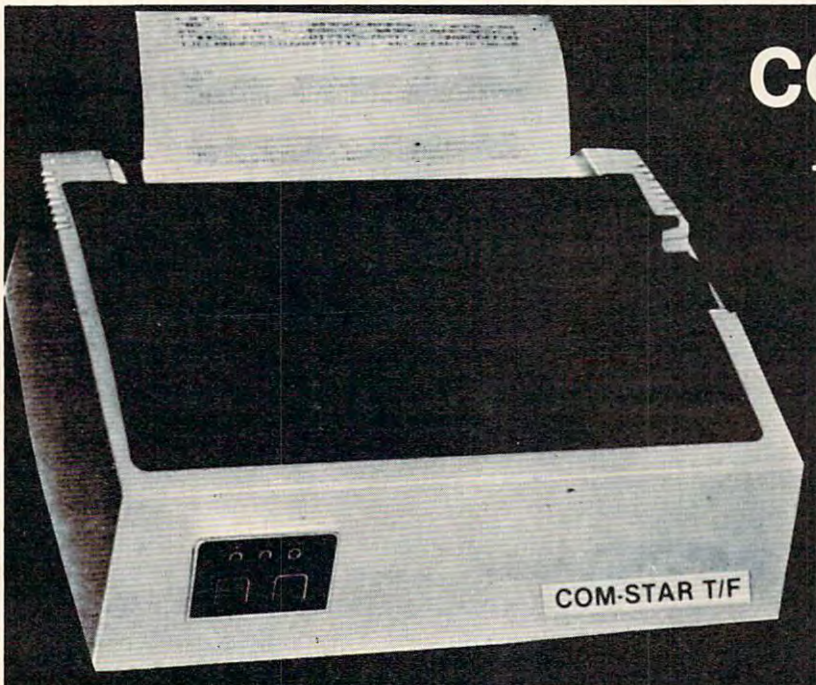

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Commodore Files For Beginners
Part 1

Jim Butterfield, Associate Editor

In Part 1 of this article, Jim Butterfield explains what files are and how to create them on either disk- or tape-based systems.

A computer can maintain files. They are something like the files we can keep in a filing cabinet. We may add information, remove items, change data, or just look at what's in the file.

Let's take a look at how we can create and recall information within files. Our examples will be Commodore-oriented (PET, CBM, VIC, and 64), although the principles generally apply to all computers.

The examples here involve tape or disk files. However, we won't use a special type of disk file called a *relative* file. Instead, we'll stay with *sequential* files, which are simpler, often more useful, albeit less powerful.

Ground Rules

A file is stored on disk or tape as a series of magnetic impulses. Once we have stored information in a file, it will stay there until we remove (or "scratch") it.

If you want to change a sequential file through additions, deletions, or changed data, you must create a new copy of the file containing these changes. You can't change the old file as it stands. This apparent limitation can often prove to be an advantage, however: it encourages users to keep old files as historical data or as a backup resource.

Files are similar to programs in many ways. We save both programs and files on disk or tape. Both contain data. Apart from the obvious distinction, there's a difference in usage between programs and files: files often change, programs seldom do so. As an example, a program to record student marks shouldn't need changing once it is checked out unless the school changes its procedures significantly. But the file changes from class to class, from test to test.

Programs read and write files. But files don't belong to a single program. A file of student marks might be used by several programs such as an updating program, a report printer program, and a statistical analysis program. Similarly, programs often are not locked in to a fixed set of files: a program which updates student marks might be used for several different subjects, classes, and grades, each of which would have a distinct set of files.

File Components

The elements of a file aren't hard to recognize. A *file* is a whole collection of information on some subject; it's like a file folder in your desk. A *record* is information on a single person, place, or thing. We use these words in English conversation: "This is a file of all my books; I have a record of every book I own." Within each record, a *field* is an item of information – for example, title, author, publisher, date published, price, etc.

When you're planning to set up a computer file, it's very important to work out, in detail, what fields each record will have. If you forget one, it will be a tough job to add the information later. Also, planning your fields will give you an idea of how many characters will be in each record. Multiply this by the number of records you expect to have, and you'll be able to estimate the amount of disk space or length of tape that the computer will need.

First File Mechanics

In order to read or write a file, your program must go through three distinct phases:

1. The file must be OPENed. We must give information on such things as: what physical device (disk or tape); what the filename must

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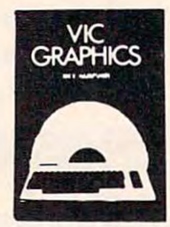

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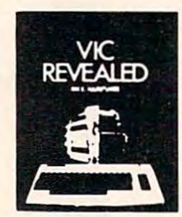

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be; and whether the file is to be an input or output type. This is the only time we give any of this information. In addition, we give this file a reference number, called a "logical file number"; this is the only number that we will use in the following commands.

2. We may write to the file (using PRINT#) or read from the file (using INPUT# or GET#) as much as we like. We identify the file only by its logical file number.

3. Finally, the file must be CLOSEd. This winds up activity on this file, unless we OPEN it again later. Once again, we identify the file only by its logical file number.

Note that the first step (OPEN) is the only time we deal with the details of what kind of a file is involved. Once the file is open, we never again mention whether it is disk or tape, or some other device for that matter. If we were reading a program and saw the statement:

```
PRINT#5,"HELLO"
```

we would not know whether the output was going to tape, disk, printer, modem, or other device until we backtracked and saw what the OPEN 5 statement said.

This turns out to be a good thing. With minor changes to a program – just in the OPEN statements – I could redirect output to any device I chose. This makes programs flexible and can help in the debugging process when you are writing the program.

Now that we've seen some of the rules, we're ready to go ahead and write a data file.

First Planning

Let's plan a simple file for students.

Our fields will be: surname, student number, and mark. That's not much, but it will show the principles involved.

We estimate sizes with:

Surname:	15 characters maximum	
	8 characters typical	
Student number:	4 characters	
Mark:	3 characters maximum	
	2 characters typical	

Average record size will be 8+4+2, plus 3 (one RETURN character for each field). Total record size is then 17; we think we may have 200 students maximum, so we estimate the file size at 3400 characters (3.4K memory; about 14 disk sectors at 254 bytes per sector; about 18 tape blocks at 191 bytes per block which will take about a three-minute length of tape). We will not be writing 200 student records for our example, of course.

A First Run

To create the file, we would normally write a program. We'll do that later as part of a review; but let's write this file using direct BASIC statements. This way, you can watch as the file comes into being. Do be careful – an error message during the creation process could wreck our file.

Our first step is to open the file. If you have disk, type:

```
OPEN 1,8,2,"0:STUDENTS,S,W"
```

If you have tape, type:

```
OPEN 1,1,2,"STUDENTS"
```

The disk will whirr, or the computer will display PRESS RECORD AND PLAY. Obey the instructions, and let's talk for a moment about what we have typed.

In either case, we have opened a file using a working number (logical file number) of 1. That's the only information we'll use for the remainder of this exercise. The second number is the device: 8 for disk, 1 for tape. The third number has a different meaning for disk versus tape. On the disk, this is called a "secondary address"; we pick an unused number from 2 to 14 and "give" it to the disk for its internal use. On tape, this is called a "command"; a value of 2 instructs the computer that this is a write file, and will be the last file on this tape (an "end of file" block will be written behind the file).

The name of the file is STUDENTS; this information will be written into the disk directory or the tape header block. For disk, we must give extra information: a prefix of "0:" to indicate if necessary that this file should be written on drive 0; and a suffix of ",S,W" to signal that this is to be a sequential type file, and it will be written, not read.

We've opened the file, but we have written no data. Let's do that.

Writing The Data

Type (carefully) the following commands:

```
PRINT#1,"SMITH";CHR$(13);
PRINT#1,"3487";CHR$(13);
PRINT#1,78;CHR$(13);
```

These are the three fields of a student record. *Important:* Do not put a space after PRINT since PRINT# must be typed as one block; and don't forget to use a semicolon at the end of each line.

The CHR$(13) character is a RETURN character; we use it to signal the end of each field. We are better off not typing just PRINT#1,"SMITH" since an extra character called a *linefeed* might sneak its way in there and cause trouble later.

The name SMITH is a string, of course. So is the student number – even though it's numeric, we will never want to do arithmetic on it. The student mark is a genuine number, however, since we may want to compute high scores or

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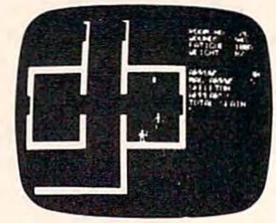

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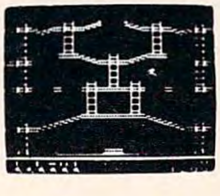

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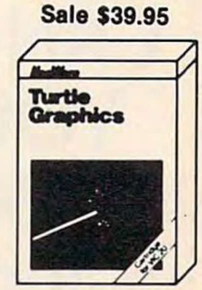

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averages. So it's not written or read as a string (no quote marks).

I prefer printing three fields with three lines. It seems to me that they stand out better. But you can print everything in one line. For variety, let's write our second student record that way:

```
PRINT#1,"WONG";CHR$(13);"3921";"CHR$(13);72;
  CHR$(13);
```

The information is harder to read, but it's all there. Remember the semicolon at the end.

One more student, and we'll wrap up our file. Again, let's use a slightly different method to show variety:

```
X$=CHR$(13):PRINT#1,"BLOGGS"+X$+"3985"+
  X$;77;X$;
```

We've done two things here: by setting X$ equal to our RETURN character we've saved a little typing in the PRINT# statement; and instead of using semicolon punctuation, we've used the + sign for concatenation where we can. No real difference either way. But don't forget the semicolon at the end.

Wrapping Up

You may have noticed something odd: when you typed in each student record, there was no activity. The disk did not spin; the tape did not move. Why? Because the characters are stored in a buffer (an area of the computer's memory) until there are enough of them to make it worthwhile writing to tape or disk.

We must close the file, or the data won't be written. So let's type:

```
CLOSE 1
```

and our file is complete. Next month, we'll see how to read it. ©

Atari Disk Detective

D. G. Denby

A helpful disk utility for Atari owners, this program searches your disk and locates any user-specified string (hex or ASCII). It's especially useful for file recovery.

"Disk Detective" is a utility program that will appeal most to the advanced programmer, but will also prove useful to the novice. The program is designed to search through a disk, sector by sector, and find occurrences of a user-specified string of either hexadecimal or ASCII characters.

Practical Applications

Suppose you want to recover a disk file that has gone awry, but can't find all of its bytes. We know that the last byte of each sector is a pointer that tells DOS the number of sectors to jump to find the next sector of the file. Also, we know that the VTOC (Volume Table Of Contents) contains information showing DOS the way to the first sector of a file and that the VTOC is located beginning at sector 361 through sector ___. Who likes to search through an unknown number of sectors with a sector dump utility to find out where the information for "MYPROG" is given?

This program will let you specify the range of sectors to be searched and the string to be found in your choice of hex or ASCII. As an example, let's select ASCII and enter the characters for our filename, and presto – we have the sector and byte to get the information for our file. A word of caution here: DOS apparently leaves the directory entries intact after a file has been deleted. It just revises the VTOC listing to indicate that the file has been deleted (see *Inside Atari DOS* for more information). This will allow you to recover deleted files by changing the VTOC record if DOS has not written any subsequent information over the required sectors.

You can have more than one listing in the VTOC for a filename if you have made revisions and then reused the filename. Also, because DOS fills any unused characters in the first field of a filename with blanks, it is necessary to include an appropriate number of blanks when searching for a filename that uses an extender (for example, MYPROG BAS doesn't use the "dots" found in: MYPROG.BAS). This becomes a small problem once you understand how DOS saves filenames.

Machine language programmers will probably find Disk Detective useful for finding hex strings on boot disks where they might like to make minor modifications for their own use or to look for a particular operating system call in order to see how the designers used these routines in their programs. (*Note:* Disk Detective allows a maximum of 20 characters in its search string.)

Suppose you want to find all calls to the resident disk handler in sectors 1-20. You would first specify this sector range in answer to the prompts, select hex, enter 20-53-E4, then hit RETURN. (For the benefit of those who aren't machine language programmers, the resident disk handler is located at ($ = hex) $E453, and it is called by a JSR command ($20); the 53 comes before the E4 because the CPU expects to read the low byte and then the high byte when reading or executing an object code program from disk or memory.)

Program Explanation

Lines 170-260 are concerned with translating the internal characters returned by the keyboard into their true hexadecimal values and then POKEing them into their respective locations in B$. Variables LN and HN are the low nybble and the high nybble of each byte that is to be POKEd. A is a counter for the low-high nybble; B is a counter for the length of the search string.

Lines 300 through 340 serve the same function

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only for ASCII characters and therefore need no translation.

Lines 400 through 810 set up the call for the machine language portion of the program and examine the results before writing to the screen.

Lines 1000 through 1050 reserve an area in memory for the machine language program and then POKE it into memory.

Lines 2000 through 2140 are the data for the machine language program. This, by the way, uses the resident disk handler to retrieve data from the disk sectors and put the results into A$. It then proceeds to search through A$ to find all occurrences of the search string and then returns to BASIC.

As you can see, this program is useful only after some experience with the machine, and it also assumes that you already have some kind of sector dump/modify utility. You will certainly find many more uses for this program than those discussed here.

Disk Detective

```
10 ? "{CLEAR}":GRAPHICS 2+16:POSITIO
   N 5,3:? #6;"PRESENTING":POSITION
   3,6:? #6;"disk detective"
20 ? #6
30 FOR I=1 TO 2000:NEXT I
40 GRAPHICS 0
90 ? "{BELL}":POKE 752,1:? "{CLEAR}"
   :POSITION 8,8:? "Loading Machine 
   Language":POSITION 16,11:? "Routi
   ne"
100 CLR :DIM A$(128),B$(20),CH$(1):G
    OSUB 1000:REM **LOAD ML**
105 GRAPHICS 0:POKE 752,0:? "Be sure
     to load your search disk":? "
    {BELL}":FOR I=1 TO 2000:NEXT I
110 RPAGE=ADR(B$):? "{CLEAR}":? "BEG
    INNING SECTOR FOR SEARCH";:INPUT
     X:IF X<1 OR X>720 THEN 110
115 B$="{19 ,}"
120 POSITION 2,2:? "ENDING SECTOR FO
    R SEARCH";:INPUT Y:IF Y<X OR Y>7
    20 THEN 120
130 POSITION 2,4:? "INPUT STRING IN
    HEX OR ASCII?":OPEN #1,4,0,"K:"
135 REM ** IS IT ASCII **
140 GET #1,KB:IF KB=65 THEN 300
145 REM ** OR HEX **
150 IF KB=72 THEN 170
160 ? "{BELL}":CLOSE #1:GOTO 130
170 POSITION 2,4:? "ENTER HEX STRING
    :{19 SPACES}":A=0:B=0
180 GET #1,KB:IF KB=155 THEN 400
190 A=A+1:CH$=CHR$(KB):? CH$;:IF A=2
     THEN ? "-";:LN=KB:GOTO 210
200 HN=KB:GOTO 180
210 HN=HN-48:LN=LN-48:IF HN>9 THEN H
    N=HN-7
220 IF LN>9 THEN LN=LN-7
230 HN=HN*16:BYTE=HN+LN:IF BYTE>255
    THEN ? "{BELL}":? "{BELL}":? "ER
    ROR":FOR I=1 TO 600:NEXT I:GOTO
    100
240 POKE RPAGE,BYTE:RPAGE=RPAGE+1:A=
    0:B=B+1
250 IF B=21 THEN 400
260 GOTO 180
300 POSITION 2,4:? "ENTER ASCII STRI
    NG:{17 SPACES}":B=0
310 GET #1,KB:IF KB=155 THEN 400
320 B=B+1:CH$=CHR$(KB):? CH$;",";:PO
    KE RPAGE,KB:RPAGE=RPAGE+1
330 IF B=20 THEN 400
340 GOTO 310
400 CLOSE #1:C=128-B:POKE 207,B-1
410 BYTE=1776:IF X>Y THEN 600
420 ML=USR(ASSEM,X,ADR(A$),ADR(B$),C
    )
430 IF PEEK(771)=144 THEN 700
440 IF PEEK(771)<>1 THEN 800
450 IF PEEK(BYTE)<>0 THEN 500
495 X=X+1:GOTO 410
500 IF BYTE=1781 THEN 495
503 ? :? "=>SECTOR: ";X;"  BYTE: ";P
    EEK(BYTE)-1
505 IF PEEK(BYTE+1)<>0 THEN BYTE=BYT
    E+1:GOTO 500
510 GOTO 495
600 ? "{BELL}":? :? "{10 SPACES}FINIS
    HED!":? "DO YOU WANT TO INSPECT
    OTHER SECTORS? (Y OR N)"
610 OPEN #1,4,0,"K:":GET #1,KB:CLOSE
     #1:CH$=CHR$(KB)
620 IF CH$="Y" THEN 110
630 END
700 ? :? "BAD SECTOR AT ";X
710 GOTO 495
800 ? :? "ERROR ";PEEK(771);" AT SEC
    TOR ";X
810 GOTO 495
1000 RESTORE 2000
1010 RAMTOP=106:MYPG=PEEK(RAMTOP)-10
1020 ASSEM=MYPG*256:ADDR=ASSEM
1030 READ B:IF B=-1 THEN RETURN
1040 POKE ADDR,B
1050 ADDR=ADDR+1:GOTO 1030
2000 DATA 104,104,141,11,3,104,141,1
     0,3,104
2010 DATA 133,204,141,5,3,104,133,20
     3,141
2020 DATA 4,3,104,133,206,104,133,20
     5,169
2030 DATA 1,141,1,3,169,82,141,2,3,1
     04,104
2040 DATA 133,224,32,83,228,173,3,3,
     201,1
2050 DATA 240,1,96,141,240,6,141,254
     ,6,162,0
2060 DATA 142,241,6,142,242,6,142,24
     3,6,142
2070 DATA 244,6,160,255,200,177,203,
     209,205,240
2080 DATA 25,24,165,203,105,1,133,20
     3,24,173
2090 DATA 254,6,105,1,157,240,6,141,
     254,6,197
2100 DATA 224,208,224,240,38,152,197
     ,207,208,219
2110 DATA 224,5,240,29,232,24,165,20
     3,105,1,133
2120 DATA 203,24,173,254,6,105,1,141
     ,254,6,24
2130 DATA 173,240,6,234,234,141,240,
     6,24,144,184
2140 DATA 169,0,157,240,6,96,-1
```

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64 SOUND TESTER

Ronald V. Picard

The Commodore 64's sound system surpasses the capabilities of all previous microcomputers. Before the 64, a variety of waveforms, attack/decay and sustain/release features were available only on sound synthesizers. Understanding and adjusting to the many different sounds and settings can be perplexing to both beginning and advanced programmers.

"Sound Test" allows you to experiment with these features, then listen to the results and modify the settings. You can explore up to eight octaves as well as the noise generator. At any time the data used may be displayed before exploring other settings.

When you're running the program, a listing of the current values will appear, with a cursor next to the top one. If you want to change the value on that line, you should enter the new value and then press RETURN. If you don't wish to change the value, just press RETURN.

T,S, and P refer to triangle, sawtooth, and pulse waveforms. N stands for the noise generator and Q for quit the program. Anytime you would like to see the data, enter D.

After the last value is entered, a tune will be played with the current ADSR values, after which the program will loop and repeat.

Anyone wishing a cassette copy of the program, send $3, a cassette, and a stamped, self-addressed mailer, to:

Ronald V. Picard
T52 E. Shaw
M.S.U.
E. Lansing, MI 48825

Sound Test

```
5 DIM SO(16,8)
10 HF=54273:LF=54272:AD=54277:SR=54278:W=
   54276:V=54296:HP=54275:LP=54274
15 FORI=1TO8:A(I)=0:NEXT:W$="S"
20 FOR O=1TO8:FOR N=1TO16:READ SO(N,O):NE
   XT:NEXT
25 FOR N=1TO8:READ D(N):NEXT
100 PRINT"{CLEAR}";CHR$(18);"PULSE SETTING
     USED ONLY WITH PULSE WAVE ";CHR$
    (146)
102 PRINT
110 PRINT"WAVEFORM (T,S,P,N) =";W$
112 PRINT"VOLUME (1-15) =";A(1)
114 PRINT"OCTAVE (1-8) =";A(2)
116 PRINT"ATTACK SETTING (0-15) =";A(3)
118 PRINT"DECAY SETTING (0-15) =";A(4)
120 PRINT"SUSTAIN SETTING (0-15) =";A(5)
122 PRINT"RELEASE SETTING (0-15) =";A(6)
124 PRINT"HIGH PULSE SETTING (0-15) =";A(7
    )
126 PRINT"LOW PULSE SETTING (0-255) =";A(8
    )
130 PRINT"{HOME}";"{03 DOWN}";
140 PRINTTAB(33);"?";:GOSUB500:IF Z$="D"TH
    EN 600
150 IF Z$="Q" THEN PRINT"{CLEAR}":END
155 IF Z$<>CHR$(13)THEN W$=Z$
160 FORO=1TO6
170 PRINTTAB(33);"?";:GOSUB500:IF Z$<>CHR$
    (13) THEN A(O)=VAL(Z$)
180 NEXT
190 IF W$<>"P" THEN 230
200 FORO=7TO8
210 PRINTTAB(33);"?";:GOSUB500:IF Z$<>CHR$
    (13) THEN A(O)=VAL(Z$)
220 NEXT
230 POKEV,A(1)
240 POKEAD,16*A(3)+A(4):POKESR,16*A(5)+A(6
    )
250 IF W$="T" THEN POKE W,17
260 IF W$="S" THEN POKE W,33
270 IF W$="P" THEN POKE W,65:POKEHP,A(7):P
    OKELP,A(8)
280 IF W$="N" THEN POKE W,129
300 O=0
310 FOR I=1TO15STEP2:POKEHF,SO(I,A(2)):POK
    ELF,SO(I+1,A(2)):O=O+1:FORN=1TOD(
    O)
311 NEXT
315 POKEHF,0:POKELF,0:NEXT:POKEW,0:POKEAD,
    0:POKESR,0:POKEHP,0:POKELP,0
320 GOTO100
500 Z$=""
510 GETY$:PRINTCHR$(18);" ";CHR$(146);:FOR
    I=1TO25:NEXT:PRINTCHR$(157);" ";
515 PRINTCHR$(157);:FORI=1TO25:NEXT:IFY$="
    "THEN510
520 PRINTY$;
530 IF Y$=CHR$(13) THENIF LEN(Z$)=0 THENZ$
    =CHR$(13)
540 IF Y$=CHR$(13) THEN RETURN
550 Z$=Z$+Y$:GOTO510
600 PRINT"{CLEAR}"
610 PRINT:PRINT"ATTACK/DECAY   = ";16*A(3)
    +A(4)
620 PRINT"SUSTAIN/RELEASE= ";16*A(5)+A(6)
630 PRINT:PRINT:PRINT"HIT ANY KEY TO CONTI
    NUE";
640 GETY$:IFY$=""THEN640
650 GOTO100
1000 DATA 1,155,1,90,1,110,1,155,1,90,1,110
     ,1,155,1,205
1010 DATA 3,54,2,179,2,220,3,54,2,179,2,220
     ,3,54,3,155
1020 DATA 6,108,5,103,5,185,6,108,5,103,5,1
     85,6,108,7,53
1030 DATA 12,216,10,205,11,114,12,216,10,20
     5,11,114,12,216,14,107
1040 DATA 25,177,21,154,22,227,25,177,21,15
     4,22,227,25,177,28,214
1050 DATA 51,97,43,52,45,198,51,97,43,52,45
     ,198,51,97,57,172
1060 DATA 102,194,86,105,91,140,102,194,86,
     105,91,140,102,194,115,88
1070 DATA 205,133,172,210,183,25,205,133,17
     2,210,183,25,205,133,230,176
1080 DATA 500,250,250,250,250,250,250,1000
```
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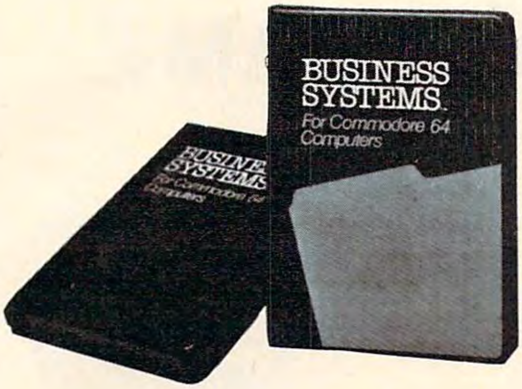

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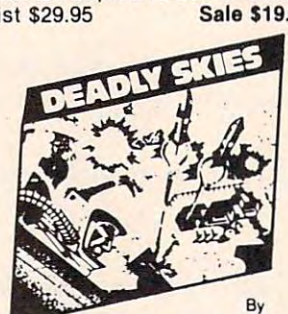

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How To Improve The TV Quality Of The Commodore 64

Jim Butterfield, Associate Editor

If you own a 1701 Video Monitor, you may not be getting maximum video quality. Here's an alternative hookup that produces a remarkable picture. Even if you don't use a 1701, you can still use some of these ideas to improve your computer's picture quality on a TV or monitor.

The Commodore 1701 Video Monitor is an attractive 13-inch color monitor with good color definition and good sound. But most Commodore 64 users miss a bet: they hook it up via the front connections.

There seems to be a rumor that you can't use the connections at the back unless you have an 8-pin video connector. Not true – you can get a magnificent picture from the traditional 5-pin interface.

Inside A Monitor

There are two parts to a video signal: the brightness and the color. Most monitors mix them together to produce a "composite" video signal. Inside a monitor – or television set – the two signals must be split apart once again before they can be used.

The color (or *chrominance*) signal is carefully designed so that it can be mixed in with the brightness (or *luminance*) and later separated. The system isn't perfect, however, and there's always a trace of the color signal left in the screen brightness.

Traces of the chrominance signal left in the brightness can cause viewing trouble. Depending on the foreground and background colors, a finely checkered pattern can appear on the screen. To make matters worse, this pattern interferes with the normal pixel resolution of the screen, and every second character on the screen will look smeared.

For some colors, this isn't a problem. Other color combinations look bad. But the whole problem can be solved by not mixing chrominance and luminance; instead, deliver them on separate wires to the monitor.

By the way, there's another method used to deliver signals to video monitors. It's called RGB, for Red/Green/Blue; it uses three signal wires, one for each color. However, this method is not available for use with the Commodore 64.

Hooking It Up

There are two different video signals available on the 5-pin DIN connector on the 64. The signal on pin 4 is called *Video Out*: it's a composite video signal containing both luminance and chrominance. On pin 1, we'll find the luminance signal: a sharp, black-and-white signal with no color component. If you connect pin 1 to the 1701's luminance connection, and pin 4 to the nearby chrominance connection (they are both on the back of the monitor), you'll get a picture of marvelous quality.

I'm amazed to find that the necessary cable doesn't come in the box with the monitor. The

connector that comes with the monitor is wired for the front connection. This is fine for both the VIC and the 64, but the 64 can do far better on the rear connection. At the present time, the cable isn't provided; you'll have to wire one up or buy one.

If you'd rather not wire your own cables, you can buy a general-purpose "octopus" connector that brings out all five pins to differently colored plugs. The color codes don't seem to be universally consistent, but on the ones I tried, the most common arrangement seemed to be: red for luminance, white for chrominance (video out), and black for audio. Remember – throw the little switch at the back of the monitor to energize the back connections.

How is it that we can use a composite video signal as chrominance? Because the chrominance connection throws out any luminance that may be mixed into the signal.

Sharpness

Let's talk for a moment about why the picture is so sharp on a properly hooked-up monitor. It has to do with two aspects of television standards.

First, the color signal is "modulated," or coded, using a high frequency signal at slightly over 3.58 megacycles per second. That's a TV standard: it was designed long ago so that we could decode the color signal and separate it from the brightness. If we didn't take out the color signal (and we can never remove it completely), we would get a pattern of fine dots on the screen. These dots would not be too noticeable on a conventional television picture, but would interfere with our perception of computer characters.

Second, television color has been carefully designed to be less sharp than the black-and-white part of the picture. It turns out we can't detect color sharpness as accurately as black-and-white; so the television engineers deliberately take out the sharp color edges to allow them to design the television signal more efficiently. The technical term for this, by the way, is *lower bandwidth.*

So the sharpness is always in the black-and-white, or luminance, part of the signal. And the chrominance signal is not only less sharp, but also contains an extra frequency that will degrade the picture. No wonder we would prefer not to mix them.

The strange interrelationship of sharpness and color leads to another odd thing. If you ever draw high-resolution pictures on the 64, you are advised to make lines at least two pixels wide. Why? Because extremely thin, sharp lines get partly mixed into the color signal, and you'll get a slight but annoying "color smear" on these lines. But it won't happen on a rear-connected 1701 monitor.

If You Don't Have A 1701...

Even if you don't have the 1701 monitor, you can make use of the information on how the video signal works.

If you have a conventional color monitor, or just a color TV set, you can try for a sharper picture. The objective here is to put more luminance into the video signal. We do this by making a connection between pin 1 and pin 4 on the video connector of the 64. If you have a monitor, you can connect the two pins within the cable. If you have a TV set, you must make up a video plug with the two pins strapped together; even though the signal doesn't go out through this connector, the balance between luminance and chrominance will change. In either case, you'll need to readjust the color controls to get a satisfactory picture; and you might not even like the results. If you'd rather not do your own cabling or soldering, have your local computer or TV service store do the job for you.

You can also make a significant improvement on a black-and-white monitor, which you might use for such things as word processing or financial calculations where color doesn't matter. Now that you know about pin 1, which contains the luminance signal only, you can use it for a crisp black-and-white picture. ©