NO. 35
OCTOBER 1985

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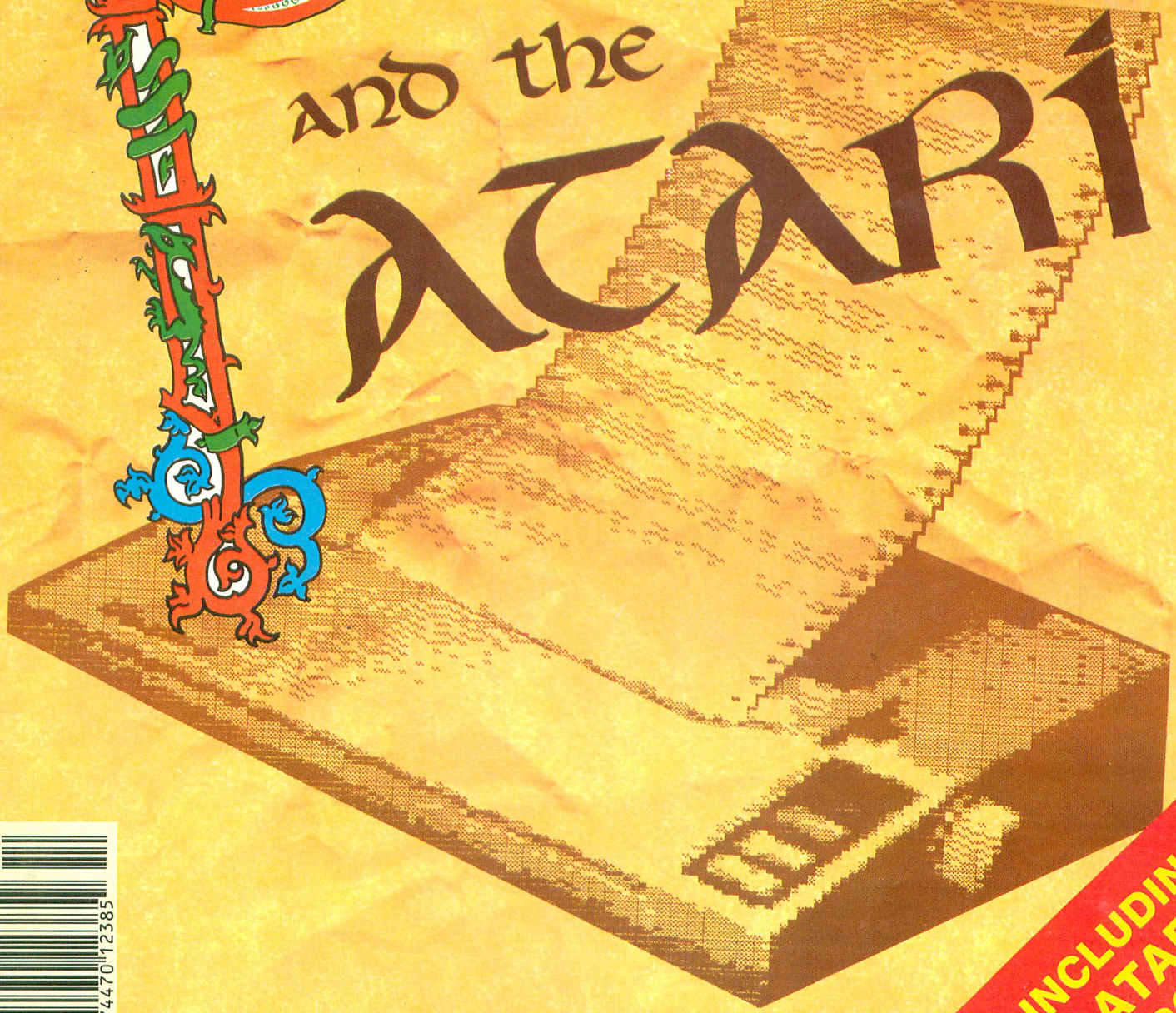

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## REVIEWS



## REVIEWS *continued*



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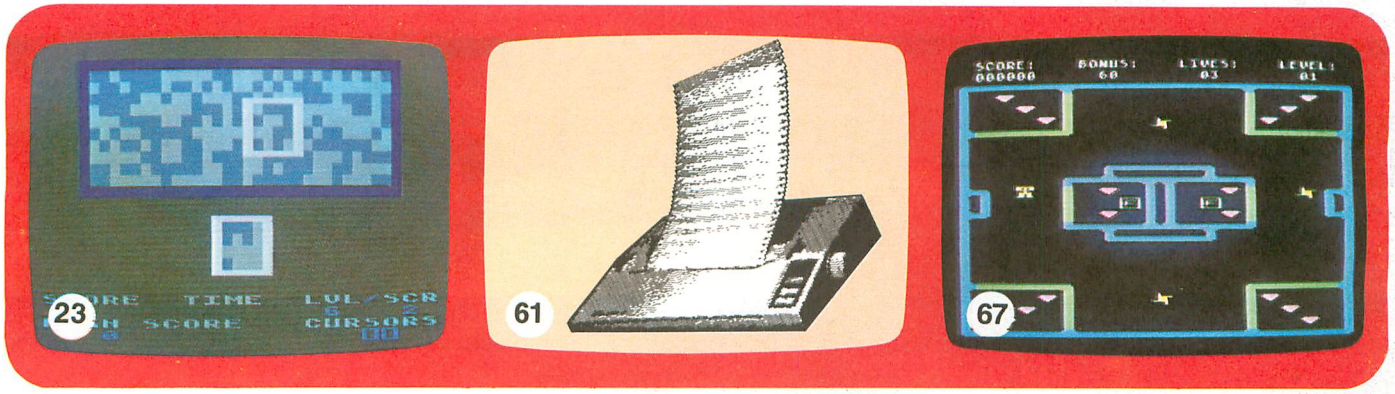


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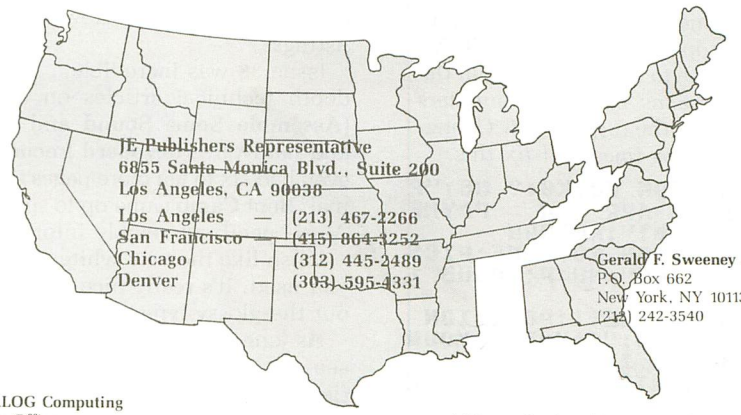

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# READER COMMENT

### Loan Shark update.

*The program* ***Loan Shark*** *which appeared in issue 30 of* ***ANALOG Computing*** *did not operate properly on XL/XE computers, due to an obscure bug in the operating systems of these computers which affected the display list. Changing the following lines will fix this.*

```
600 POSITION K0,K0:? #6;"P
RINCIPAL    APR    #    PAYME
NT TOTAL INT":RETURN
2005 POSITION K0,LINE:PIC$
="        .00":NU=P:GOSUB 1
00
3020 LINE=LINE+1:POSITION
K0,LINE:? #6;"PAYOFF AMOUN
T FOR ABOVE IS  ";FRM$
5035 IF TEXT$(8,8)=" " THE
N 5100
```

—*Ed.*

### Mystery boxes.

When I bought my 800XL, I noticed two little plastic boxes connected to the power and video cables. I ignored them, but recently I've gotten a hankering to know what they are. So, what are they?

Adam E. Wade
Takoma Park, MD

*The heavy box connected to the power cord contains a step-down transformer used to supply 5 volts of alternating current, a bridge rectifier to convert the alternating current (AC) to direct current (DC), a filter capacitor to smooth out any bumps in the voltage, and a voltage regulator to make sure it stays at 5 volts.*

*The smaller box on the RF cable contains a torroid coil which is made of a ferrite ring with the cable looped several times through it. It's used to reduce both radio and TV interference.*

—*Ed.*

### Comprehensive comment.

I just had to comment on issue 33. Up to now, my main reason for buying **ANALOG Computing** was for the assembly language listings. Ninety percent of my assembly knowledge grew from those listings.

Issue 33 was incredible. . .It had in-depth technical articles on assembly (**Assemble Some Sound** and **C.COM**) and hardware (**Keyboard Encoding**). It even had six to ten more pages than normal. **Boot Camp** came up to speed with Atari-specific assembly information.

I also like the new white paper stock you used. It's really nice to read without the glossy-type paper.

As long as I'm here, things I'd like to see are: (1) more reviews on hardware (leave the game reviews to others); (2) an in-depth article on vertical blanking interrupts; (3) an article on different types of sorting algorithms; (4) more technical explanations on the techniques used in your programs (**R.O.T.O.** or **Fire Bug** would be good ones to go through —I like to find out how to do things, and it's tough to figure out from minimally commented code); and (5) a good look at the 520ST hardware, especially input/output (I'm sure I'll see plenty on GEM-DOS from everybody else).

I think issue 33 was great, and, if this is a sign of things to come, count me in.

Mike Evans
Albuquerque, NM

*Thanks. . .That list should keep us busy for a minute or two.* —*Ed.*

### More on Z-Plotter.

Once again, thanks for accepting my program, **Z-Plotter**, for publication in your issue 30.

The following program will, one minute after it's run, transform all capital letters into one color and all the lower case into capitals of another color. This allows three colors in graphics 0.

```
0 DIM A$(20):A=PEEK(106)-8
:POKE 204,A:POKE 206,224:A
A=A*256:FOR T=1 TO 20:READ
 S:A$(T)=CHR$(S):NEXT T
1 T=USR(ADR(A$)):FOR T=776
+AA TO 984+AA:S=PEEK(T-512
):P=0:GOSUB 4:POKE T,S+P:N
EXT T
2 FOR T=264+AA TO 472+AA:S
=PEEK(T):R=0:GOSUB 4:POKE
T,S+R:NEXT T
3 POKE 710,14:POKE 709,0:P
OKE 712,14:POKE 756,A:? "T
HE job... Is DoNe!":END
4 IF S>127 THEN S=S-128:P=
128
5 IF S>63 THEN S=S-64:R=64
6 IF S>31 THEN S=S-32:P=P+
32
7 IF S>15 THEN S=S-16:R=R+
16
8 IF S>7 THEN S=S-8:P=P+8
9 IF S>3 THEN S=S-4:R=R+4
10 IF S>1 THEN S=S-2:P=P+2
11 IF S=1 THEN S=0:R=R+1
12 RETURN
13 DATA 104,162,4,160,0,17
7,205,145,203,200,208,249,
230,206,230,204,202,208,24
2,96
```

### RAMDISK for the 800XL.

Here's a way to use the RAMDISK on the 800XL that I thought other XL owners would be interested in. I sure was! Here's how to do it:

(1) Boot DOS 2.5 with BASIC; (2) POKE 1802,PEEK(1802)+128 then GO-TO DOS; (3) use "L" (binary load) RAMDISK.COM; (4) format drive 8 (ramdisk); (5) use "H" (write DOS) to drive 8; (6) if you want to save space, delete *D8:DOS.SYS*—it's not needed; and (7) Return to BASIC and POKE 5439,56. This will tell DOS to look at drive 8 for MEM.SAV (if there) and DUP.SYS. Now, GOTO DOS; it'll come up instantly!

If you want, you can write MEM.SAV. Once you've done all that, you can use the RAMDISK for whatever you want. You have to remember that you only have around 101 sectors, even though, when you catalog drive 8, you get 499

sectors free, since DOS thinks you have an XE.

I hope all XL owners will enjoy this feature.

Sincerely,
Larry Nocella
Woodbury Heights, NJ

### Synthesizer keyboard update.

I'm writing to you in regard to an error that I noticed in the article **Keyboard Encoding for Computer Music Applications** in issue 33 of **ANALOG Computing**.

The schematic of the scanning encoder (Figure 4, page 66) correctly shows pins 1 and 2 or IC2 connected to pin 3 of IC5. However, the circuit board layout (Figure 7C, page 67) shows the pins of IC2 connected to pin 3 of IC4.

Although this board would pass the test program in the article, the strobe will not work properly.

Michael A. Zachary
Phoenix, AZ

*To fix the problem, cut the trace going from pin 1 of IC2 to pin 3 of IC4. You also must add a jumper between pins 3 and 8 of IC4, and another between pin 1 of IC2 and pin 3 of IC5.*

*The printed circuit boards available from ComputerWorks are of a later revision and do not have this problem.*

*—Ed.*

### On the C side.

Sure, I'll renew my subscription. I enjoy **ANALOG Computing** very much. Keep up the good work.

How about some articles on the language C? I have a very good grasp of BASIC, but don't seem to be able to get interested in assembly language beyond the point of being able to follow what someone else has written. Perhaps C would be more to my mental set.

I have a modem, but, living in a rural area, find that everywhere is a long distance phone rate from here. Add the phone bill to a service like CompuServe, and the price is prohibitive.

A few hours on a BBS, and the bill exceeds what a good piece of commercial software would cost. Due to phone rates, I may just miss the communications revolution.

Thank you for a great magazine; keep 'em coming.

Sincerely,
Everett Hubbard
Highland, IL

*Now that the STs are available, we'll have some articles (or maybe even a column) on C. Our in-house programming genius, Tom Hudson, has been using C extensively on the ST.*

*Also, try out our TCS. At the moment, the long distance rate might be expensive, but the huge number of programs available on our TCS makes it worthwhile. We're also working on a way to lower our TCS rates.* *—Ed.*

### REVved up.

In response to Matthew Ratcliff's letter in issue 32's **Reader Comment**. . .

He states that BASIC REV B is *defective* because it eats 16 bytes of memory each time a program is SAVEd. I want to point out that this does not make REV B defective. It just means that it has a new bug to replace an old one.

BASIC REV B is 100% functional! You need to LIST the program occasionally during the programming phase to reclaim the memory. It otherwise doesn't affect programs.

If you don't do much programming, then you don't need to upgrade to REV C. I became aware of this bug in February of 1985. Since I regularly LIST my programs anyway (to clean up the variable name list), the bug really poses no problem.

REV C is finally shipping—the XEs come with it.

Rick Detlefsen, Editor AACE
Austin, TX

### Z-Plotter modification.

Having entered the **Z-Plotter** program and found that the results were most interesting, I modified the program so that one could use the same function without re-entering it.

Also, owning a Prowriter, the **49 Second Dump** was useless to me. I've written a highly modified version of that routine that will work with the Prowriter machine. It is a bit slower (about 70 seconds), but it works.

I have often wondered why the C.Itoh machines have not been supported by magazines in general.

Philip Roth
Rockville, MD 20855

```
208 IF PEEK(764)=28 THEN ?
 "R":GOTO 1046
300 CLOSE #K1:OPEN #K1,8,K
0,"P:":PRINT #1;CHR$(14);C
HR$(27);CHR$(62):PRINT #1;
CHR$(27);"T08"
301 REM *CHR$(14) TURNS ON
 EXPANDED MODE AND WILL MA
KE Z-AXIS TWICE AS LONG WI
THOUT CHANGE TO X OR Y
302 FOR X=DM TO DM+39
304 A$=CHR$(K0):A$(192)=A$
:A$(2)=A$:B$=A$
306 W=USR(1536,X,ADR(A$),A
DR(B$))
308 PRINT #1;CHR$(27);"501
92";A$
310 PRINT #1;CHR$(27);"501
92";B$
312 NEXT X:PRINT #1;CHR$(2
7);CHR$(60);CHR$(27);"A";C
HR$(15)
314 CLOSE #1
316 RETURN
1000 K1=1:GRAPHICS 24:REST
ORE 1000:FOR Z=K0 TO 137:R
EAD X:POKE 1536+Z,X:NEXT Z
1001 DIM A$(192),B$(192):D
M=PEEK(88)+PEEK(89)*256:DM
=DM+40*191
1002 T=K0:DIM Z$(169),Q$(4
0),F$(20),FC$(40):I50=0.52
3598775
1046 POKE 82,K0:GRAPHICS K
0:? :?
1048 ? "MAKE SELECTION TO
USE SAME FORMULA OR   NEW
FORMULA."
1050 ? :? "   1)  SAME FOR
MULA":? "   2)   NEW FORMU
LA"
1052 ? "ENTER SELECTION )"
;:INPUT T
1054 IF T=2 THEN 1008
1056 IF T<>1 THEN ? "WHOOP
S":GOTO 1052
1058 ? "R":GOTO 1013
1100 DATA 104,104,141,35,6
,141,54,6,104,141,34,6,141
,53,6,104,141,46,6,104,141
,45,6,104,141,64,6,104,141
,63
1102 DATA 6,160,192,173,25
5,255,136,240,70,41,240,32
,110,6,141,255,255,238,45,
6,240,45,173,255,255,10,10
,10
1104 DATA 10,32,110,6,141,
255,255,238,63,6,240,33,17
3,34,6,56,233,40,141,34,6,
141,53,6,144,4,24,76,33,6,
206
1106 DATA 35,6,206,54,6,76
,33,6,238,46,6,76,52,6,238
,64,6,76,70,6,96,24,162,0,
134,203,10,102,203,10,102,
203
1110 DATA 10,102,203,10,10
2,203,70,203,70,203,70,203
,70,203,165,203,96
```

### Unwanted translator features.

I recently bought issue 32 of **ANALOG Computing**. As I was leafing through it, I came upon Angelo Giambra's **Homemade Translator**.

Reading through it, I became very interested and excited about making a

*(continued on next page)*

translator for my brand new 130XE from my trusty old 800. Being the "do first, then read" type, I typed in the code, **Unichecke**d it and SAVEd the perfect copy to disk.

Referring back to the article, I blew the dust off the 800 and made the AUTORUN.SYS file. Booting this on the 130XE resulted in much whooping and hollering, as the RAM OS took over and ran my old software like crazy. So far, so good.

When I booted my DOSXL utilities disk, however, I discovered some very undesirable "features" in the RAM OS that are unnoticeable in programs which don't use the screen editor.

First of all, I don't like a darker background color. Second, I want the keyclicks back! Over the past few years, I've read with some dismay letters from people complaining about keyclick. Well, maybe I'm in the minority, bu I like it just the way it is.

Third, the bell routine has been disabled. Why have all these things been done? I would ask all you programmers out there to provide some options in programs like this. I have no idea how to change the patches, but would like them changed.

All in all, though, I'd like to thank Mr. Giambra for a useful program whose time has come.

Thankful but frustrated,
Brian A. Nakata
Portland, OR

*We're glad you liked the program itself, at any rate. Future programmers, take note: not* everyone *hates keyclick, and users welcome options to personalize their software.* —*Ed.*

### Matrix method.

First, I want to say that you have a great magazine, and I'm very glad that you've stuck with Atari through thick and thin. I really appreciate it.

Second, I've enclosed a small subroutine I created a few days ago that might be helpful to those of your readers who have troubles with matrices.

In the program I was using this subroutine in, I needed to save as much memory as possible. Instead of defining the value of each "box" of the matrix one by one, I wanted to do them all quickly. The values I used went from 0-30, so I created a five-column by seven-row matrix. That filled up the first six rows completely and the first box in the seventh row, too.

In the last row, I had four boxes left over. The following subroutine DIMs a five by seven array, fills the first thirty-one boxes with values from 0-30 and leaves the "left over" boxes with a value of -1.

```
500 DIM MATLOC(4,6)
510 X=0:Y=0:VALUE=0:REM VA
LUE will equal the value o
f the number in the "box".
520 IF X>4 THEN X=0:Y=Y+1:
REM If column number is >4
 then reset column number
to 0 and increase row valu
e by one.
530 IF Y>6 THEN RETURN :RE
M RETURN to original progr
am from subroutine, that i
s.
540 IF VALUE>30 THEN VALUE
=-1:REM When it gets to th
e 30th room, set the left
over matrix "boxes" to -1.
550 MATLOC(X,Y)=VALUE
560 X=X+1:IF VALUE<>-1 THE
N VALUE=VALUE+1
570 GOTO 520
```

Of course, the REMs don't have to be typed in; they're just there for explanation.

Sincerely,
Richard E. Matthews
San Diego, CA

### Avalanche fix.

I am a subscriber to your excellent magazine and have owned an Atari 800 computer for three years now. I'm writing to inform you of a problem in your assembly game **Avalanche**, in issue 21.

When playing this game, if you receive your 1000-point bonus when your score is less than 1000 points from a 10,000-point mark, you actually have 10,000 points deducted from your score. In other words, if your score is 9010 points when you receive the 1000-point bonus, it will be reduced to 10 points.

This has kept me from receiving a needed extra man on many occasions. Please print a fix for this bug.

Otherwise, I think that your magazine is #1.

Yours truly,
Donald Simmons
Whitbourne, Nfld.

*It seems that not many people got up high enough to notice this nasty little*

*(continued on page 9)*

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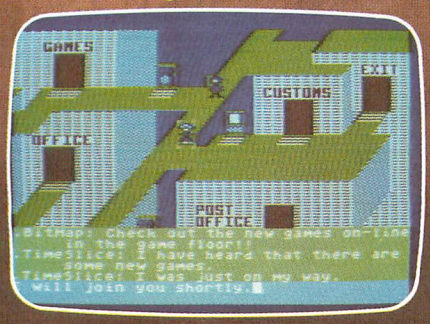


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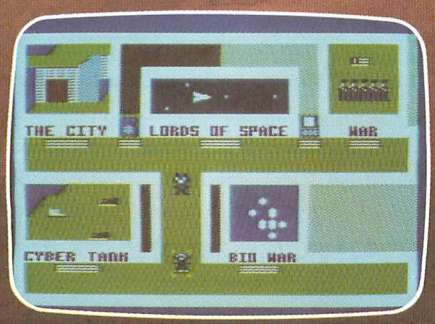


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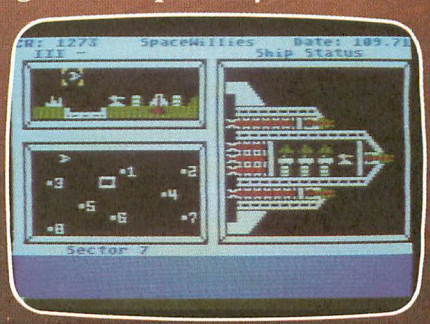


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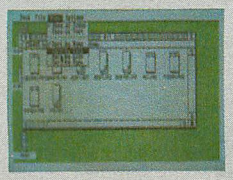

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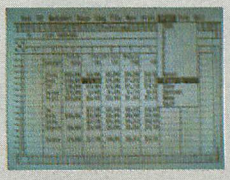

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## READER COMMENT *continued*

*bug. Replacing Lines 1240 and 1250 in the BASIC object file maker program with these should correct the problem:*

```
1240 DATA CA10F2A9008D01D2
A209BD9C339DBD37CA10F7A202
FE1A06BD1A06C91A9005A9109D
1A069D0036CA900210E9A9,844
1250 DATA C84CD32180808080
9B00000000000000000000000AD
0136C588F002B00160E688E689
20FA22A202A9208D00D2A0,32
```

*And, for those who'd like to know, here are the machine language source code changes:*

```
5HOBM5  LDA BONM5G,X
        STA DISP22+5,X
        DEX
        BPL 5HOBM5
        LDX #2          ;ADD
5HO51   INC 5CORE,X     ;1000
        LDA 5CORE,X     ;POINTS
        CMP #26         ;TO
        BCC 5HO5X       ;5CORE
        LDA #16
        STA 5CORE,X
5HO5X   STA DISP,X
        DEX
        BCC 5HO52
        BPL 5HO51
5HO52   LDA #200    ;WAIT 200
        JMP WAIT    ;JIFFIES
        .BYTE $80,$80,$80
        .BYTE $80,$9B,0
        .WORD 0,0,0,0,0
```

*The machine language listing is optional.* —*Ed.*

### No applause, please.

I've been an **ANALOG Computing** reader since June of 1984 and *eagerly* await its arrival each month. I'm in the process of trying to get as many back issues as possible and have recently become aware that issues 11 and 14 are no longer available. I hope to see a "Compendium II" soon, containing articles that were in these issues, especially utilities, games and articles in a series (like **Fine Scrolling, Part 2**).

I really enjoy Tom Hudson's work. His article **Moving Players in BASIC** is invaluable, and **Graphic Violence** is incredible. I've also enjoyed Kyle Peacock's material, although I disagreed with his review of **Robotron**.

When two talents like these come together, a game like **Fire Bug** is inevitable. I can say without hesitation that it's the best game I've ever typed into my 800XL (and I've got well over 300K).

Although I don't buy educational software, I find Dr. Griffin's column entertaining and thought provoking. Mark Comeau's games are excellent ways to

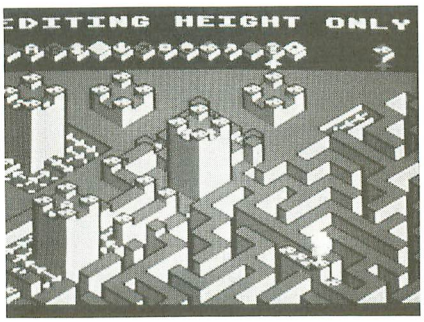
*(continued on page 12)*

# NEW PRODUCTS

## SEQUEL TO LODE RUNNER

**Lode Runner**, one of the highest rated games for the Atari, is now followed by **Lode Runner's Rescue**. In this new scenario, the player takes on the character of Alexandra, daughter of the famous **Lode Runner**.

Alexandra must rescue her father from a prison cell by successfully negotiating forty-six mazes and picking up keys as she goes. One variation from the original is graphics: rather than the 2-D format of **Lode Runner**, this version is 3-D. Sound effects are also greatly improved. A game editor to create your own screens is provided, and uses graphic icons to assist in development. Your new screens can be saved and played with all features, including hidden trapdoors, guards, elevators and rushing rivers.

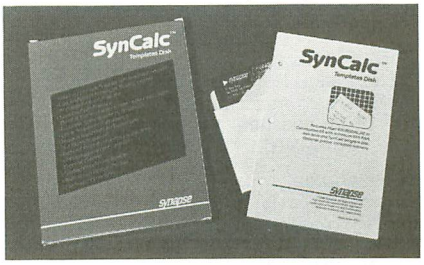



Price is $29.95 for 48K disk. Broderbund Software, 17 Paul Drive, San Rafael, CA 94903-2101 — (415) 479-1170.

## SYNCALC TEMPLATES

For use with the **SynCalc Spreadsheet** program, this disk includes twenty-two predesigned spreadsheet formulas and formats.

Templates include: personal property inventory and valuation, weekly appointment calendar, an expense report, mortgage analysis, kitchen measurement conversion table, stock portfolio evaluation, and analysis table of renting vs. buying a home. Instructions to fit the **SynCalc** binder are provided, with a description and "how to use it" for each template.

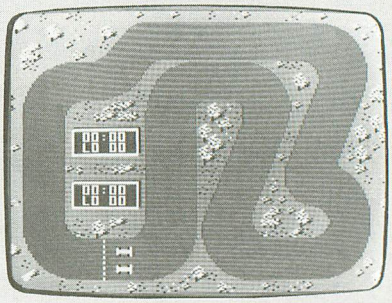



Cost is $19.95 from Synapse Software, 17 Paul Drive, San Rafael, CA 94903.

## COMPUTER MODEL CAR RACING

**On-Track** is Gamestar's latest release in their "Sport's Alive" series. A game for one or two players, it gives you an overhead view of the track, which fills the screen.

Options let you select between several tracks, including Watkins Glen, Daytona and Monaco. You also must choose one of three "drivers" for your car. Each of these drivers has a car with individual characteristics of speed, handling and brakes.



Using your joystick, you turn left and right, brake, and shift gears. In one-player mode, it's you against the computer (which never seems to crash, spinout, maim or make any mistakes).

Requires 48K, one or two joysticks—lots for $24.95. From Gamestar, 1302 State Street, Santa Barbara, CA 93101.

## OTHER NEWS

The **Invoicer** is designed for small business owners, wholesalers and retailers who need a fast, low-cost way of invoicing orders and keeping track of them.

Some features include: auto invoice numbering, tracking taxable and nontaxable sales, and letterhead formatting.

Available for $49.95 from MiccaSoft, 406 *Windsor Lane, New Braunfels*, TX 78130 — (512) 629-4341.

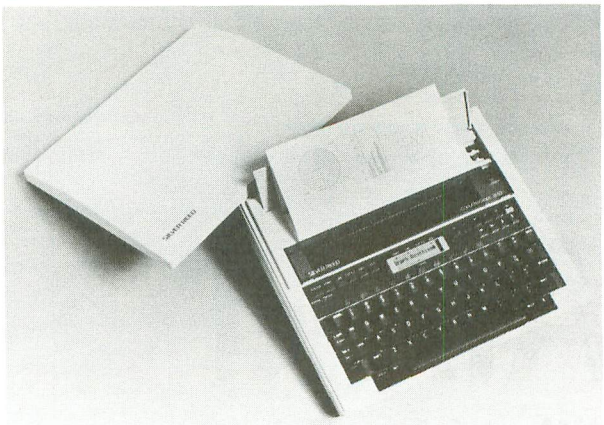
■ ■ ■

A list of forty-five **astronomy-related programs** for several computers, including the Atari, is available. The listing contains a brief description of the software function and the full address of the manufacturer.

To obtain a list, send a $1.00 donation (to cover postage and handling) to the Astronomical Society of the Pacific, 1290 24th Avenue, San Francisco, CA 94122.

## PENGRAPH EB50

**PenGraph EB50** from Silver Reed offers twelve different graphs and prints via a rotating ballpen writing head, to plot charts and graphs in four colors. Characters can be printed in Courier and Italic, and both graphs and prints can be produced in three sizes.



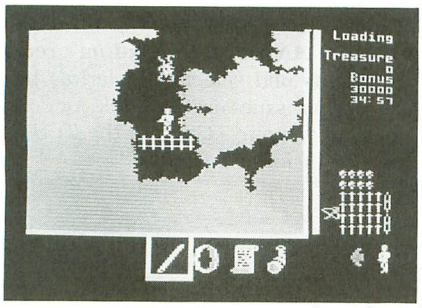
Along with nine other graphic formats, the **EB50** is capable of plotting out your line graphs or bar and pie charts with ease. Connection is via a Centronics interface.

Additional features include a 10-key buffer and a 16-character LCD display. And it weighs in at only 5½ pounds.

For further information on the **EB50**, we suggest you contact: Silver Reed, 19600 South Vermont Avenue, Torrance, CA 90502 — (213) 516-7008.

## ACTION, STRATEGY AND ADVENTURE IN THE NETHERWORLD

This is the quest for five missing pieces of a magical gemstone stolen long ago. You'll explore ninety caverns and rooms, and battle up to eight different creatures, attempting to fend them off with fireballs and arrows.




**Gemstone Warrior** features full color and smooth-scrolling graphics, uses a joystick and keyboard, and allows you to pause and save the game at any time. Different levels of play may also be selected. The instruction manual and Atari "version" card included are extremely well designed and very thorough—one of the better ones we've seen.

Cost is $34.95 for 48K Disk. Strategic Simulations, Inc. (SSI), 883 Stierlin Rd., Building A-200, Mountain View, CA 94043-1983 — (415) 964-1353.

## 101 PROGRAMMING SURPRISES & TRICKS

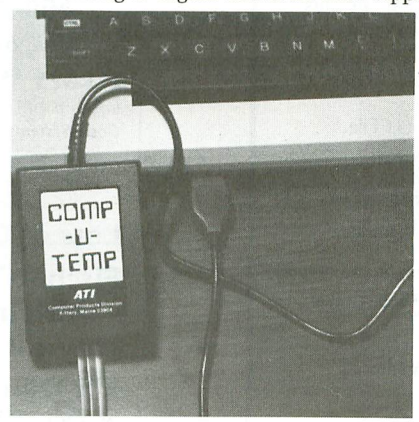
. . . ***for Your Atari Computer*** was recently published. It's a book containing just over 100 short programs. These consist of games, educational programs, applications and just plain bizarre listings for you to type in.

Rarely is a program explained at all; the user types them in and runs them, simply to see what they do. All of the programs begin with "profound" proverbs, jokes (of a sort) or comments that make no sense . . .This is intended to be part of the fun and surprise of this book. It's a good book for the beginner who would enjoy typing in these small listings and watching the outcome.

***101 Programming Surprises & Tricks for Your Atari Computer*** was written by David L. Heiserman. It's 196 pages softbound and is sold for $11.50. For information, contact TAB Books Inc., Blue Ridge Summit, PA 17214.


## TEMPERATURE MONITOR AND DATA LOGGER

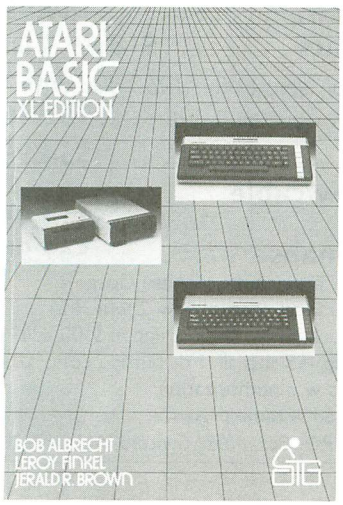
An analog-to-digital converter from Applied Technologies registers a temperature range of −15 to +180 degrees Fahrenheit. At one-degree resolution, with the ability to display eight to sixteen temperature channels, the **Comp-U-Temp** plugs into the Atari's joystick port.




Other features include weather-protected sensors and software capable of hard copy printouts, labeling sensor locations, selecting high or low alarm settings, and several other functions. **Comp-U-Graph** is a program which, when used with the temperature sensor, will graph your recorded data.

Available in three versions, with package prices ranging from $89.95 to $179.95. For more information on **Comp-U-Temp** and **Comp-U-Graph**, contact Applied Technologies, Inc., Computer Products Division, Lyndon Way, Kittery, ME 03904 — (207) 439-5074.

## HANDS-ON GUIDE TO XL ATARI BASIC




This new book is a sequel to *Atari BASIC*, the original shipped with 400 and 800 computers (in the old days).

With new diagrams and artwork to include the XL line, ***Atari BASIC XL Edition*** is laid out very well. The use of excellent examples helps to demonstrate difficult concepts for the beginner.

Chapters cover essentials of BASIC, BASIC arithmetic, graphics, sound, using a cassette recorder, programming tips and initial setup. There are dozens of short programs, charts and "self tests."

The XL edition, written by the original's authors, Albrecht, Finkel and Brown, is 388 pages, softbound and sells for $14.95. Published by Wiley Press, 605 Third Avenue, New York, NY 10158.

## OTHER NEWS *continued*

ICECO has just introduced a **parallel interface converter** to allow the hookup of a Centronics-compatible (parallel) printer to the Atari's joystick port. It's capable of working with *any* Atari computer, from the 400 to the 1200XL to the 520ST. The powerful software package included supports most BASIC programs, **Letter Perfect**, **AtariWriter**, **B/Graph**, **Atari Artist** and other popular third-party programs.

Contact: Integrated Computer Equipment Company, 8507 Natural Bridge Road, St. Louis, MO 63123 — (314) 423-3390.

increase my knowledge of BASIC, and they're very addicting. Scott Scheck also contributes top-notch programs to **ANALOG Computing**.

**Air Attack** is superb. **Climber** and **Bopotron!** are great. I also enjoy short games like **Reckless Racer** and **Miner Jack**. **Two-Gun** is fantastic!

On to utilities. . . **Binary File Menu Loader** saved me a lot of disks. **P/M Creator/Animator** is a program I'd pay $20 for.

**Unicheck** is the best proofreader I've worked with. It catches *all* errors; it's fast; and it has a provision for when you're typing really well. **Numeric Keypad** is a typist's dream come true. **Microcheck** is a commercial-quality utility that I've been looking for in a magazine for a long time.

Miscellaneous articles that I've enjoyed immensely are: **ANALOG Computing's Guide to Atari Computer Publications**, **Atari Stocking Stuffers**, coverage of the Winter CES, interviews, Atari CON report and guides to hardware.

What would I like to see in future issues? All the things I've complimented, including games (both assembly and BASIC), tutorials, reviews, new products, additions to previous articles and utilities of all sorts.

Specifically, I'd like to see **Minicomp** compile itself and maybe even add more commands (FOR/NEXT). When I get back issue 16, I'll type in **Solid States**, which I'm sure I'll love. I could swear I saw a suggestion that that might be compiled, too. I'd like to see this done.

In addition, I would like to see DOS3 utilities, such as **XL-DOS** and **Revive** written in DOS3. Also, it would be nice to see more uses for the unused 16K in the 800XL. Maybe it could be used as a printer buffer for the **AtariWriter**.

I would also like an AUTORUN file (similar to the **Binary File Menu Loader**) that runs BASIC programs. I've filled a couple of disks with BASIC games, and feel this would be a nice utility.

Keep up the dynamite work.

Your loyal reader,

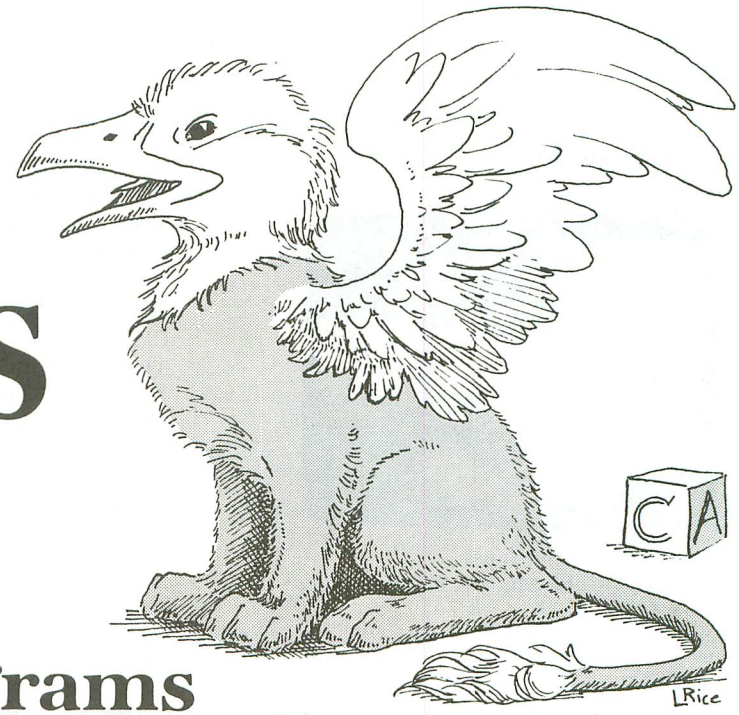
Peter Scimeca

Highland, NY

P.S. Do you allow subscribers to download the programs in the magazine from a modem? If so, I will immediately buy a modem.

*For those of you who've been trying to obtain a copy of issue 16, only to be told that we were out of them—good news! A limited supply of issue 16 was found at our warehouse. Call our editorial offices (617-892-9230) to request a copy before they all vanish.*

*All of **ANALOG Computing**'s recent programs and selected materials from the earlier issues are available for downloading via our **TCS**. See the **TCS** ad, on the inside front cover.*




# GRIFFIN'S LAIR

## Educational Programs Review

by Braden E. Griffin, M.D.

This month's column was written in the middle of the sweltering heat of summer. We'll deal with a couple of educational programs for the young members of the audience. Excuse the brevity of the introduction, but *it's hot in here!*

**DR. SEUSS**
**FIX-UP THE MIX-UP PUZZLER**
**CBS SOFTWARE**
**A Unit of CBS Publishing Group**
**CBS, Inc.**
**Greenwich, CT 06836**
**48K Disk $29.95**

The computer's version of the jigsaw puzzle has been around for a number of years. Instead of using a puzzle piece's shape and the part of the original picture contained therein to reassemble the whole, only the latter element is necessary in the electronic version.

If ever there were an ideal collection of characters to be mixed up in a puzzle of this sort, the incredibly unique creations from the stories of Dr. Seuss are it. CBS Software has introduced such a game for children of four years and up.

The game itself isn't much different from other, similar programs. Three of the available six Dr. Seuss characters are randomly selected and displayed at the start of each level. Pressing the fire button initiates the puzzle's scrambling.

To the right of the puzzle is an area referred to as a Space Holder. Using the joystick to move a white box throughout the puzzle to the Space Holder, the child creates a blank space. By moving the white box over any other piece and pressing the fire button, a player moves that piece to the blank spot. The puzzle pieces can be moved wherever one desires.

Level one divides the picture into nine equal-sized pieces, each containing a body part. This is sort of a practice level, not requiring the child to reassemble the puzzle in any particular order. It provides an opportunity to demonstrate to the child how the game works.

Level two is also a nine-piece puzzle, but this time some pieces are upside down. Hitting the SPACE BAR while a piece is surrounded by the white box results in the piece's being rotated 180 degrees. Once the puzzle is solved correctly, the characters become animated, and a score appears in the upper right-hand corner of the screen.

Level three divides the puzzle into sixteen parts, making it much more difficult to recognize a particular character's parts in an individual piece. The characters must also be reassembled in the correct left-to-right order, as they were originally displayed.

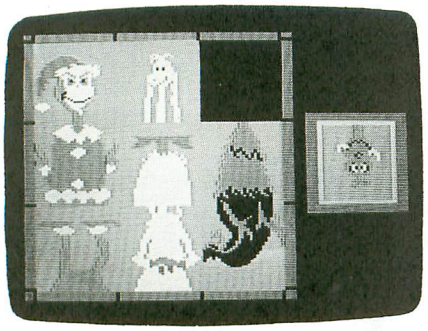
This level incorporates a time limit, enabling the player to score 800 bonus points if the puzzle's completed promptly. Level four is similar, except this time some of the pieces are upside down.

Level five is, as one might expect, the most difficult. Twenty-five pieces comprise the puzzle, some of which are upside down. Again, if one beats the timer, bonus points are given. This level is a real challenge. I spent the better part of an afternoon trying to gain the bonus points at this level. I failed.

This type of game stimulates the development of a number of learning skills. Pattern and object recognition, sequenc-

ing, and memory skills are involved to a great extent. The nonthreatening and delightful manner of presentation makes this game an enjoyable way of enhancing these skills.

It's easy for young children to learn to play **Fix Up the Mix Up**. *And they won't lose any puzzle pieces!*



**Dr. Seuss**
**Fix Up the Mix Up Puzzler.**

The Muppet Learning Keys™ may be used in place of the joystick. Every time the puzzle is completed and the characters begin to animate, the joyful world of Dr. Seuss is recalled for an instant. It feels good. It should.

An Atari computer,
Any will do—
To fix up
*The Doorman of Solla Sollew.*
The shyest of kids
Will leap from the closet
For the chance, if one dares,
To restore the strange *Woset.*
*Clark* and *The Grinch,*
That dastardly soul,
Are waiting for children
To come make them whole.
My apologies to those
Who cringe at my rhyme,
But this game gives more
Than just a good time.
*The Cat in the Hat*
And his crew also will teach;
I know, 'cause I heard it from
*The Star-Bellied Sneetch.*

**TIMEMASTERS**
**NATURAL SOFTWARE SOLUTIONS**
**Box 360**
**Rutland Hollow Road**
**Watertown, NY 13601**
**48K Disk $29.95**

Telling time ranks right up there with colors, numbers and tying one's shoes as an important learning milestone. Clock time, that is, with the big hand and the little hand.

Probably the only drawback of the digital watch, one of the great technological advances of our generation (second only to the much-decorated T-shirt), is the impediment it has created for children trying to learn how to tell time the old fashioned way.

With so many of the digital variety timepieces around, there is a lack of incentive (or necessity) for youngsters to develop this skill. Here's an educational program intended to fill this void.

Designed for children from four to nine years of age, **TimeMasters** teaches

# ATARI

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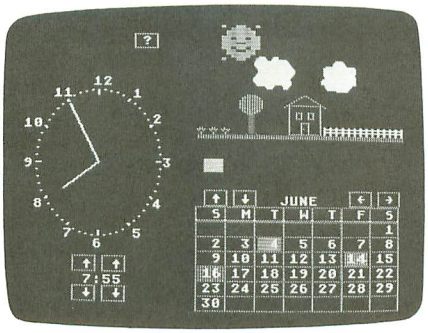
CIRCLE #108 ON READER SERVICE CARD

clock time, days of the week, months of the year and holidays. Three teaching modes are available. The Learning mode displays a clock, a calendar and an outdoor picture.

As the clock hands are moved, the time is displayed digitally. Also, while the time changes, the outdoor picture changes from night to day, etc. Additionally, as each day passes, the calendar day advances, and the picture changes to reflect the change of seasons with each passing month.

The Clock Checker mode displays a clock (surprise!) and five possible time choices. The child is to pick the correct time. A similar mode is used with the Calendar Checker, employing the days of the week. The score is kept with each mode, and a correct response is rewarded with a colorful graphic display and musical accompaniment.

This program will probably do what it sets out to, and it's adequately presented. The holidays are set for 1985; it would be nice to be able to change this yearly. But gimme a break!



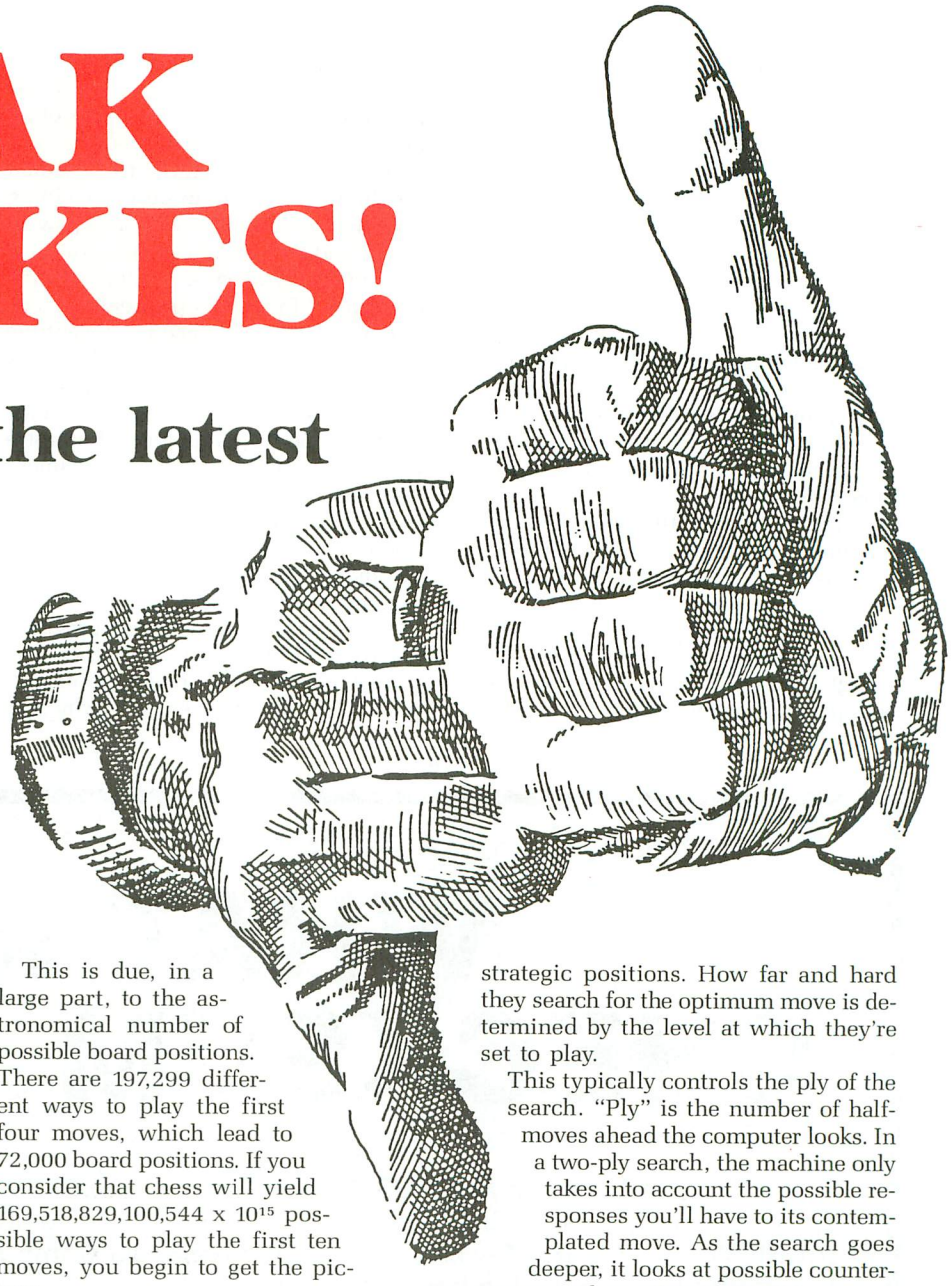

**TimeMasters.**

I don't think we need a computer program to teach this skill. A pencil and paper, a long and a short piece of string are all the materials required to accomplish the same task. Oh yes, one more thing is necessary. Time. I think your time and money can be better spent. □

*Dr. Griffin, as Chief of Newborn Medicine at a perinatal center, spends most of his time in the newborn intensive care ward. Off-hours, he's been using an Atari 800 for four years. In keeping with his gentle profession of nurturing preemies, Dr. Griffin's number one game is* ***Crush, Crumble, Chomp****.*

# PANAK STRIKES!

## Reviews of the latest software



**by Steve Panak**

Being totally humiliated and reduced to human wreckage by a trio of computer chess games is not a pretty sight, nor one for the faint of heart.

At first, they beat me down to a quivering mass. However, I had promised you my considered opinion; I had to persevere. Once I regained my wits and started to think. . .well, then they simply outsmarted me. Finally, after a couple of hours, I was able to win—I could to bear to look at myself in the bathroom mirror. I was victor.

Chess is an old and complex game, so much so that there is no way I could do it justice here. Nor will I try. A good set of reference works is the Pergamon Press Chess Series. These books offer a complete history and analysis of the game, along with a volume (although a couple years out of date) which covers computer chess. These, or any of a host of others available at your local library, can familiarize those unacquainted with the game.

The invention of machines capable of playing chess (and, no, the word is not capitalized—perhaps an indication of the antiquity of the game) is nearly as old as the game itself. However, apart from the old automatons with chessmasters hidden inside, only recently have machines been close to capable of challenging even the novice player.

This is due, in a large part, to the astronomical number of possible board positions. There are 197,299 different ways to play the first four moves, which lead to 72,000 board positions. If you consider that chess will yield 169,518,829,100,544 x $10^{15}$ possible ways to play the first ten moves, you begin to get the picture.

By the time I tell you that the total number of possible games greatly exceeds the number of atoms in the known universe, you have not only gotten the picture, but you've probably burned out the unsettling image. So the logical next question is: how do these games work?

I'll give you a weasel answer: they're programmed to and, as such, they can only play as good a game as their programmers. The typical program works by analyzing possible board positions, choosing the one which yields the best results. . .or, perhaps, the least damage.

Either way you look at it, they take into account material gain, mobility and strategic positions. How far and hard they search for the optimum move is determined by the level at which they're set to play.

This typically controls the ply of the search. "Ply" is the number of half-moves ahead the computer looks. In a two-ply search, the machine only takes into account the possible responses you'll have to its contemplated move. As the search goes deeper, it looks at possible counter-moves and counter-responses.

Using a decision tree, which branches out as deeply as the ply of the search, it chooses the board position most valuable to it. It can easily be seen that, if it utilizes a shallow search, the program cannot possibly see the rationale for sacrificing a queen that forces a checkmate five ply down the road.

So, on the easy levels, a simple two-move attack (such as a knight fork) might well spell doom. But, as you increase the depth of the search, the machine becomes more and more invincible.

Add to this the fact that the computer makes no mistakes, and—well, you get the picture, again.

I had first planned to battle the games against each other, to try to determine the "best" of the three. Not only was this difficult and time consuming, I also realized that it would be fruitless.

One problem is that no program precisely defines what it considers on the various levels, nor always the depth of search. So, level 1 on one game might naturally be equivalent to level 2 on another. Thus, the only level which really makes sense in a battle is the highest level.

The problem now is that, on the high levels, these programs search for hours, days or, in one case, perpetually—the thing *never* stops looking until you tell it to; it will search until the public utility company itself folds. But there is one point on which all the games are weak.

This is endgame, which is loosely defined as the last third of a game, when most major pieces have been eliminated through trades, so only pawns and kings (and, perhaps, one major piece) are left. I found it very easy to beat any one of these games, if I was able to survive until the endgame (which was not often possible).

In my opening, I offer a trade which results in the program either doubling up or isolating one or more of its pawns. In the middle game, I eliminate these to give myself a pawn advantage. In the endgame, I force my opponent to sacrifice his last major piece to prevent me from moving my pawn to the last rank and obtaining a queen. Using this strategy and avoiding an early checkmate (which is the programs' forte), I was able to win a good majority of the games.

However, just one mistake, though it may be unknown to you, will spell your doom. Lose your queen and you probably should hang it up, unless you're an extremely strong player.

When you choose a chess program, whether one of these or another, you probably will want to determine just how much you will use it, and why. Any program here will play a challenging game, follow the rules religiously, and help you improve your own play of this classic.

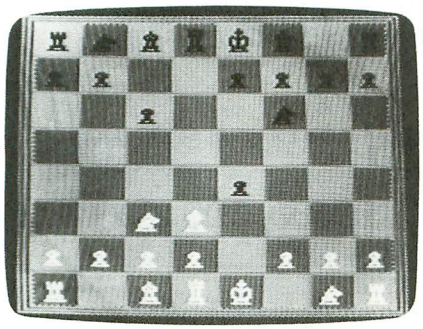
Now, let's take a look at the games themselves.

**SARGON II**
**by Dan and Kathe Spracklen**
**HAYDEN SOFTWARE**
**600 Suffolk Street**
**Lowell, MA 01854**
**16K Disk $19.95**

The **Sargon** chess program has been around quite a while. In 1978, the first **Sargon** took first place in a chess tournament exclusively for microcomputers. The book, *Sargon—A Computer Chess Program*, from the Hayden Book Company, completely analyzes the program, as well as giving a listing of it in Z-80 assembly language. If you wish to understand exactly how such a program works, I strongly recommend this book.

**Sargon II** is a refinement of the original, making it easier to use, as well as toughening the opponent and adding a beginner's level. It has the advantage of being the cheapest program I tested. However, it also lacked many of the most basic features and was extremely hard to use.

To make a move against **Sargon II**, you must enter (using the keyboard) the coordinates of the piece you wish to move, followed by the coordinates of the space you wish to occupy. The board is referred to by letters along the X-axis and numbers along the Y-axis. Thus, the top right-hand square has the location H8; the bottom left, A1.



**Sargon II.**

The only problem is that the numbers and letters are not displayed alongside the board. This means that you must either visualize them or, perhaps, place a cardboard cutout on your monitor. It was difficult at first, but, after a while, I was able to enter my moves with some rapidity. It was, however, always inconvenient and made the concentration necessary to beat the game that much harder to attain.

Taking back moves is also difficult, so much so that it can't be fully explained here. Basically, though, you take back moves the same way as you set up a custom board.

It's so tough that you'll prefer to start over if it's still early in the game. A later mistake will force you to figure it out. No doubt, it can be done; the issue is that it could have been done much more simply. Perhaps **Sargon III**, currently available for some systems, has remedied this; I'll report back to you when it comes out in an Atari version.

The manual for **Sargon II** was also the poorest of the bunch, giving no rules for chess, much less strategies. So, if you're unfamiliar with the game, plan to go to the library to learn it.

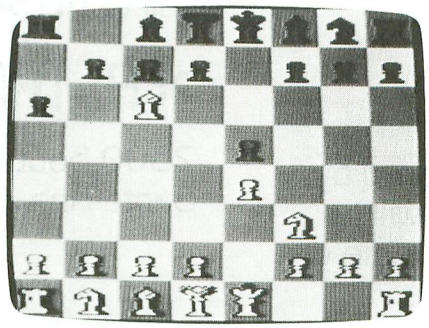
As for features, you can set up a board anytime, switch sides, or choose color (white always moves first, a basic chess rule).

**Sargon II** is a bargain program which is hard to use and inexpensive. However, it played a tough game and offered seven levels, enough to keep most budding masters busy until the turn of the century.

**CHESS**
**PARKER BROTHERS**
**Beverly, MA 01915**
**16K Cartridge $49.95**

This cartridge from Parker Brothers was surprisingly good, probably because I really didn't expect much from it. I don't have that much confidence in the makers of basically luck-oriented games like Monopoly (a great game, but hardly one requiring a *lot* of strategy). For the money, though **Chess** was the best of the bunch.

Since it is a cartridge, no disk drive is needed, which opens this game up to all Atari owners, unless you don't have a cartridge slot (in which case, obtain professional help, because something is seriously wrong with you or your computer). Also, since the keyboard selects moves, no controllers are needed. However, the joystick makes it easier to lean back on the couch and absorb the repetitive, crushing defeats.



**Chess by Parker Brothers.**

Moves are easily made, by placing a cursor over the piece to be moved, pressing the button, then carrying the cursor to the destination square. On the keyboard, you use the ARROW keys and the RETURN key. The cursor seemed slow to move at times, but it's hard to fault this—chess is *supposed* to be a slow game.

Pressing other keys will activate options like: take back (a move), replay (a game to the current point), hint (makes your move), autoplay, change sides, or position pieces. All of these are easily accomplished, with none of the difficulties **Sargon II** presented.

The manual is good and lengthy, at 70-plus pages. It gives basic rules of the game, along with strategies and some background information on computer chess.

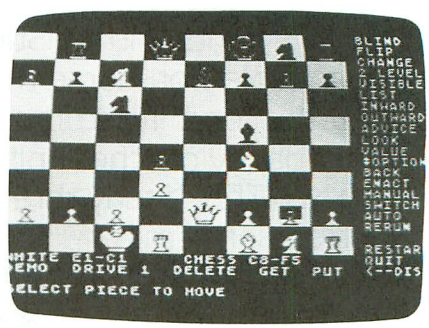
My only complaint was that I found the pieces hard to recognize, although they appear well defined on the screen. This is due to the fact that Parker Brothers did not choose the classic chess pieces, examples of which appear in the chess problems frequenting some big-city Sunday papers. The queen and king are very similar, as well as bishops and pawns, and it takes a while to get acquainted with them, especially if you're used to the classic images.

I really have to recommend this program, particularly if value is your criterion.

**CHESS**
**by Larry Atkin**
**ODESTA**
**3186 Doolittle Drive**
**Northbrook, IL 60062**
**48K Disk $69.95**

Since this was the most expensive program tested, it's not surprising that it was also the best. I can find no faults at all, except for the fact that no provision is made to print the game out. It's not that I think this is *necessary*; it's just that the program has everything else, so why not?

The screen is as I envision chess on a Macintosh. Using either the paddles or the keyboard, you move a flashing prompt over all the pieces which may move. When you choose a piece, the prompt moves to each of the squares that that piece may head for (an excellent teaching aid).




**Chess by Odesta.**

*(continued on page 21)*

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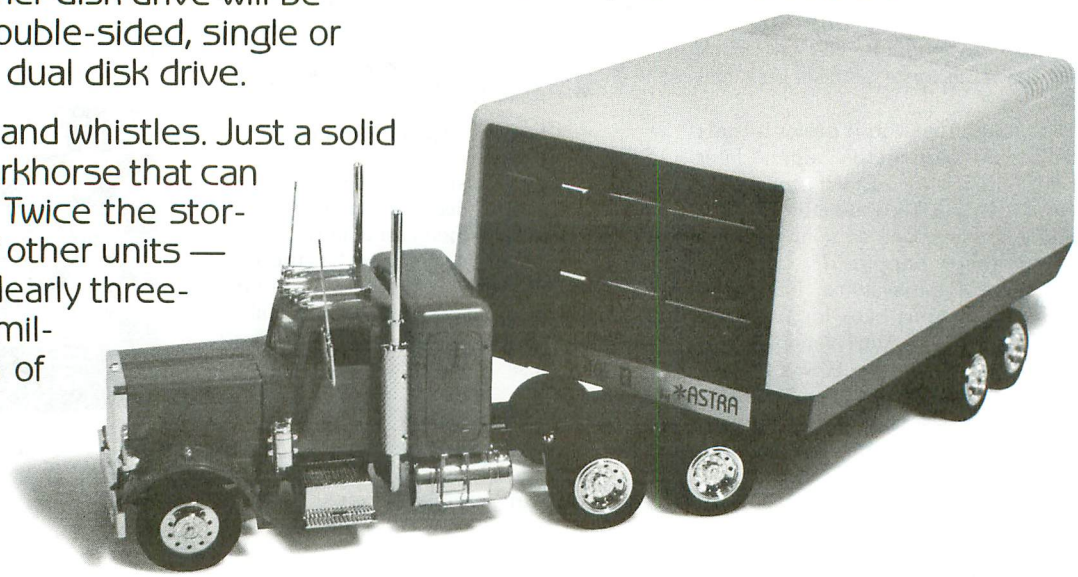



CIRCLE #109 ON READER SERVICE CARD

You want to change your mind? Just place the prompt over the chosen piece and hit RETURN. Now, move to make another choice.

After you've cycled through all the moveable pieces, the prompt jumps over to the column of choices on the right of the screen. By selecting OPTION, you move along the menu, choosing to take back a move, change sides, increase the level, flip the board, or even ask for help —just that easily.

You can access a disk menu to save games. As I mentioned before, this program leaves little out in terms of versatility. In fact, the only complaint I have is with the selection of paddles over joysticks as controls. It's not that I have anything against paddles, except that I don't have any. And I don't think too many others have them, either.

As the computer searches in this version of **Chess**, the screen displays the current best move. By hitting RETURN, you can terminate the search, and the computer will make its move. In perpetual mode, you must stop it, unless you want to be responsible for a computer's nervous breakdown.

The pieces are the easiest to recognize, since the classic chess pieces are used. The manual is complete and thorough in every way, describing the program, chess, its history and computer chess.

So, if money is no object, and you want the ultimate chess game, Odesta's **Chess** is your selection.

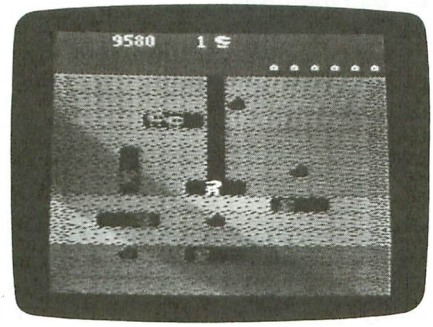
**DIG DUG**
**by Namco**
**DATASOFT**
**19808 Nordhoff Place**
**Chatsworth, CA 91311**
**48K Cassette or Disk $29.95**

The last few months, I've examined quite a few of the games in the Premier Arcade series from Datasoft. These have generally been excellent conversions from the arcade to the home, and my problem with most has been that I simply didn't like the arcade game. This is how I feel about **Dig Dug**.

Technically, the game's performance is nearly identical to its big brother who gobbles quarters, the only difference being a slight loss in the graphic detail.

In **Dig Dug**, you tunnel through the earth, in search of fruits and vegetables to gobble up. Joining you are Pooka (a big, round monster) and Fygar (a fire-breathing dragon).

Using your pump, you fire at your enemies, either once to stun or repeatedly to blow them up. You can also drop rocks on these fiends, crushing them for additional credit. After you've dropped two boulders, a treat appears at the center of the screen, and you must attempt to reach it for the really big points.




**Dig Dug.**

That's about it, over and over again. You get an extra man at 10,000 points and at every 40,000 points thereafter, making you able to go on indefinitely—if you can stand it. Difficulty increases with more monsters, and they can become ghosts which pass through the soil to get to you.

My greatest complaint was the monotony. There was nothing new, nothing to look forward to. Another of the deadly video sins.

I just finished testing **Mr. Do** a few weeks ago, and this was basically the same thing. However, while **Mr. Do** had some strategy involved, like when and where to burrow, **Dig Dug** seemed to require no strategy whatsoever. Of course, if I'd **Dig Dug**ed before I **Mr. Do**ed, I might have liked the former better than the latter; I just don't know.

Both disk and cassette are included in the package, providing a backup for those with both devices. One or two may play, using joysticks, and there are ten difficulty levels. There's an elaborate scoring system detailed in the fine instruction manual.

# PANAK STRIKES! *continued*

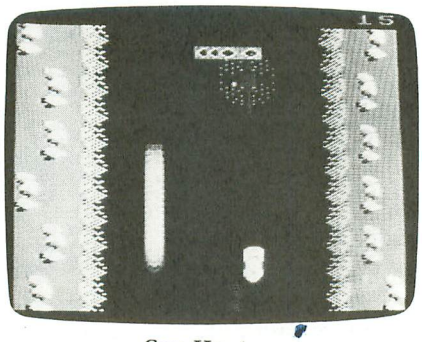
So, though I can't recommend **Dig Dug**—on the basis of the game's monotony—I will say that Datasoft has done a fine job of bringing this game into the home. True **Dig Dug**ers will enjoy hours of play.

**SPY HUNTER**
**by Bally/Midway**
**SEGA**
**360 N. Sepulveda, Suite 3000**
**El Segundo, CA 90245**
**32K Disk $39.95**

James Bond and Maxwell Smart, look out! **Spy Hunter** is here, and he's hot on your tail.

**Spy Hunter** is Sega's home version of the now-classic arcade game, and I can start by saying that the translation was nicely done. All the elements of the arcade version are present, along with most of the excitement.

In **Spy Hunter**, you drive your custom car across the highways and byways, eliminating all who would oppose you and neutralizing a few innocent bystanders in the meantime.



**Spy Hunter.**

After booting the disk and choosing expert or novice level and keyboard or joystick control, you navigate your car along the road, encountering various enemy agents. The Road Lord is bulletproof and must be rammed off the road. The Enforcer blasts at your side with a shotgun, and Switch Blade extends his buzz-saw hubcaps to slash your tires, sending you spinning off the road to become flaming wreckage.

When you hear the **Spy Hunter** theme, that means the weapons van is nearing. By carefully driving your car up and into the van, you acquire additional weapons (missiles, oil slick or smoke screen), to increase your invulnerability.

By going through the boathouse, your car is converted into a spy speedboat. You then navigate the waterways, battling against Dr. Torpedo and the Barrel Dumper. Hitting another boathouse lands you back on the road again.

The graphics are good, although not nearly as detailed as those in the arcade version. The big problem I had was with control.

In the arcade, you have a steering wheel, which I always find easier when a video game involves driving. However, this is impossible to produce for the home at any reasonable price. The solution: keyboard or joystick control.

The keyboard is very difficult to use, even though the keys are close together. If you choose the joystick control, you'll need two joysticks, which are secured in a plastic holder provided with the game. One stick is used to control movement, while only the button on the second stick is used, to launch rear-firing weapons. Still, the movement control seems crude, resulting in a constant weaving all over the road—and occasional slamming into trees.

The manual is complete, describing the game in detail and offering hints on play. You can continue perpetually, as you receive an extra car at 10,000 points and every 20,000 points thereafter, but the problem is that the game is difficult. Rarely did we break 40,000.

Still, once again, there wasn't enough. Not enough track, not enough variety. After only a few hours' play, you've done all you can do, and the only challenge is to get a higher score.

Without the thrill of having a quarter at stake, the excitement of **Spy Hunter** just doesn't hit home, and I can't recommend this game.

Now that I'm through raving for this month, I'll power down and eat a couple aspirin to try to reduce the swelling in my brain a little. □

*Programs provided through the courtesy of Magic One Computer Shop, 176 Second Street, Barberton, Ohio, (216) 753-0431.*

*Steve Panak is a banking computer operator and free-lance writer living in northeastern Ohio. He holds a B.S. in B.A. and currently attends law school, where he develops software to teach complex legal concepts. In his spare time, he enjoys computer games.*

# HIDE AND SEEK

by Greg Peck

**Hide and Seek** is a nonviolent game that tests your visual skills against the clock. Your goal is to find, within the 30x10 pattern at the top of the screen, the 4x4 pattern displayed on the lower half of the screen.

Once the pattern is found, another pattern is drawn, and you go at it again. To make things interesting, you have to find the right pattern before you run out of time. Points are awarded based on how fast you find the patterns and how many you find.

## Playing Hide and Seek.

To play the game, begin by selecting the level of play, using joystick movement. Press the button when the desired level is displayed (start with level 1). A random pattern is then selected and displayed on the screen. Move the cursor around the large grid and find the hidden pattern with the joystick. Press the joystick button to lock your cursor in position over the hidden pattern and push forward on the joystick to check for a match.

The amount of time it took you to find the pattern is displayed with the score when the pattern is found. A low tone will signify a mismatch and send you back looking for the correct match.

If you run out of time, you'll be shown the hidden pattern with a flashing cursor. The darker the screen gets and the louder the sound gets, the less time you have left. As a final warning, the border of the large grid turns white, indicating just less than 10 seconds remain.

Time allowed to find the hidden pattern decreases as you play **Hide and Seek**. You have just under a minute on screens 1 through 5 and less than 10 seconds on screen 18 and any remaining screens in level 1. More difficult levels allow more time to make the match.

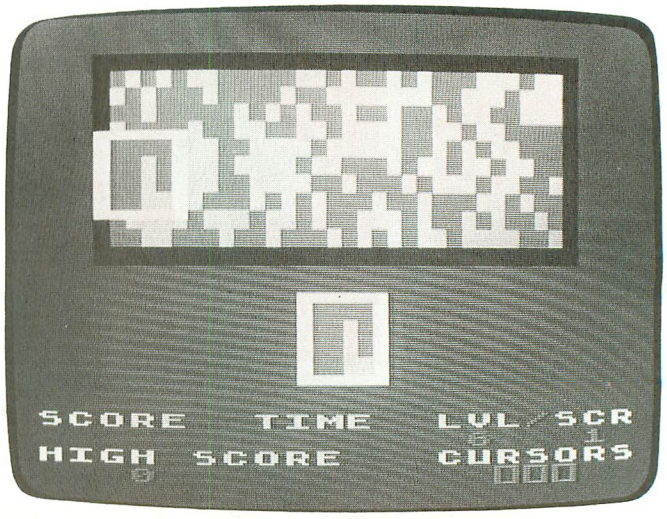
Points are figured by taking the screen number times 100, subtracting the number of seconds it took to find the pattern, then multiplying by the level of play. There are no points awarded or taken away for failing to find a pattern. The game ends, however,

when you fail to find three patterns. Press the joystick button to play again.

There are six levels of difficulty to choose from. Levels 1 through 3 use a simpler large grid than do 4 through 6. The first and fourth levels play the same, as do the second and fifth, and the third and sixth. The easiest is level 1, in which the small 4x4 pattern appears just as it does in the large grid above. Level 4 is the same, with a harder large pattern.

In level 2, the small pattern may be displayed right side up or inverted. You can flip the small pattern over by pressing the joystick button and pulling back on the joystick. Level 5 does the same, with a harder large pattern.

The small grid in level 3 may be rotated clockwise 0, 90, 180 or 270 degrees. To rotate the small pattern, press the joystick button and pull back on the stick. Level 6 plays the same, with the harder large pattern. On levels 2, 3, 5 and 6, the small pattern *must* be displayed right side up in order to get a match.




**Hide and Seek.**

On a few occasions, you may find a pattern that matches the small pattern but is not the same one that was identified by the computer. The computer

---

Some program listings reproduced in **ANALOG Computing** may contain "strange" characters not shown on the keyboards of earlier Atari models. These are special characters which use the CTRL, ESC and "ATARI LOGO" (inverse) keys. Shown below is a list of these characters and the keystrokes used to get them.

```
♥ --- CTRL ,
├ --- CTRL A
| --- CTRL B
┘ --- CTRL C
┤ --- CTRL D
┐ --- CTRL E
/ --- CTRL F
\ --- CTRL G
◢ --- CTRL H
  --- CTRL I
◣ --- CTRL J
  --- CTRL K
  --- CTRL L
▔ --- CTRL M
_ --- CTRL N
  --- CTRL O
┼ --- CTRL P
┌ --- CTRL Q
▔ --- CTRL R
┼ --- CTRL S
● --- CTRL T
▄ --- CTRL U
| --- CTRL V
┬ --- CTRL W
┴ --- CTRL X
▌ --- CTRL Y
└ --- CTRL Z
  --- ESC ESC
↑ --- ESC CTRL UP-ARROW
↓ --- ESC CTRL DOWN-ARROW
← --- ESC CTRL LEFT-ARROW
→ --- ESC CTRL RIGHT-ARROW
♦ --- CTRL .
♠ --- CTRL ;
  --- ESC SHIFT CLEAR
  --- ESC BACK S
  --- ESC TAB
  --- INVERSE CTRL ,
  --- INVERSE CTRL A
  --- INVERSE CTRL B
  --- INVERSE CTRL C
  --- INVERSE CTRL D
  --- INVERSE CTRL E
  --- INVERSE CTRL F
  --- INVERSE CTRL G
  --- INVERSE CTRL H
  --- INVERSE CTRL I
  --- INVERSE CTRL J
  --- INVERSE CTRL K
  --- INVERSE CTRL L
  --- INVERSE CTRL M
  --- INVERSE CTRL N
  --- INVERSE CTRL O
  --- INVERSE CTRL P
  --- INVERSE CTRL Q
  --- INVERSE CTRL R
  --- INVERSE CTRL S
  --- INVERSE CTRL T
  --- INVERSE CTRL U
  --- INVERSE CTRL V
  --- INVERSE CTRL W
  --- INVERSE CTRL X
  --- INVERSE CTRL Y
  --- INVERSE CTRL Z
  --- ESC DELETE
  --- ESC INSERT
  --- ESC CTRL TAB (CLR)
  --- ESC SHIFT TAB (SET)
  --- INVERSE SPACE
  --- INVERSE _
  --- INVERSE CTRL .
  --- INVERSE CTRL ;
  --- INVERSE |
  --- ESC CTRL 2
  --- ESC CTRL BACK S
  --- ESC CTRL INSERT
```

fills the large grid randomly and then selects a small pattern to be found. It doesn't check to see if that same pattern lies elsewhere.

If you do find one of these matches, the screen will flash, you'll be shown the match that the computer had selected, and you'll receive 1000 bonus points. The chances of this happening are much greater in levels 1 through 3 than in the harder levels.

The game can be played for most points or most screens (only high score is maintained). The levels can be used for handicapping between different players.

Pause the game during play by pressing any key on the computer keyboard. Press the joystick button to continue.

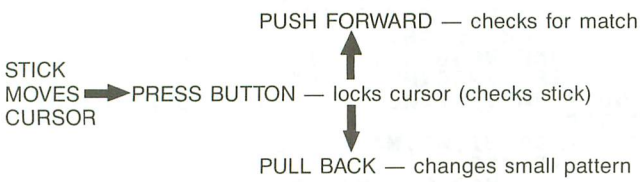



**Figure 1 — Controls.**

### Program breakdown.

The program for **Hide and Seek** consists of eight main parts. Several machine language routines were used to speed things up, including Tom Hudson's **Moving Players in BASIC** (**ANALOG Computing** issue 10).

| Lines | Function |
|---|---|
| 110-310 | String manipulation. |
| 320-600 | Main loop. |
| 610-670 | Read stick. |
| 680-800 | Check for match. |
| 810-880 | Show match. |
| 890-950 | End game. |
| 960-1210 | Initialize. |
| 1220-1330 | Title page. |

The program disables the BREAK key, then initializes player/missile graphics, custom display, custom character set, stick array and machine language routines. Next, it displays the title page. Play begins by randomly selecting the large and small patterns, displaying game information and placing a cursor in the center of the large pattern.

Stick input moves the cursor until the button is pressed, at which time the appropriate action is taken (changing small pattern or checking for a match). After a match is made, **Hide and Seek** continues with another screen until three cursors are lost. The game then ends and allows selection of a level for the next game. □

*Greg Peck is in his ninth year as a drafting instructor in Mexico, Missouri. He's a co-founder of the Mid-Missouri Atari User's Group (M.A.U.G.) and is now serving as its president. **Hide and Seek** is his second published program.*

**Listing 1.**
**BASIC listing.**

```
10 REM +--------------------+
20 REM +   HIDE AND SEEK    +
30 REM +         BY         +
40 REM +     GREG PECK      +
50 REM +--------------------+
60 REM + COPYRIGHT (C) 1985 +
70 REM +  ANALOG COMPUTING  +
80 REM +--------------------+
90 REM
100 GOTO 960
110 FOR I=N1 TO N15:T=ADR(FILL2$):IF L
EV>N3 THEN T=ADR(FILL$)
120 D=USR(T,ADR(A$))
130 T=INT(RND(N0)*N50):SOUND N0,T,N14,
N10:D=N0:T=PEEK(N53770):C=INT(T/N16)*N
16+N6:C2=C+N36:C3=C+24
140 IF C2>N255 THEN C2=C2-N256
150 IF C3>N255 THEN C3=C3-N256
160 POKE N708,C:POKE N709,C2:POKE N710
,C-N4:POKE N704,C3:POKE N705,C3:SCR=PE
EK(N88)+PEEK(N89)*N256
170 T=INT(RND(N0)*N50):SOUND N0,T,N14,
N10:D=USR(ADR(M$TR$),ADR(A$),SCR+N45):
NEXT I
180 SOUND N0,N0,N0,N0:RETURN
190 T1=INT(RND(N0)*26)+N1:T2=INT(RND(N
0)*N6)+N1:T=T1+T2*N30:MATCH=T
200 FOR I=N1 TO N4:G$(I*N4-N3,I*N4)=A$
(T):T=T+N30:NEXT I
210 IF LEV=N2 OR LEV=N5 THEN ON INT(RN
D(N0)*N2+N1) GOTO 230,250
220 IF LEV=N3 OR LEV=N6 THEN ON INT(RN
D(N0)*N4+N1) GOTO 230,270,280,290
230 FOR I=N1 TO N4:POSITION N18,N13+I:
? #N6;G$(I*N4-N3,I*N4):SOUND N0,I+I,N1
0,N8:NEXT I:SOUND N0,N0,N0,N0
240 RETURN
250 FOR I=N1 TO N4:POSITION N18,N13+I:
? #N6;G$((N5-I)*N4-N3,(N5-I)*N4):SOUND
 N0,I+I,N10,N8
260 G2$(I*N4-N3,I*N4)=G$((N5-I)*N4-N3)
:NEXT I:SOUND N0,N0,N0,N0:G$=G2$:RETUR
N
270 FOR I=N1 TO N16:G2$(I,I)=G$(N17-I)
:NEXT I:GOTO 300
280 FOR I=N1 TO N4:FOR D=N1 TO N4:G2$(
I*N4-N4+D,I*N4-N4+D)=G$(D*N4+N1-I):NEX
T D:NEXT I:GOTO 300
290 D=USR(ADR(ROT$),ADR(G$),ADR(G2$))
300 FOR I=N1 TO N4:POSITION N18,N13+I:
? #N6;G2$(I*N4-N3,I*N4):SOUND N0,I+I,N
10,N8:NEXT I
310 SOUND N0,N0,N0,N0:G$=G2$:RETURN
320 GOSUB 110:GOSUB 190:POKE N656,N0:P
OKE N657,N0:? "score  time  lvl/scr"
330 POKE N656,N2:POKE N657,N0:? "high
score   cursors":POKE N656,N2:POKE N65
7,N3:? "↓";BSCORE
340 IF TRY$=N3 THEN POKE N656,N2:POKE
N657,N10:? "↓     @@@"
350 CNT=CNT+N1:POKE N656,N1:POKE N657,
N14:? LEV;"   ";CNT:POKE N712,12:IF CN
T>N5 THEN POKE N712,N10
360 IF CNT>N8 THEN POKE N712,N8
370 IF CNT>N11 THEN POKE N712,N6
380 IF CNT>N14 THEN POKE N712,N4
```

```
390 IF CNT>N17 THEN POKE N712,N2
400 IF CNT>N11 AND LEV=N3 THEN POKE N7
12,N6
410 IF CNT>N11 AND LEV=N6 THEN POKE N7
12,N7
420 IF CNT>N14 AND LEV=N2 THEN POKE N7
12,N4
430 IF CNT>N14 AND LEV=N5 THEN POKE N7
12,N5
440 IF CNT>N17 AND LEV=N1 THEN POKE N7
12,N2
450 IF CNT>N17 AND LEV=N4 THEN POKE N7
12,N3
460 POKE 77,N0:POKE N19,N0:POKE N20,N0
:T2=N0:Z=N0:POKE N764,N0
470 T=PEEK(N19):IF T>T2 THEN POKE N712
,PEEK(N712)-N1:T2=T:IF PEEK(N712)<N3 T
HEN POKE N710,N14
480 IF  NOT PEEK(N712) THEN 810
490 X=X+XADD(STICK(N0)):Y=Y+YADD(STICK
(N0)):T1=PEEK(N53770):SOUND N0,T1,N14,
T:D=USR(PM,N0,PMB,PLR,X,Y,N20)
500 IF  NOT STRIG(N0) THEN SOUND N0,N0
,N0,N0:GOSUB 610
510 IF PEEK(N764) THEN 580
520 IF PEEK(53252)<>N7 THEN 470
530 POKE 53278,N1:IF X<N64 THEN X=N64
540 IF X>168 THEN X=168
550 IF Y<N18 THEN Y=N18
560 IF Y>42 THEN Y=42
570 GOTO 470
580 T=PEEK(N19):T1=PEEK(N20):POKE N708
,N0:POKE N709,N0:SOUND N0,N0,N0,N0
590 IF STRIG(N0) THEN 590
600 POKE N19,T:POKE N20,T2:POKE N708,C
:POKE N709,C2:POKE N764,N0:GOTO 470
610 SOUND N0,N100,N10,N8:IF STICK(N0)=
N14 THEN 680
620 IF STICK(N0)=N13 AND (LEV=N2 OR LE
V=N5) THEN SOUND N0,N0,N0,N0:GOTO 250
630 IF STICK(N0)=N13 AND (LEV=N3 OR LE
V=N6) THEN SOUND N0,N0,N0,N0:GOTO 290
640 T=PEEK(N19):IF T>T2 THEN POKE N712
,PEEK(N712)-N1:T2=T:IF PEEK(N712)<N3 T
HEN POKE N710,N14
650 IF  NOT PEEK(N712) THEN 810
660 IF STRIG(N0) THEN RETURN
670 GOTO 610
680 T1=INT(X/N4)-N15:P=INT((Y-N18)/N4)
:P=P*N30+T1:Z=P
690 TRAP 620:FOR I=N1 TO N4:IF G$(I*N4
-N3,I*N4)<>A$(Z,Z+N3) THEN 740
700 Z=Z+N30:NEXT I:IF P=MATCH THEN 750
710 FOR I=N1 TO N10:SOUND N0,N50,N10,N
8:POKE N712,32:FOR D=N1 TO N15:NEXT D
720 SOUND N0,N200,N10,N8:POKE N712,N14
:FOR D=N1 TO N15:NEXT D:NEXT I
730 TSCORE=TSCORE+1000:SOUND N0,N0,N0,
N0:POKE N712,N4:Z=-N1:GOTO 810
740 SOUND N0,250,N10,N10:FOR I=N1 TO N
200:NEXT I:SOUND N0,N0,N0,N0:RETURN
750 SOUND N0,N50,N10,N10:T=PEEK(N19)*N
256+PEEK(N20):MIN=INT(T/N3600):SEC=INT
((T-MIN*N3600)/N60)
760 TEN=INT((T-MIN*N3600-SEC*N60)/N6):
SCORE=CNT*N100-SEC:SCORE=SCORE*LEV
770 POKE N656,N1:POKE N657,N7:? SEC;".
";TEN;"   "
780 TSCORE=TSCORE+SCORE:POKE N656,N1:P
OKE N657,N0:? TSCORE:SOUND N0,N0,N0,N0
790 IF TSCORE>BSCORE THEN BSCORE=TSCOR
E:POKE N656,N2:POKE N657,N3:? "↓";BSCO
RE
800 D=USR(PM,N0,PMB,PLR,N1,N1,N20):POP
 :GOTO 320
810 T2=INT(MATCH/N30):T1=MATCH-T2*N30:
T1=T1*N4+N60:T2=T2*N4+N18:D=USR(PM,N0,
PMB,PLR,T1,T2,N20)
820 SOUND N0,175,N10,N8:FOR I=N1 TO N2
0:POKE N704,N0:FOR D=N1 TO N10:NEXT D:
POKE N704,C3:FOR D=N1 TO N10:NEXT D
830 NEXT I:SOUND N0,N0,N0,N0:D=USR(PM,
N0,PMB,PLR,N1,N1,N20):POKE N704,C3
840 IF Z=-N1 THEN 750
850 TRY$=TRY$-N1:IF TRY$=N2 THEN POKE
N656,N2:POKE N657,N15:? "↓ @@"
860 IF TRY$=N1 THEN POKE N656,N2:POKE
N657,N15:? "↓ @ "
870 IF TRY$=N0 THEN POP :GOTO 890
880 POKE N656,N1:POKE N657,N7:? "
":GOTO 320
890 SOUND N0,125,N10,N10:POKE N656,N2:
POKE N657,N15:? "↓      ":FOR D=N1 TO N
6:NEXT D:SOUND N0,N0,N0,N0:LEV=N1
900 IF STRIG(N0) THEN 900
910 POKE N656,N2:POKE N657,N0:? "
                ":POKE N656,N2:? "  SEL
ECT LEVEL -     ":LEV=N1
920 POKE N656,N2:? "↓     PRESS BUTTON
   ":IF  NOT STRIG(N0) THEN 920
930 POKE N656,N2:POKE N657,N17:? LEV:I
F STICK(N0)<>N15 THEN LEV=LEV+N1:IF LE
V=N7 THEN LEV=N1
940 POKE N656,N2:? "↓     PRESS BUTTON
   ":IF STRIG(N0) THEN 930
950 ? "K":CNT=N0:TRY$=N3:TSCORE=N0:GOT
O 320
960 READ N1,N3,N4,N6,N2,N5,N8,N10,N11,
N14,N15,N16
970 READ N17,N18,N19,N20,N50,N60,N64,N
88,N89
980 READ N7,N13,N30,N36,N35,N45
990 READ N100,N106,N200,N254,N255,N256
,N300
1000 READ N656,N657,N704,N705,N708,N70
9,N710,N712,N764,N53770,N3600
1010 POKE N106,PEEK(N106)-9:GRAPHICS N
0:T=PEEK(N16)-128:IF T>N0 THEN POKE N1
6,T:POKE 53774,T
1020 DIM PM$(N100),MOV$(54),M$TR$(N100
),PLR$(N36),FILL$(N60),FILL2$(N60),A$(
N300),G$(N16),G2$(N16),ROT$(58)
1030 G2$="                ":PLR=ADR(PL
R$):POKE 752,N1:POKE N712,N4:POKE N710
,N4:DLIST=PEEK(560)+PEEK(561)*N256
1040 POKE DLIST+N3,68:FOR I=N0 TO N18:
POKE DLIST+N6+I,N4:NEXT I:POKE 703,N4:
POKE 659,N1
1050 FOR I=N0 TO N3:POKE DLIST+25+I,N6
:NEXT I:POKE 82,N0:PM=ADR(PM$):? "  RE
ADING DATA"
1060 POKE N708,22:FOR I=N1 TO N100:REA
D J:PM$(I)=CHR$(J):NEXT I
1070 POKE N708,56:FOR I=N1 TO 54:READ
J:MOV$(I)=CHR$(J):NEXT I
1080 POKE N708,N64:FOR I=N1 TO N100:RE
AD J:M$TR$(I)=CHR$(J):NEXT I
1090 POKE N708,78:FOR I=N1 TO 58:READ
J:FILL$(I)=CHR$(J):NEXT I
1100 POKE N708,146:FOR I=N1 TO 57:READ
 J:FILL2$(I)=CHR$(J):NEXT I
1110 POKE N708,158:FOR I=N1 TO 58:READ
 J:ROT$(I)=CHR$(J):NEXT I
1120 POKE N708,178:FOR I=N1 TO N20:REA
D J:PLR$(I)=CHR$(J):NEXT I:PMB=PEEK(N1
06)+N1:POKE 54279,PMB:PMB=PMB*N256
1130 DIM XADD(N15),YADD(N15):FOR I=N5
TO N15:READ T:XADD(I)=T:NEXT I
1140 FOR I=N5 TO N15:READ T:YADD(I)=T:
NEXT I:POKE N708,198
1150 POKE 559,46:POKE 53277,N3:POKE 53
256,N3:POKE 53257,N3:POKE N704,N4:POKE
 N705,N4:POKE 623,N1:X=112:Y=N30
1160 D=USR(PM,N1,PMB,PLR,116,70,N20)
```

```
1170 CHRSET=PEEK(N106)+N5:D=USR(ADR(MO
V$),57344,CHRSET*N256,1024):POKE 756,C
HRSET:LOC=CHRSET*N256+776
1180 FOR I=N0 TO N7:POKE LOC+I,85:NEXT
 I:FOR I=N8 TO N15:POKE LOC+I,170:NEXT
 I
1190 FOR I=N16 TO 23:POKE LOC+I,N255:N
EXT I
1200 LOC=CHRSET*N256+N256:POKE LOC,N25
4:FOR I=N1 TO N6:POKE LOC+I,198:NEXT I
:POKE LOC+N7,N254:COLOR 99
1210 PLOT N4,N0:DRAWTO N35,N0:DRAWTO N
35,N11:DRAWTO N4,N11:DRAWTO N4,N0:A$="
0":A$(N300)="0":A$(N2)=A$
1220 ? "K":GOSUB 110:A$="abababbbbbbbb
bbbbbaaabbbbbbbbbbababbbbbbbbbbabbbbbbabb
bbbbbbbbb"
1230 A$(61)="aaaaaabbbbaaabbbbbbaaaaaab
bbbbbabababbbbbbabababbbbbbbaabbbbbbbbb"
1240 A$(121)="abababaabbbbbbaabababaaaab
aaabbbbbbaaaabababbbbaaaabbbbaaaabbbbb"
1250 A$(181)="bbbbbbabaaaabababaabbbbbbb
aabababbbbbbaabababbbbbbbbaabbbbbaaaaab"
1260 A$(241)="bbbbbbbbbaabbbbbbbababbbb
bbbaabbbbbbbbbbbaaabbbbbaabbbbbbbbbaba":
SCR=PEEK(N88)+PEEK(N89)*N256
1270 D=USR(ADR(MSTR$),ADR(A$),SCR+N45)
:GOSUB 190:POKE N656,N0:POKE N657,N0:?
 "    hide and seek"
1280 POKE N656,N2:? "     BY GREG PECK
   ":FOR D=N1 TO N300:NEXT D
1290 POKE N656,N2:? "  SELECT LEVEL -"
:LEV=N1
1300 POKE N656,N2:POKE N657,N17:? LEV:
FOR D=N1 TO N5:NEXT D
1310 IF STICK(N0)<>N15 THEN LEV=LEV+N1
:IF LEV=N7 THEN LEV=N1
1320 POKE N656,N2:? "↓     PRESS BUTTON
   ":IF STRIG(N0) THEN 1300
1330 ? "K":TRY=N3:GOTO 320
1340 REM CONSTANTS
1350 DATA 1,3,4,6,2,5,8,10,11,14,15
1360 DATA 16,17,18,19,20,50,60,64,88
1370 DATA 89,7,13,30,36,35,45,100
1380 DATA 106,200,254,255,256,300
1390 DATA 656,657,704,705,708,709,710
1400 DATA 712,764,53770,3600
1410 REM PM$
1420 DATA 216,104,104,104,133,213,104,
24,105,2,133,206,104,133,205
1430 DATA 104,133,204,104,133,203,104,
104,133,208,104,104,133,209,104
1440 DATA 104,24,101,209,133,207,166,2
13,240,16,165,205,24,105,128
1450 DATA 133,205,165,206,105,0,133,20
6,202,208,240,160,0,162,0
1460 DATA 196,209,144,19,196,207,176,1
5,132,212,138,168,177,203,164,212
1470 DATA 145,205,232,169,0,240,4,169,
0,145,205,200,192,128,208,224,166
1480 DATA 213,165,208,157,0,208,96
1490 REM MOV$
1500 DATA 104,104,133,205,104,133,204,
104,133,207,104,133,206,104,133
1510 DATA 209,104,133,208,166,209,240,
16,160,0,177,204,145,206,136,208
1520 DATA 249,230,205,230,207,202,208,
242,164,208,136,192,255,240,7,177
1530 DATA 204,145,206,24,144,244,96
1540 REM MSTR$
1550 DATA 104,104,133,205,104,133,204,
104,133,207,104,133,206,169,60
1560 DATA 133,208,162,0,160,0,177,204,
145,206,200,196,208,240,27
1570 DATA 232,224,30,240,3,24,144,239,
216,165,206,24,105,10,133
1580 DATA 206,165,207,105,0,133,207,16
2,0,24,144,220,192,240,240
1590 DATA 37,165,204,24,105,60,133,204
,165,205,105,0,133,205,169
1600 DATA 240,133,208,160,0,165,206,24
,105,70,133,206,165,207,105,0,133
1610 DATA 207,162,0,24,144,179,96,0
1620 REM FILL$
1630 DATA 104,104,133,204,104,133,203,
160,255,173,10,210,41,1,240
1640 DATA 5,169,98,24,144,2,169,97,200
,145,203,192,255,208,235,166,204
1650 DATA 232,134,204,173,10,210,41,1,
240,5,169,98,24,144,2,169,97,200
1660 DATA 145,203,192,44,208,235,96,0
1670 REM FILL2$
1680 DATA 104,104,133,204,104,133,203,
160,255,173,10,210,41,3,240
1690 DATA 5,169,98,24,144,2,169,97,200
,145,203,192,255,208,235,166,204
1700 DATA 232,134,204,173,10,210,41,3,
240,5,169,98,24,144,2,169,97,200
1710 DATA 145,203,192,44,208,235,96
1720 REM ROT$
1730 DATA 104,104,133,204,104,133,203,
104,133,206,104,133,205,169,12,133
1740 DATA 207,169,255,133,208,162,12,2
16,165,207,168,177,203,230,208,164
1750 DATA 208,145,205,138,201,4,48,6,2
33,4,170,24,144,236,230,207,166,207
1760 DATA 224,16,240,3,24,144,223,96
1770 REM PLR$
1780 DATA 252,252,132,132,132,132,132,
132,132,132,132,132,132,132,132,132
1790 DATA 132,132,132,252,252
1800 REM STICK DATA
1810 DATA 4,4,4,0,-4,-4,-4,0,0,0,0
1820 DATA 4,-4,0,0,4,-4,0,0,4,-4,0
```

●

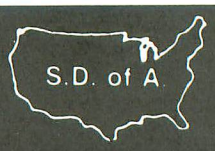
CHECKSUM DATA.

*(see page 18)*

```
10 DATA 954,212,599,139,962,508,751,96
8,267,717,960,589,949,733,741,10049
160 DATA 119,616,977,529,887,762,455,2
69,595,986,651,576,669,798,45,8934
310 DATA 910,95,699,236,296,190,75,81,
87,663,674,672,683,681,692,6734
460 DATA 744,628,977,49,108,233,978,96
1,0,68,780,739,352,423,332,7372
610 DATA 282,716,735,623,972,866,727,6
55,283,926,293,826,546,445,761,9656
760 DATA 667,108,169,438,361,150,774,9
3,856,630,997,597,736,561,407,7544
910 DATA 733,416,853,839,143,192,275,8
8,274,847,383,315,411,256,837,6862
1060 DATA 913,677,332,958,975,930,732,
545,455,216,403,671,818,789,138,9552
1210 DATA 228,589,124,358,388,912,625,
776,662,362,875,397,550,711,716,8273
1360 DATA 953,704,653,285,367,715,823,
133,872,544,315,254,912,0,152,7682
1510 DATA 451,317,765,898,979,862,611,
845,851,245,758,835,621,499,470,10007
1660 DATA 246,73,630,504,472,794,10,47
2,562,721,952,0,142,151,881,6610
1810 DATA 833,846,1679
```

●

# Software Discounters of America

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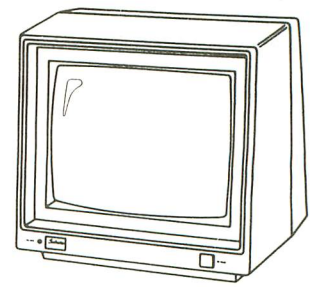

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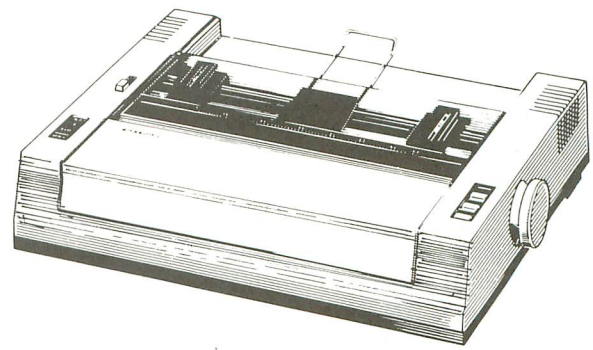

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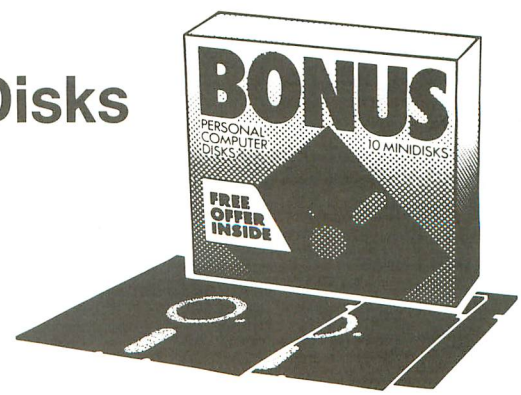


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CIRCLE #115 ON READER SERVICE CARD

**MEGAFONT II+**
**XLENT SOFTWARE**
**P.O. Box 5228**
**Springfield, VA 22150**
**(703) 644-8881**
**48K Disk $24.95**

by Mark Weaver

There I was in my computer room, trying to find a way to get around the task in front of me. I had to make a new character set for my printer (a Gemini 10X), so I could print my files in the new character set. I had lost hope when a friend called and asked if I would try out his new program on my printer, to see if it was compatible.

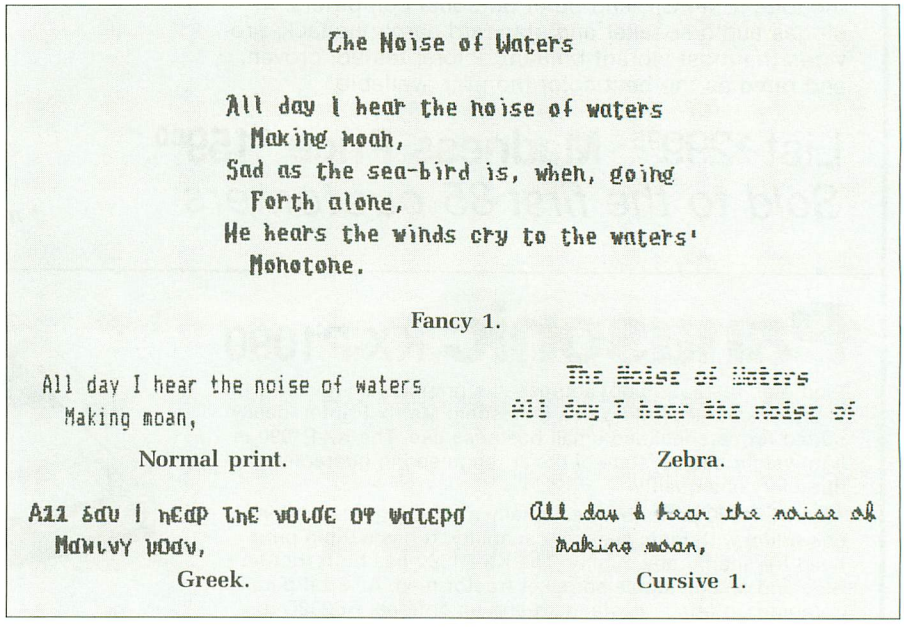
Not wanting to tackle the new character set, I said I'd try out his program, **Megafont II+** by Xlent Software. When he dropped it off, I wasn't too excited. But, when I opened the manual, an idea began to form.

This program was supposed to print different styles of characters on the printer. If **Megafont II+** had a character set I could use, it would save me the trouble of making a new one. As I started to read the manual, I found myself engulfed by the capabilities of this program.

The disk had over ten character sets that I could use without any trouble, including Greek. After reading the manual, I needed only half an hour to get everything printed in script. When I was done, I had time to experiment.

**Megafont II+** is quite a useful program. Not only can it print character sets, it can do graphics dumps in four different sizes. The quality of the dumps is clear, and they can be printed in normal or inverse. The only thing I didn't like about the graphics dumps is that they're limited to graphics 7+ or 8 pictures. It would be better if the program could use a graphics 9 or 11 screen, as well.

Another **Megafont II+** feature is the capability to convert character sets designed on a character set generator such as **Create-A-Font** (**ANALOG Computing**, issue 16). These files are made in about ninety seconds and take seventeen sectors on a disk.




**Sample fonts.**

Another option available is the combining of two fonts. This means that your **Megafont II+** can take a cursive font and combine that with a script font. Then, the program could combine the font it just made with another.

And, for the user's convenience, **Megafont II+** has its own mini-DOS, built into the program. This allows the operator to get a directory, delete and rename files, and perform other DOS functions.

The program is run by menus and is very easy to use. If you don't like to read directions, you shouldn't have to. **Megafont II+** is so well designed that anyone should be able to boot it up and start using it without reading the directions.

Xlent Software did a great job when putting this program together. It has been improved to handle seven printers. It provides three demo pictures to run with the graphics dump program, showing some of the things **Megafont II+** can do. It also has nineteen fonts for the Prowriter and compatible machines, as well as fifteen fonts for the Epson and compatible printers.

The possibilities of this program are endless. I think **Megafont II+** would be a good addition to anyone's library. At $24.95, it's a lot better than some of the other graphics dump programs. □

*A high school junior, Mark Weaver has had his Atari 800 for three years. His main interests lie in graphics and sound, and he hopes to work someday in a computer related field.*

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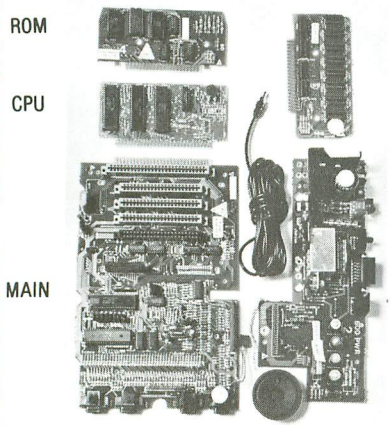


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De Re ATARI (All About ATARI) $15, tells you everything you want to know about the ATARI 400 and ATARI 800 Home Computers, but were afraid to ask. It's an excellent resource and training text for professional programmers who use ATARI Home Computers and for advanced hobbyists who understand ATARI BASIC and assembly language. Neither an introductory manual nor a reference for the computer, De Re ATARI explains the concepts behind the internal structure of the ATARI Home Computer.

Topics include graphics indirection, player-missile graphics, display list interrupts, scrolling, sound, the Operating System, the Disk Operating System, ATARI BASIC and CTIA. Extensive appendices, sample programs, display screens, and diagrams generously illustrate the discussions. A glossary defines and explains some less commonly encountered terms.

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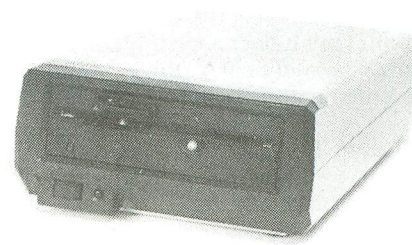

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CIRCLE #116 ON READER SERVICE CARD

**SG-10 PRINTER**
**STAR MICRONICS INC.**
**200 Park Avenue**
**New York, NY 10166**
**$299.00**

## by Jim Van Leeuwen

First and foremost, I bought an **SG-10** because of its value and price. An Epson FX-80 is $150 more than what I paid for my printer. Keep in mind that they're basically the same printer, except for a few differences, some of which are mentioned below.

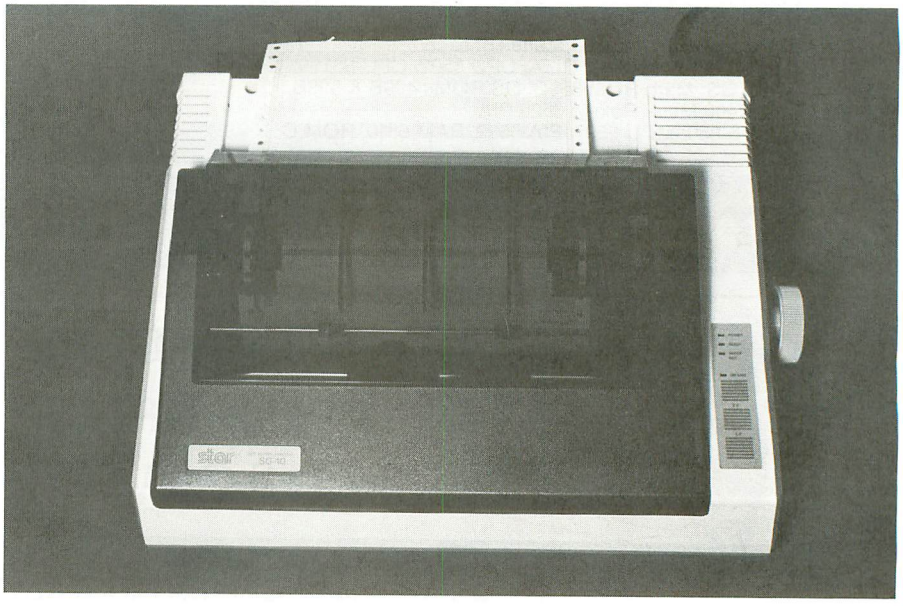
The **SG-10** has all of the features I can possibly need in a printer, and then some. It can print all of the fancy types from A to Z, but it does something that not many other dot-matrix printers can —near letter quality. The print is wonderful!

This feature has the printer make two passes over the line of type. The process takes quite a bit longer to do a job, but it really looks a lot better.

The **SG-10** itself is very quick. It is said to print 160 characters per second (cps) in draft mode, but is really around 120 cps in normal use. The near-letter-quality mode greatly reduces the speed to around 30 cps, but is well worth the wait. There is a 20% increase in speed over its older brother, the Gemini 10X.

When you unpack the **SG-10** from its box, you're ready to print, using both single sheets and fanfold paper. With the Epson, an adjustable tractor feeder is an additional $40. In my opinion, a printer costs enough already; why should you have to pay more? And the **SG-10** can accept paper from 3 inches up to 10 inches wide.

A very nice feature is the ability to use a standard typewriter ribbon (an Underwood spool). They're very cheap and come in a variety of colors. This little capability can soothe your wallet when you use up the ribbon in one day with the **Print Shop**, like I did.



**The SG-10.**

The **SG-10** is a workhorse. Even after several hours of printing, weird things don't happen, as they do on some printers I've seen. According to Star, the average time between failures is around five million lines. The head should last for around one hundred million characters. The **SG-10** also has a better warranty than the Gemini 10X; it is now warrantied for one year.

The printer itself is fairly quiet. It does have the tendency to make some pretty strange loud noises occasionally, but they're not particularly annoying.

One of the main reasons for my buying the **SG-10** was its ability to work with so many existing programs. Compatible with most of the programs designed for Epson printers, it can be used very easily with the **AtariWriter**, with or without a printer driver. And a printer driver is only about $10. Moreover, the **SG-10** is completely compatible with the Gemini 10X, for which a lot of programs were designed.

If you're in the market for a printer with all the features you can get for a reasonable price, the Star **SG-10** really deserves a close look! □

*Jim Van Leeuwen is a high school student in southwestern Ohio. He's been using an Atari for two years, for computer graphics, music and art.*

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by Andrew J. Kennedy, Jr.

**Home Accountant**, a product of Continental Software, has been advertised for quite some time as the preeminent financial software package for the Atari. Why not? After all, **Home Accountant** will do everything you could ever want and more!

Just consider a few of the features described in the user guide: (1) define up to fifty budget categories; (2) keep track of up to five checkbooks; (3) flag transactions for later recall for tax purposes; (4) search, display and edit transactions by date, check number, payee, amount, budget category, memorandum, or any combination of these; (5) split or spread individual transactions over several budget categories; and (6) reconcile bank statements quickly and easily.

On top of all of this, **Home Accountant** has a most impressive array of printed reports, to wit: (1) balance sheets; (2) net worth statements; (3) income and expense summaries; (4) activity reports for all transactions or for only transactions in a given budget category; (5) special reports by search fields; and (6) bar graphs, line graphs and trend analyses.

**Home Accountant** can be tailored for any printer on the market and can make use of the 132-character print capability in those printers which permit it.

As an added incentive, you can even purchase an "Extended Warranty" and obtain help with problems over the telephone through a customer support office. The warranty also allows you to obtain any future updated versions of **Home Accountant**.

The only criticism of the program that I ever read was that it had a tendency to be difficult to use. As a professional computer programmer with over twenty-five years' experience on every machine from IBM and UNIVAC mainframes to small desktop microcomputers, I could hardly be worried by complexity.

Actually, I looked forward to a truly professional program running on my Atari. I really believe that the Atari is the best home computer on the market, but I bristle at the fact that most software written for it tends to be either overly simplistic or "cute."

I looked at most of the other financial programs then available for the Atari, like **Financial Wizard**, but considering all the features and the favorable product reviews, I decided to take the plunge and bought **Home Accountant** in the fall of 1983.

The product and its authors didn't let me down. I was duly impressed. **Home Accountant** did everything it was supposed to. Yes, it is a little complex and it's not cute. There are no fancy sound effects. For the most part, all display screens are the classic white characters on a blue background. For the first six to seven months, it did its job and did it well.

The program saves all transactions to disk, with a limit of about 500 transactions per disk. When a disk fills up, the user simply closes out the full disk and begins using a second. So, when I filled the first disk, I closed it out and set up a second for use through the rest of the year. For several months everything went well, then the trouble began.

While perusing one of **Home Accountant**'s printed reports, I realized that I had made several errors in entering information for some of the transactions on the first "closed out" disk. Since the **Home Accountant** has a search/edit capability, correcting errors should be no problem—even on closed out disks.

But I could not correct the errors. This was clearly a program bug. Now was the time to try out the "Extended Warranty" I'd purchased months before.

I called the customer support office at Continental Software and told them of my problem. They confirmed the problem's existence and said that it had been fixed. They would send me a corrected version if I sent my original disk back.

I was curious as to why the corrected version had not been sent to me automatically when it first came out. My contact at Continental had no answer, and, being easy to please, I didn't press the issue. Instead, I sent them my original disk. Several weeks later, I received the latest version.

The new disk did correct the problem I'd reported, but presented me with a different problem—much worse than the first.

Now, I couldn't search transactions on every field and, therefore, couldn't display data after it was entered. Again, I called the customer support office and was told (believe this if you can) that, yes, there was a new problem, but it was fixed just that morning. They would send me a new disk correcting all of the problems.

About two weeks later, I got my new disk. With much anxiety, I sat down at my Atari to check this, the third version, out.

Eureka! All bugs were corrected. I tried out everything, even features I'd never used before. They worked. Congratulations to Continental Software. I was back in business.

But no. . .wait. **Home Accountant** was now slow. I mean *really* slow. It took 10 to 15 seconds per transaction. Once again, I called customer support.

Yes, they said, it was slow. The author made it that way intentionally, and they didn't have a fix. If he ever gets around

to making it fast again, they would send me the new version, since I had purchased the "Extended Warranty."

That was hard to believe, since the only versions I ever received were the ones I got when I complained. Nothing was ever automatic. In a couple months, I'll call to see if a new version is out.

But, for the time being, I wouldn't recommend **Home Accountant** to anyone. You'll either purchase a fast version with errors or a very slow, error-free version. Could it be that the author is more interested in the PC version and cannot be bothered with fixing a lowly Atari program? □

*Andrew J. Kennedy, Jr. graduated from Syracuse University and has worked in the ADP field for twenty-three years. A Computer Specialist with the National Oceanic Services in Rockland, Maryland, he bought his Atari 800 in 1982.*

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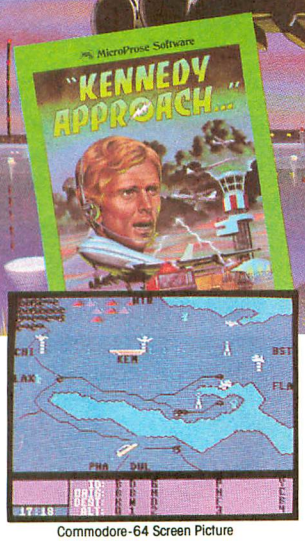


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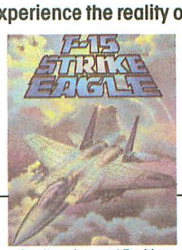


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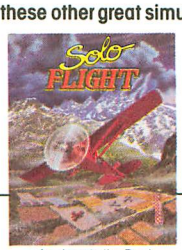


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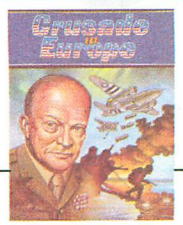


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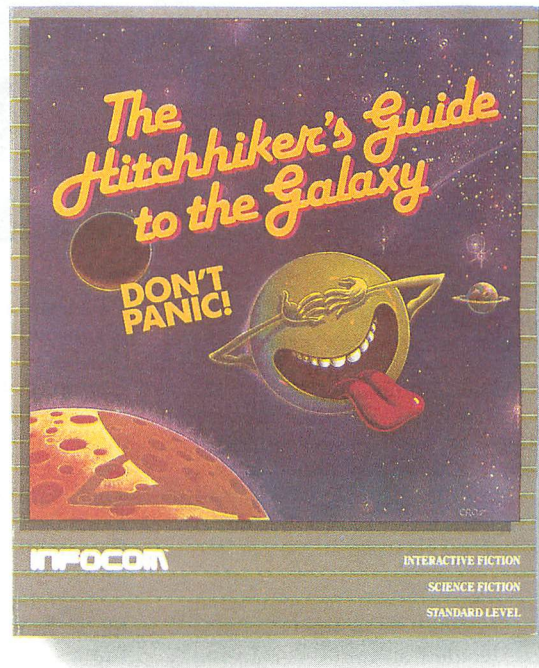


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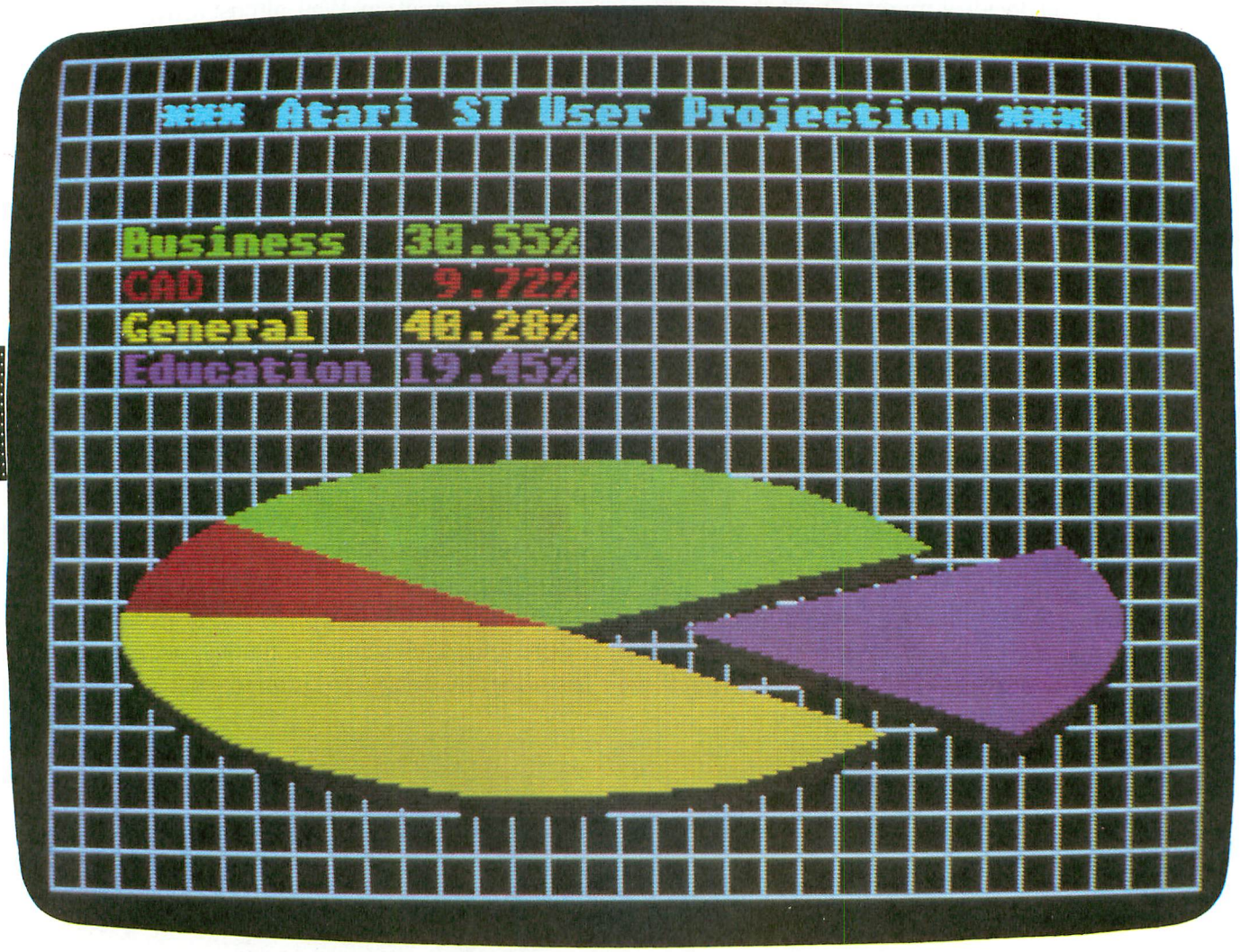



by Tom Hudson

In **ANALOG Computing**'s issue 32, there was an article describing my first impressions of Atari's new 16-bit ST computers. The article contained several short sections of a C listing which used GEM (Graphics Environment Manager) subroutines to generate a simple pie chart.

At that time, we were not sure what could be revealed about the GEM system, and decided to limit our printing of GEM application source code listings until the ST was released.

At the time of this writing, the ST has been shipping for two weeks, and users are already hoping to see more software available for their computers. It's on the way from several software publishers and, of course, **ANALOG Computing**. This issue starts our coverage of ST programs with a complete dissection of a GEM application, written in the C programming language.

C is widely used in software development for many computer systems, primarily because it's highly "structured." That is, programs can be built up from many parts, programmed by several programmers and compiled into the final form very easily.

C can be used on many different systems, from microcomputers to mainframes, and the code is standardized so that a program written for a microcomputer in C can be compiled and run on a mainframe, with very little conversion required.

All this would mean very little if the programs written in C were slow. Fortunately, C compiles very efficiently into the machine language of the computer it's running on, producing object code that operates very quickly.

The version of C that the pie chart demo is written in is Digital Research's C/68K. This C compiler produces 68000 assembly language source code, which is then assembled and "linked" with other required object files, to produce an executable program.

Your C compiler may vary slightly from the C/68K compiler, but the pie chart should transport to another compiler, such as Haba Systems' "Hippo C," with very little trouble.

### A recipe for pie.

The pie chart demonstration program, while very primitive as GEM applications go, is a good way to get familiar with C and the C "bindings" for GEM. A "binding" is a standardized procedure used to call a subroutine. For subroutine

ST

# Easy as Pie
# PIE CHART DEMO

520ST

calls in C, the programmer must provide certain parameters used by the subroutine.

The GEM Programmer's Guide lists each GEM subroutine, along with the parameters required and returned by the routine. If you follow the requirements of each function when making GEM system calls, you can perform many functions very easily, with very little programming effort.

Unlike a "true" GEM application, the pie chart will only operate in the system's low-resolution mode (320 by 200 pixels, in 16 colors). With a little extra effort, the pie chart program could be converted so that it would run in all three graphics modes supported by the ST.

The pie chart demo doesn't use windows or icons, either. The use of these will be covered in a future issue.

**On with the dissection!**

The first three lines of the pie chart demo program (note that C/68K doesn't use line numbers) are "comments." Comments in C are denoted by the use of the /* characters at the beginning of the comment, and */ at the end. Everything between /* and */ is ignored by the C compiler. As with programming in any language, you ought to use the comments function whenever possible, especially if the purpose of a section of code is unclear.

The first statement processed by the C compiler is the *#include "portab.h"* command. This tells the compiler that the file "portab.h" is to be read in and treated as a part of the C source code we've written. This file contains several convenient equates, most of which are not used by the pie chart program.

The next five statements tell C to reserve five data storage areas which GEM uses to communicate to the calling program. Each of these items is a numeric array, ranging in size from 12 to 128 "words" (2-byte storage locations). The "int" declaration tells C that these locations will be used to store 2-byte "integer" values.

The next line tells C that we're defining a program section called "main." Processing always starts at main when a program is executed. You'll notice that the main declaration is followed by a set of empty parentheses. These will let the compiler know that the main routine doesn't require parameters. In future C programs, we'll see how to set up modules which use parameters.

The next line has a single, opening brace character, which tells the C compiler that this marks the beginning of the code that makes up the main() section. If you skip ahead to the end of the program listing, you'll see a closing brace, which marks the end of the main() section.

The next seven lines define the various variables used by the pie chart program. Most of these are 2-byte integers or integer arrays, but the final "variable" is a character array called "title." This holds a text string used by the program later.

The next statement, *appl_init()*, is a GEM call which tells GEM to initialize for this application. This is a necessary call to get your applications rolling.

The following three statements get the "handle" of the current application and clear the screen. A "handle" is a unique identifier assigned to your application by GEM. In this case, we're asking GEM to tell us what the handle for the current application is.

Parameters *&gr_1*, *&gr_2*, *&gr_3* and *&gr_4* tell GEM where to place information on size of the current character font. The pie chart program doesn't use these variables. The *graf_handle* call returns the value of the current handle and places it in the variable we set up and called "handle."

The next statement after the *graf_handle* call, *v hide c(handle)*, tells GEM to hide the cursor. Note that, from this point on, nearly every GEM call passes the handle to GEM. Since GEM can be running several applications at once, it must know which application is requesting an operation, and the handle is used for this purpose. After this call is executed, the mouse cursor is erased from the screen.

The third call in this sequence, *v clr wk(handle)*, clears the screen. This is a very straightforward command and prepares the screen for our use.

At this point, we're ready to open a "workstation." This process assigns our application its own handle, allowing it to perform graphics calls without disturbing any other application.

To open a workstation, the programmer must set up an array of values which tell GEM what kind of workstation is being opened. The next four lines of the program set up the *1 intin* array with the proper values.

The first value, placed in *1_intin[0]*, is a *1*. This tells GEM that we're using device 1, or the screen. The next eight values are set to *1* (these set default line

types, color indexes, and so on). The last index, number ten, is set to *2*, indicating that we're using the "realworld coordinate" system.

GEM has an option for what's known as a "Normalized Device Coordinates" function, which automatically scales device output to whatever device is in use (screen, plotter, printer, and so forth). The use of this feature will be covered in a future issue.

Finally, after all the values in the *1__intin* array are initialized, a *v opnvwk* (open virtual workstation) call is issued, with *1__intin* as the first parameter.

Since we're opening up a new workstation, GEM returns the handle of the application to the second parameter (& handle) and places information about the device we just opened (the screen) in the *1__out* array. At this point, our application is initialized, opened and ready to go.

The next three sections of code, set apart by command lines, tell GEM to set the screen colors to the values we want. This is done by setting the red, green and blue color values for each color register we want to change.

The *rgb__in* array will be used, with the red component going into *rgb__in[0]*, the green into *rgb__in[1]*, and the blue into *rgb__in[2]*. The range of values in each of these locations is from 0 to 1000, with 0 indicating dark and 1000 light. There are 8 brightness levels available, but GEM has been designed to handle up to 1000.

To make the screen background black, all the color levels are set to *0*, the color index is set to *0* (background) and a call is made to the GEM *vs__color* routine.

Next, we want to set color 1 to gray, so all the *rgb__in* values are set to 400. This gives a 40-percent white, or a dark gray. The "index" variable is set to *1*, indicating that we want color register 1 set.

Finally, we want to set color number 8 to white, so all *rgb__in* input values are set to *1000*, and the *vs__color routine* is called. Note that this call places the color register number *(8)* directly in the function statement, rather than in the index variable. This saves some time, as well as typing.

Now that all the colors are set the way we want, we'd like to draw a white grid on the screen for a nice background. We have defined color register 8 as the white register, so we set the "color index" variable to *8*. We then call *vs color* to tell GEM that we want to draw with register 8.

To draw the grid, we'll use the line-drawing capability of GEM. This will utilize the *pxyarray* array to hold the endpoints of the line. Index 0 holds the starting X-coordinate, and index 3 holds the ending Y-coordinate. A line is drawn by simply calling the GEM *v pline* function with the number of endpoints *(2)* and the array holding the endpoint information *(pxyarray)*.

To make the grid look even on the screen, we plot the first line manually from 0,0 to 319,0. We then enter a for-loop which alters the Y-coordinate and plots a line every 10 Y-units.

Next, the process is repeated, but we draw the vertical lines of the grid pattern.

Now, it's time to draw the pie chart itself. Fortunately, the GEM subroutines include routines for the generation of circles, ellipses and pie wedges, both filled and outlined. Our pie chart will, of course, use the filled pie option.

We start the pie-drawing sequence by setting the "fill" color to register 1, the register we set to gray earlier. The filled circle, ellipse and pie functions all use the fill color when they draw. GEM is extremely flexible in the area of color selection and allows many options.

To draw a pie wedge, you specify the X- and Y-coordinates of the center of the wedge, the starting and ending angle of the wedge in tenths of degrees (0-3600), and the X- and Y-radii. You can generate round or elliptical pie charts with equal ease.

Our pie chart is an elliptical one, with an X-radius of 120 pixels and a Y-radius of 40 pixels. The main pie shadow is centered at the coordinate 140,140 and ranges from 30 to 320 degrees. The *v ellpie* function call draws the main pie shadow on the screen.

To show a particular piece of data, a section of the pie is to be displayed as "pulled out" from the rest. So next, we plot the shadow of this piece of pie, the X-coordinate shifted to 178. To match the main pie shadow, this piece ranges from 320 degrees *(begang = 3200)* to 30 degrees *(endang = 300)*. We plot it in the same manner.

Now we're ready to plot the multi-colored slices of the pie, starting with the pulled-out section (after all, its parameters are still in the variables, and all we have to do is move it up and change its color).

The color is changed with a *vsf color* call, which sets the color to index number *12*. The Y-coordinate is moved up from *140* to *135*, and the slice is plotted. Hardly any work at all, is it?

The other segments are plotted in a similar fashion, in colors 3, 2 and 6, with their angles going from 30-140 degrees, 140-175 degrees and 175-320 degrees, respectively. These calls are all very similar and easy to use.

Now, the pie chart itself is complete, and we're ready to label it. GEM has a fantastic variety of ways to show text, in any color. I was told that, when the pie chart demo in issue 32 was shown at the Consumer Electronics Show, many people said it wasn't done on an ST, because "That isn't the ST's text!"

Sorry to disappoint those doubting Thomases, but the ST can scale its text to about twenty sizes, in styles ranging from normal to italicized, to half-tone, to outline. I simply used the "Set Text Special Effects" function, *vst effects*, to make the text bolder than normal, and *voila!*—a different style of text.

The first line in the chart labeling section of the program set the text color to that contained in color register 5, which is cyan, or light blue. This will be used for the title.

The function which sets the text color is the *vst color* function. It works just like the other color-setting functions. All you have to provide is the color register number.

The next line sets the infamous "Text Special Effects" option of GEM. The value of *1* used in this call tells GEM to use the thickened text option. All told, there are six options, which can be mixed and matched as desired. These are: thickened/not thickened, normal/light intensity, skewed/not skewed, underlined/not underlined, outlined/not outlined and shadow/no shadow.

Next, the title is plotted to the screen using the "Justified Text" function. This function plots your text (in this case, the text stored in the "title" string defined at the start of the program), starting at a certain X- and Y-coordinate (30,17), for a certain pixel count (290), and tells GEM whether or not it can adjust the inter-character or inter-word spacing (the *1,1* at the end of the parameter list tells GEM that it can modify both). GEM will attempt to make the text fit exactly between 30,17 and 290,17.

The next four groups of commands set the text color to the various pie slice

colors (3, 2, 6 and 12) and plot the chart's sectional subtitles, using the graphic text *v qtext* function.

This function simply plots the specified text starting at a particular X- and Y-coordinate (for the "Business" text, the text starts plotting at the coordinates 20,47). This process is repeated for each pie section's subtitle and percentage readout.

The program's designed to plot the pie chart and wait for a key to be pressed, so we must monitor the keyboard. The first thing to do is tell GEM that we want to wait for input, rather than grab it "on the fly."

This is done with the *vsin mode* command. Our call to GEM tells it to set the keyboard string input (number 4) to request data *(1)*, waiting until a carriage return is encountered or the input array is full.

The actual input is done with the *vrg string* function, which, in this case, tells GEM to get one character *(1)*, don't echo it to the screen *(0)*, and provides dummy values for the echo location (which we don't use) and the string itself, which we aren't concerned about, either.

The *vrg string* command, when configured in this manner, will wait until *one* key is pressed on the keyboard, then continue.

Once a key is pressed, the program will return to the GEM desktop screen. Before this is done, we must return the color palette to its previous state, that is, the background must be set to white, and color register 1 must be set to black. Color register 8, which we set to white at the beginning of the program, isn't critical and is left as is.

Now that everything's back to its proper setting, we must close the workstation and return to the GEM desktop screen.

The first operation necessary to accomplish this is to close the workstation we're using, with the "Close Virtual Workstation" call. This is simply the statement *v clsvwk(handle)*. This tells GEM it no longer has to keep track of the information it was keeping on our application.

Next, we do an *appl exit()* call, to let the application library routines clean up when an application is through processing.

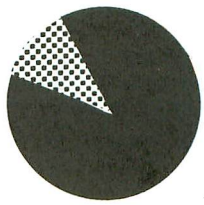
Finally, the *exit(0)* call exits back to the GEM desktop screen.

### That's it!

In a nutshell, this program gives you the information that's necessary to write a rudimentary GEM application in the C programming language. In future articles, we'll look at how you can build your own windows, pop-down menus and other fancy structures.

Until then, try typing this program in on your ST, compiling it with C and playing around with it. You'll need a good C compiler, an editor, a linker-relocater and the GEM linker files.

And, remember, if you're intending to do any serious GEM development work, get the documentation package from Atari. □



```
/*  Pie Chart Test 3/29/85    */
/*       by Tom Hudson        */
/* ANALOG Computing Magazine */

#include "portab.h"

int contrl[12];
int intin[128];
int ptsin[128];
int intout[128];
int ptsout[128];

main()

{

int handle, i, pxyarray[12], l_intin[11], l_out[57];
int index, rgb_in[3], dum1[2], dum2[6];
int x, y, xradius, yradius, begang, endang;
int set_color, set_effect, color_index;
int gr_1,gr_2,gr_3,gr_4;
int set_mode;
static char title[] = "*** Atari ST User Projection ***";

appl_init();

handle=graf_handle(&gr_1,&gr_2,&gr_3,&gr_4);
v_hide_c(handle);
v_clrwk(handle);

/* open workstation */

l_intin[0] = 1;
for (i = 1; i < 10; i++)
  l_intin[i] = 1;
l_intin[10] = 2;
v_opnvwk(l_intin, &handle, l_out);

/* set backgnd color to black */

rgb_in[0] = 0;
rgb_in[1] = 0;
rgb_in[2] = 0;
index = 0;
vs_color(handle, index, rgb_in);

/* set color 1 to gray */

rgb_in[0] = 400;
rgb_in[1] = 400;
rgb_in[2] = 400;
index = 1;
```

*(Listing continued on page 102)*

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☆ ☆ **$12.95** ☆ ☆

# ATARI

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|---|---|---|
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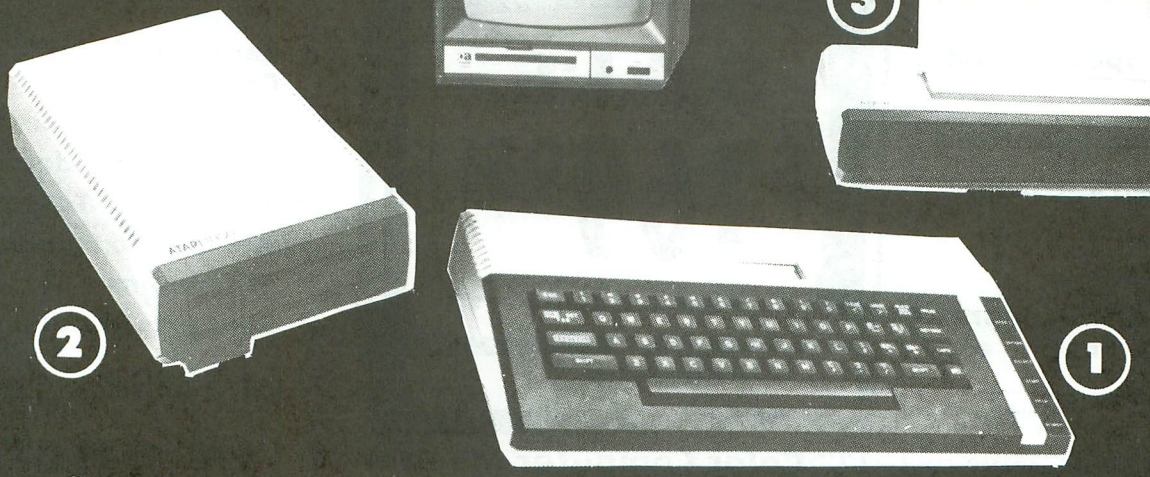


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*Connecting cable $9.95

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***15 Day Free Trial - 90 Day Immediate Replacement Warranty***

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List $399.00 **10" Printer**

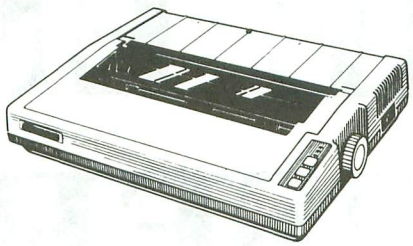
SALE **$179.00** SALE

**10" Comstar 10X** — This Bi-directional Tractor/Friction Printer prints standard sheet 8½"x11" paper and continuous forms or labels. High resolution bit image graphics, underlining, horizontal tab setting, true lower descenders, with super scripts and subscripts, prints standard pica, compressed, expanded, block graphics, etc. Fantastic value. (Centronics parallel interface.)
List $399.00. **Sale $179.00.**

*1 Year Warranty*

**120-140 CPS**

*Premium Quality*



List $599.00 **15½" Printer**

SALE **$249.00** SALE

**15½" Comstar 15X** — Has all the features of the 10" Comstar 10X plus a wider 15½" carriage and more powerful electronics to handle large ledger business forms! (Better than FX-100). The 15½" Comstar 15X also prints on standard size paper and continuous forms and labels. Fantastic value. (Centronics parallel interface.)
List $599.00. **Sale $249.00.**

List $499.00 **10" Printer**

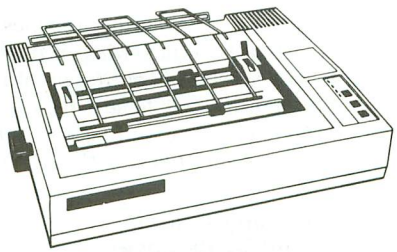
SALE **$229.00** SALE

**10" Comstar 160+ High Speed** — This Bi-directional Tractor/Friction Printer combines the above features of the 10" Comstar 10X with speed (150-170 cps) and durability. Plus you get a 2K buffer, 96 user definable characters, super density bit image graphics, and square print pins for clearer, more legible print (near letter quality). This is the best value for a rugged dependable printer. (Centronics parallel interface.)
List $499.00. **Sale $229.00.**

*1 Year Warranty*

**150-170 CPS**

*High Speed*



List $699.00 **15½" Printer**

SALE **$299.00** SALE

**15½" Comstar 160+ High Speed** — This Bi-directional Tractor/Friction Printer has all the features of the 10" Comstar 160+ High Speed plus a wider 15½" carriage and the heavy duty electronics required for today's business loads. You can use large ledger business forms as well as standard sheets and continuous forms and labels. This is the best wide carriage printer in the U.S.A. (Centronics parallel interface.)
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List $599.00 **10" Printer**

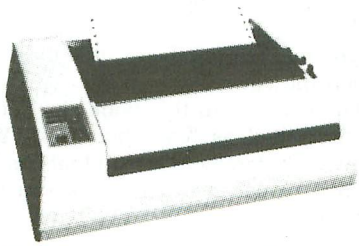
SALE **$259.00** SALE

**10" Comstar 2000** — The ultimate printer has arrived! This Bi-directional Tractor/Friction Printer gives you all the features of the Comstar 160 plus higher speed (165-185 cps), 256 downloadable characters, proportional setting, external dark printing mode and a *lifetime printhead warranty. **PLUS** ...

*Lifetime warranty**

**165-185 CPS**

*High Speed & Letter Quality*



List $599.00 **10" Printer**

SALE **$259.00** SALE

With the flip of a switch you can go into the letter quality mode which makes all your printing look like it came off a typewriter. Turn in term papers, do articles or just print programs. Have the best of letter quality and speed in one package. Fantastic printer (Centronics parallel interface.)
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CIRCLE #122 ON READER SERVICE CARD

# THE END USER

## THIS MONTH:
## A book, a disk and some music.

by Arthur Leyenberger

*As the heart of autumn approaches, a slight chill and a quickening of pace can be felt. October's a beautiful month, especially here in New Jersey. It's also a very busy time. This month's* ***End User*** *is no different—very busy, with a lot to be done.*

### Judging a book . . . not by its cover.

I recently obtained a book titled *Presenting the Atari ST: An In-depth Look at the Sensational New Computer that Promises to Bring You "Power Without the Price."* Aside from winning an award for longest title, this book also gets the award for being the first available book concerning the new Atari ST.

One of the ways that I judge a book is simply by seeing if it has an index. Well, this one certainly has, but it won't do you much good: there's little meat between the covers.

The material in this book can better be described as "carbohydrates." You know, that starchy foodstuff that has little nutritional value, yet fills you up. But, not long afterward, you're left feeling hungry again.

Published by Abacus Software, this double-spaced, $14.95 book is composed of very general information. Topics include: why a 16-bit processor is better than an 8-bit one (hint: it's faster and can address more memory), the Motorola MC68000 microprocessor instruction set, benefits of a hard disk, etc.

My gripe is that very little ST-specific information is given by authors English and Walkowiak. Some of the information here has already changed, like the 520ST's having an RF modulator for TV output; it doesn't. Or GEM's and TOS's (The Operating System) existing in the ROM; they don't at this time.

Granted, if you were a novice, you might learn some basic facts, like the difference between a serial and parallel interface. But, if you want to learn about the Atari ST, I'd recommend that you: (1) get the Atari ST brochure; (2) get the Motorola 68000 spec sheet; and (3) look at the last few issues of **ANALOG Computing**. If you do all three, you'll probably know more than if you had read this book.

While on the subject of books, I see in my fall catalog of Osborne/McGraw-Hill's new titles that there are two offerings of interest to ST owners. *The Atari ST User's Guide* by John Heilborn (at $15.95) and *Programming the Atari ST: The Advanced Guide* also by Heilborn ($19.95) will, no doubt, be more meat than potatoes.

You'll recall that McGraw-Hill's *Your Atari Computer* by Poole, McNiff and Cook is one of the two definitive books on Atari 8-bit computers. Although I've not yet seen either of these two new books, I know that this is a class publisher. No doubt these books will fulfill a need.

### A better DOS.

There's an old saying that someone will always build a better mousetrap.

*Arthur Leyenberger is a human factors psychologist and free-lance writer living in New Jersey. He has been an Atari enthusiast for four years. When not computing, he enjoys playing with robotic toys.*

ICD will certainly be catching more than mice with their new **SpartaDOS Construction Set (SDCS)**. **SpartaDOS** has been around for a while, and it's the only DOS for the 8-bit Atari computers that allows you to create subdirectories and date-and-time-stamp your files.

The new **SDCS** starts with many of the older version's features and builds onto that. The more I use this DOS, the better I like it.

**SDCS** sells for about $40 and consists of two "master" disks. The one with the grape-colored label is intended for the old 400/800 computers, whereas the one with the gray label is meant for XL and XE equipment, and offers more functions. If you have an Atari 130XE, then you'll really appreciate the features of **SDCS** (more on that in a bit).

**SDCS** is available for about $70 when purchased with the US Doubler Chip that turns your 1050 disk drive into a true double-density drive.

**SDCS** will work either in menu mode or in what ICD calls the "command processor mode." Here, all DOS commands must be issued directly. There's no menu to choose from, and you pretty much have to know what you're doing. But there's little wasted time searching for the right menu command, and more room is available on the screen.

In some ways I prefer the menu mode, because there are some features in it that can't be performed any other way. After **SDCS** is booted and at the *D1:* prompt, you simply type *menu*, and in a few seconds the menuing system is loaded.

The menu mode consists of multiple pages with five commands across the bottom of the screen. There are four columns showing the filename, extension, protection status (similar to the Atari DOS LOCK and UnLOCK parameters) and size.

The first column contains a horizontal pointer that's labeled *select*. This pointer or cursor is moved up and down with the cursor control keys (no need to hold down the CTRL key).

On the first menu page are the command files, copy, erase, rename and exit. One of the most useful features of this DOS is the ability to tag files for copying or erasing. If you wanted to erase or copy all of the files on a disk, some DOS systems would let you use wild cards, such as *D1:**.*. This would be fine if you wanted to, say, copy all of the files from drive 1 to drive 2.

But what if you wanted to copy only four of the ten files on the disk, and their names were such that no combination of wild cards would let you do it in one operation?

Using the tag feature of **SDCS**, you would move the cursor down the filenames displayed on the screen, and you would hit the SPACE BAR to tag files. Filenames so indicated then switch to inverse video, to let you know they've been tagged. Once all of the filenames to be copied have been singled out, you would press RETURN, respond to the *Destination Drive?* prompt, and your files would be copied.

Erasing files works in a similar way. Tag the files, then issue the command. Nifty, I'd say.

The SELECT key moves the bottom cursor through displayed commands, and the OPTION key brings up a new menu page with different commands at the bottom of the screen.

The HELP key is actually used to provide on-line descriptions of what various commands do. Besides five screens available in menu mode, additional commands can be issued from the keyboard and executed directly.

One of the most useful commands for 130XE owners or those with the Axlon RAMPOWER card in their old 800, is the ramdisk command. A ramdisk is nothing more than the simulation of a disk drive in the RAM memory.

Advantages are the speed at which files can be written to the "electronic" disk drive and the necessity for only one physical disk drive. The main disadvantage is that, when the computer's power is turned off, the contents of that memory are lost.

**SDCS** not only allows you to use the extra memory in the 130XE as a ramdisk, but you can also designate it to be whatever drive number you want. Simply typing *RD130D4:* will assign the extra memory as a ramdisk labeled *drive 4*. This will give you about 507 free sectors. There's also a command to install a ramdisk for use in conjunction with the internal BASIC language of the XE computer.

What else do I like about the **SDCS**? It lets you create and use subdirectories,

label your disks with a volume label, and restore your deleted files with its unerase command.

It also has a built-in RPM speed check for your disk drives, a batch file creation utility for chaining DOS commands, the ability to time-and-date-stamp your files (either by using the internal clock or with an add-on real-time cartridge), a binary file loader routine, and the ability to use DOS functions from within BASIC.

As I said before: the more I use it, the more I like ICD's **SpartaDOS Construction Set**. It could easily be the ultimate DOS for the 8-bit Atari computers.

### DOS woes.

Speaking of DOS, I've got this bee in my bonnet. . . Lately, I've been very frustrated with the copy command of Atari DOS 2.0. Unlike some other DOS systems (SWP's MYDOS, Eclipse's TOPDOS or ICD's SpartaDOS), it doesn't allow you to type more than one character on the command line.

So you end up having to type C, RETURN, then the name of the file you want to copy. Not only that, but you have to type the entire filename for the destination file.

For example, let's say I want to copy ARTFILE1 from drive 1 to drive 2. I'd like to be able to enter something like *D1:ARTFILE1, D2:*. But, oh no. I can't even specify the destination filename as *D2:*.*, since Atari DOS 2.0 will tell me wild cards aren't allowed in the copy command.

What brought this on was my surprise when I tried to perform the same operation in Atari DOS 2.5. Sure enough, the same constraints were present in Atari's latest DOS.

I would have thought that the new DOS 2.5 would have been fixed, in order to make it a little more friendly to the user. I guess not. When are these companies going to learn that current users are more sophisticated? We expect more from the products we buy.

### I've got the music in me.

I'm an amateur musician and have always loved all kinds of music. When I first purchased my Atari years ago, I bought the Atari **Music Composer** cartridge.

Like many other people, I was thrilled that my computer could actually play music. Just as exciting was the ability to alter the music, compose tunes and recreate my favorite songs.

Still, there was one problem that always bothered me with this program, the APX **Advanced Music System** and others: the drudgery of entering the music. I spent hours entering data for relatively simple tunes. There had to be a better way! Well, there is: MIDI (Musical Instrument Digital Interface).

*(continued on page 50)*

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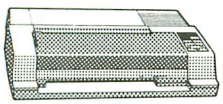
# Marketing & Consultants

## SAVE ON THESE IN STOCK PRINTERS



### AXIOM
| | |
|---|---|
| GP550AT (Atari) | 239 |
| GP550CD (C-64) | 239 |
| GP550PC (IBM) | 229 |
| GP550AP (Apple) | 269 |
| GP700AT (Atari) | 439 |
| GP700AP (Apple) | 439 |
| ELITE5CD (C-64) | 229 |
| GP100AT (Atari) | CALL |

### C. ITOH
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|---|---|
| PROWRITER 8510AP | 279 |
| 8510AP+ | 299 |
| 8510BPI | 309 |
| 8510SP | 375 |
| 8510SR | 425 |
| 8510SCP | 449 |
| 8510SCR | 469 |
| 7500AP | 205 |
| 7500AR | 245 |
| 1550P | 439 |
| 1550AP+ | 459 |
| 1550BCP | 469 |
| A10-30P | 445 |
| F10-40P or S | 859 |
| F10-55P or S | 1039 |
| F10 Tractor | 159 |
| F10 Sheet Feeder | 249 |

### CARDCO
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|---|---|
| 32K BUFFER..(C-64) | 59 |

### CITIZEN
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|---|---|
| MSP-10 | 289 |
| MSP-15 | 449 |
| MSP-20 | 449 |
| MSP-25 | 569 |
| Sheetfdr (10/20) | 189 |
| Sheetfdr (15/25) | 199 |

### CORONA
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### EPSON
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| LX80 (NEW) | 225 |
| FX80+ | 349 |
| FX100+ | 479 |
| JX80 Color | 489 |
| RX100 | 369 |
| HOMEWRITER 10 (New) | CALL |
| CR220 (C-64) | 159 |
| LQ1500 Par | 999 |
| LQ1500 Ser | 1059 |
| HI80 Color Plotter | 379 |

### JUKI
| | |
|---|---|
| Juki 6100 | 375 |
| RS232 Serial Board | 55 |
| 6100 Tractor | 119 |
| 6100 Sheet Feeder | 209 |
| Juki 6300 | 765 |

### OKIDATA
| | |
|---|---|
| Okimate 10 | CALL |
| Okimate 20 | CALL |
| 182 | 215 |
| 192 | 349 |
| 193 | 565 |
| 92P | 349 |
| 93P | 565 |
| 84P | 645 |
| 92 Imagewriter | 349 |

*IBM versions also

### BROTHER
| | |
|---|---|
| HR-15XL-P | 359 |
| HR-15XL-S | 359 |
| HR-35P | 839 |
| HR-35S | 839 |
| 2024L-P | 949 |
| M1009-P | 189 |

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| 880 | 199 |
| 1080 | 225 |
| 1380 | 265 |
| 1385 | 299 |

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| 16K BUFFER | 75 |
| 32K BUFFER | 89 |
| 64K BUFFER | 125 |

### TOSHIBA
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|---|---|
| P1340 | 559 |
| P351 | 1289 |

### MICROBITS
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| Microstuffer | 99 |

### DIABLO
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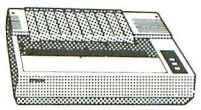
| D25 | 549 |
| 630API | 1599 |
| 630ECS | 1759 |
| D801F | 2395 |
| P32CQ1 | 699 |
| P38 | 1749 |
| C150 | 999 |



### PANASONIC
| | |
|---|---|
| ***1091*** | ***239*** |
| 1090 | 185 |
| 1092 | 375 |
| 1093 | 429 |
| 3151 Letter | 429 |
| 4K Buffer | 65 |

### SILVER REED
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|---|---|
| EXP400 | 249 |
| EXP500 | 295 |
| EXP550 | 409 |
| EXP770 | 749 |

### STAR MICRONICS
| | |
|---|---|
| ***SG-10*** | ***215*** |
| SG-15 | 375 |
| SD-10 | 339 |
| SD-15 | 445 |
| SR-10 | 485 |
| SR-15 | 585 |
| Powertype | 305 |
| SB-10 | CALL |
| SG-10C-64 (NEW) | CALL |

## MONITORS

### TAXAN
| | |
|---|---|
| 115 12" Green Composite | CALL |
| 116 12" Amber Composite | CALL |
| 121 12" Green TTL | 135 |
| 122 12" Amber TTL | 145 |
| 220 14" Color Composite | 259 |
| 410 12" RGB Hi Res IBM | 329 |
| 420 12" RGB Super Hi IBM | 409 |
| 440 12" RGB Ultra Hi Res | 569 |
| Tilt Stand | 35 |

### SAKATA
| | |
|---|---|
| SG1000 12" Green | 99 |
| SA1000 12" Amber | 109 |
| SG1500 12" Green TTL | 119 |
| SA1500 12" Amber TTL | 129 |
| SC100 13" Color Comp | 209 |
| SC200 13" RGB | 389 |
| STSI Tilt Stand | 29 |

### PANASONIC
| | |
|---|---|
| DT 1300 RG1 composite | 299 |

### NEC
| | |
|---|---|
| JB-1260 Green | 95 |
| JB-1201 Green | 135 |
| JC 1215 Color | 235 |
| JC 1216 RGB | 375 |
| JC1460 Color | 265 |
| JB-1205 Amber | 139 |

### PRINCETON GRAPHICS
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|---|---|
| MAX-12 Amber | 189 |
| HX-12 RGB | 475 |
| SR-12 RGB | 599 |

### ZENITH
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|---|---|
| ZVM 122A Amber | 84 |
| ZVM 123G Green | 75 |
| ZVM 124 Amber IBM | 129 |
| ZVM 131 Color | 275 |
| ZVM 133 RGB | 389 |
| ZVM 135 Composite | 449 |
| ZVM 136 Hi Res Color | 589 |

### X-TRON
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|---|---|
| Comcolor I Composite Green | 185 |

### AMDEK
| | |
|---|---|
| 300 Green | 125 |
| 300 Amber | 139 |
| 310 Amber IBM | 155 |
| Color 300 Audio | 245 |
| Color 500 Composite | 369 |
| Color 600 | 429 |
| Color 700 | 495 |
| Color 710 | 569 |

## MODEMS

### HAYES
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|---|---|
| SMARTMODEM 300 | 139 |
| SMARTMODEM 1200 | 379 |
| SMARTMODEM 1200B | 349 |
| SMARTMODEM 2400 | 599 |
| MICROMODEM IIE | 135 |

### ANCHOR
| | |
|---|---|
| Volksmodem | 55 |
| Volksmodem 12 | 186 |
| Mark 12 | 229 |

### MICROBITS
| | |
|---|---|
| MPP100E (ATARI) | 75 |

## DRIVES

INDUS
Atari
215

## PRINTER INTERFACE

### AXIOM
| | |
|---|---|
| AT846 (Atari) | 65 |

### ATARI
| | |
|---|---|
| 850 Interface | 109 |

### DIGITAL DEVICES
| | |
|---|---|
| ApeFace XLP (Atari) | 49 |
| U-Print A (Atari) | 54 |
| U-CALL RS232 (Atari) | 37 |

### CARDCO
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|---|---|
| C/?AT (Atari) | 49 |

## DISKETTES

### SKC (Box 10)
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| 5¼" SSDD | 13.75 | 12.99 | 11.99 |
| 5¼" DSDD | 15.75 | 14.99 | 14.25 |

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| 5¼" SSDD | 14.99 | 13.99 | 12.99 |
| 5¼" DSDD | 16.99 | 15.99 | 14.99 |
| Premium SSDD | 15.95 | 14.95 | 13.95 |
| Premium DSDD | 17.95 | 16.95 | 15.95 |

### MAXELL (Box 10)
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|---|---|---|---|
| 5¼" MD-1 | 16.75 | 15.75 | 14.75 |
| 5¼" MD-2 | 22.99 | 21.99 | 20.99 |

## ATARI SOFTWARE

### ATARI
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|---|---|
| 800XL | CALL |
| 130XE (NEW) | CALL |
| 520ST (NEW) | CALL |
| 1050 Drive | 165 |
| 1010 Recorder | 42 |
| 1020 Printer | 55 |
| 1025 Printer | 159 |
| 1027 Printer | 179 |
| 850 Interface | 109 |

### ATARI SOFTWARE (NEW)
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|---|---|
| Codewriter | 35.75 |
| Filewriter | 20.75 |
| Reportwriter | 20.75 |
| Menuwriter | 20.75 |
| Home Integrator | 19.75 |
| Small Bus. Inventory | 11.75 |
| Salesman Expenses | 11.75 |
| Accs Rec/Pay | 11.75 |
| Retail Invoice | 11.75 |
| Final Legacy | 15.75 |
| Adventure Writer | 18.75 |
| Star Voyager | 11.75 |

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|---|---|
| Kennedy Approach | 21.75 |
| Crusade in Europe | 24.75 |
| Decision in Desert | 24.75 |
| Solo Flight | 20.75 |
| Nato Commander | 20.75 |
| Spitfire Ace | 18.75 |
| F-15 Strike Eagle | 20.75 |
| Hellcat Ace | 18.75 |

### SUB LOGIC (Atari)
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| ***Flight Simulator II*** | ***32.75*** |
| Night Mission Pinball | 20.75 |

### BRODERBUND (Atari)
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|---|---|
| The Print Shop | 28.95 |
| Graphics Library | 18.95 |
| Graphics Library II | 19.50 |
| Bank St. Writer | 42.75 |
| Whistler's Brother | 18.95 |
| Spelunker | 18.95 |
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| Serpent's Star | 24.95 |
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CIRCLE #125 ON READER SERVICE CARD

Issue 33 of **ANALOG Computing** contained two articles by Craig Patchett on MIDI. One introduced and described MIDI; the other reviewed the Hybrid Arts MIDI-MATE hardware interface and software for Atari. I won't duplicate that material here, but, basically, MIDI allows various musical instruments (that have the provision for it) to be connected to and controlled by a computer.

Why is MIDI so important? Think back a few paragraphs to my complaint about the music software for Atari. Tediously entering data for musical notes isn't exactly my idea of a good time. It's such a chore that I lost interest in it.

Now, with a MIDI-compatible instrument like a drum, keyboard or guitar synthesizer, you can play your tunes right on the instrument and have the computer save the information in real time. Some MIDI software even lets you print your tunes on the printer, in the form of sheet music. Fantastic!

If you're interested in the subject of music and computers, I strongly recommend you read Craig's articles in issue 33. As a follow up to those informative pieces, I'd like to mention some additional resources and startup techniques.

One of the least expensive and most rewarding ways to get involved with the music/computer combination is to obtain an instrument like the Casio CZ-101 Digital Synthesizer. This mini-keyboard lists for $500, but can be obtained at discount houses for as low as $300. In a word, it's tremendous.

A regular-sized keyboard is available on the CZ-1000 for about $200 more. Aside from the keyboard size, the CZ-1000 is identical to the CZ-101.

The CZ-101 is an 8-voice polyphonic digital synthesizer with 16 factory preset "patches," 16 internal patch memories and the capability for another 16 patches on a removable RAM cartridge. The supplied patches (different sounds) range from trumpet, electric piano and organ voicings to far out sounds that you've only heard in your imagination. Some are more realistic than others.

Any of these patches can be modified, or new ones created by using the ADSR (Attack, Decay, Sustain, Release) parameters on the instrument. A headphone jack and a line output jack for your stereo amplifier are supplied. Also, the instrument is battery powered and shuts itself down after 7 minutes, to conserve power.

To turn your Atari into a multi-track tape recorder, a MIDI hardware interface and software like the Hybrid Arts product mentioned above is required. As suggested in the review of the MIDI-MATE, that product is a little pricey. The hardware and software can set you back about $400.

Fortunately, another company is developing a similar hardware/software product for the Atari, that will sell for less than half the price. The product is called Virtuoso by Enhanced Technology Associates of New York City, and will be available by the end of the year. When it's out, you'll read about it here.

If you want to learn more about synthesizers, I highly recommend three books published by GPI publications. They are compilations of articles that have appeared in *Keyboard Magazine*.

*Synthesizer Basics*, *Synthesizer Technique* and *Synthesizers and Computers* sell for $8.95 each, plus $1.50 postage, from GPI Books, 20085 Stevens Creek, Cupertino, CA 95014.

Another excellent resource for learning more about synthesizers is a video tape published by Ferro Productions. Called *Secrets of Analog and Digital Synthesis*, this tape (either Beta or VHS) is available from Ferro Productions, 228 Washington Avenue, Belleville, NJ 07109 (201-751-6238) for $129.95.

In this video instruction course, the fundamentals of musical sound production are explained in a thorough and entertaining way, independently of any specific brand or type of synthesizer. Also, demonstrations of many of the popular synthesizers are featured.

Ferro Productions has done an excellent job producing this course. The next course scheduled to be released in their Synth Arts series is called *Making the Most of MIDI*. Although I've not yet seen this one, I'm told that it will contain information on the uses of musical instruments in conjunction with computers, sequencers, drum machines and other synthesizers. It will also include a wide sampling of many peripherals and personal computers.

If you're either a professional or amateur musician, or just seriously interested in learning more about computers, synthesizers and music, have a look at these video instruction courses.

Next month, we'll finally get to Andy the robot. We'll also talk about using the Atari ST and have a brief interview with the very prolific Sid Meier of Microprose, author of **Solo Flight** and other excellent software. Until then, use your computer. □

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|---|---|
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| XTC 201 Color Non-Impact Dot Matrix | 109.95 |
| XDM 121 Daisy Wheel | 209.95 |
| XMM 801 Dot Matrix Impact | 169.95 |
| STC 504 Color/Non-Impact | 139.95 |
| STD 121 Daisy Wheel | 219.95 |
| SMM 801 Dot Matrix/Impact | 279.95 |

**CITIZEN**

| | |
|---|---|
| MSP-10 | 305.00 |
| MSP-15 | 450.00 |
| MSP-20 | 450.00 |
| MSP-25 | 575.00 |

**LEGEND**

| | |
|---|---|
| **1380** | **269.00** |
| **1385** | **305.00** |
| 880 | 199.00 |
| 1080 | 229.00 |

**EPSON**

| | |
|---|---|
| LX 80 | 239.00 |
| **FX 80+** | **339.00** |
| JX 80 | 479.00 |
| RX 100 | 369.00 |
| **FX 100+** | **479.00** |
| LQ 1500/P | 995.00 |

**STAR MICRONICS**

| | |
|---|---|
| **SG-10** | **214.00** |
| SG-15 | 379.00 |
| SD-10 | 345.00 |
| SD-15 | 450.00 |
| SR-10 | 485.00 |
| SR-15 | 585.00 |
| Powertype | 307.00 |

**OKIDATA**

| | |
|---|---|
| **182** | **219.95** |
| 84 | 640.95 |
| **192** | **349.95** |
| 193 | 525.95 |

**PANASONIC**

| | |
|---|---|
| 1090 | 187.00 |
| **1091** | **237.00** |
| 1092 | 385.00 |
| 1093 | 425.00 |
| 3151 | 455.00 |

## COMPUTERS

| | |
|---|---|
| 800 XL | 89.95 |
| 130 XE | 139.95 |
| 520 ST Color RGB Monitor & More | 870.95 |
| 520 ST Monochrome Monitor & More | 749.95 |

## DISK DRIVES

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|---|---|
| **Indus GT** | **205.95** |
| 1050 | 164.95 |
| Happy 1050 | 335.95 |
| Happy Enhancer | 160.95 |

## DISKETTES

**SKC** Lifetime Warr.

| | |
|---|---|
| SS/DD | 10.95 |
| DS/DD | 14.95 |

**BONUS** Lifetime Warr.

| | |
|---|---|
| SS/DD | 9.50 |
| DS/DD | 13.50 |

**MAXELL**

| | |
|---|---|
| MD 1 | 15.95 |
| MD 2 | 20.95 |

## SOFTWARE

| | |
|---|---|
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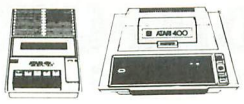

Package #AAB400P Includes: Atari 400 16K color computer, 410 program recorder, Basic cartridge, and dust cover.

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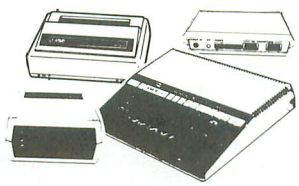

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All items are in Limited Quantities.

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AAB4024 GALAXIAN
AAB4012 MISSILE COMMAND
AAB4022 PAC MAN
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AAB8042 TENNIS
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(Repackaged without instructions)

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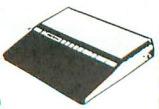

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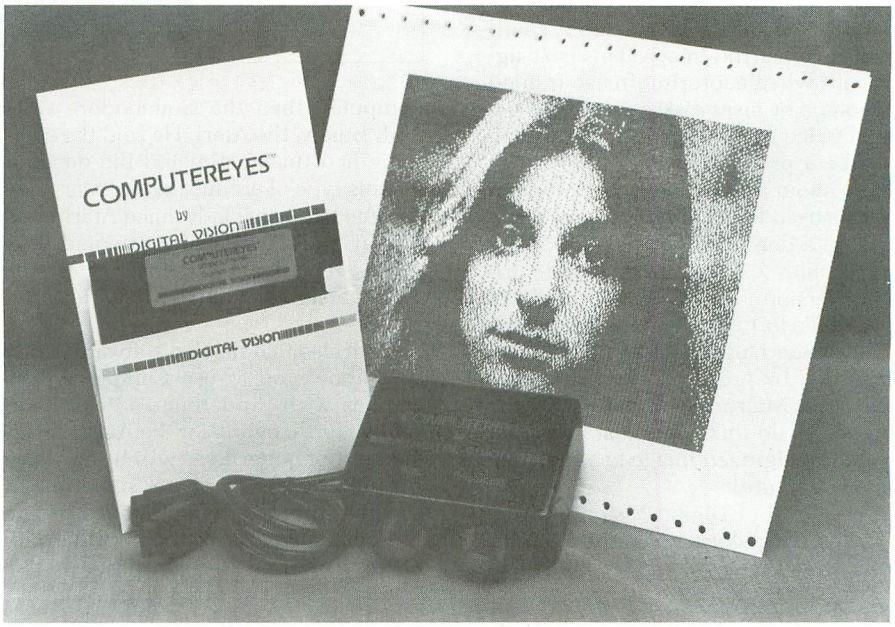
by Arthur Leyenberger

How would you like to be able to digitize video images of yourself, friends or any other person or object? I know what you're thinking: a video digitizer for the Atari computer probably costs hundreds of dollars.

You may be surprised to learn that a video capture system which will allow you to capture any video image from a VCR, videodisk or video camera and display it on your 8-bit Atari is available for only $130.

Meet **Computer Eyes** from Digital Vision. This video acquisition system lets you capture a graphics 7+ or graphics 8 image and use it with such programs as the **Koala Micro Illustrator**, **Atari Artist** and Datasoft's **Micropainter**.

Files saved by **Computer Eyes** are in uncompressed format, so that they will work directly with **Micropainter** and the Atari **Light Pen**. To use the files with either the Atari or Koala touch tablet or the **Koala Light Pen**, they must first be converted to compressed format.




**Computer Eyes.**

### How does it work?

The **Computer Eyes** interface box is a little larger than a pack of cigarettes. This little black box is connected via two cables to joystick ports 1 and 2. Then, your video source is connected to the box via an RCA phono jack. That's all there is to the hardware interfacing.

Next, the **Computer Eyes** software is loaded from disk. Called XEC (for executive), this BASIC program with machine language routines is easy to use and menu driven.

Once the program menu is on-screen, there are two things you must do to get the system up and running. The first procedure is to adjust the SYNC control knob on the unit, so that the Atari is synchronized with your video source. All you do is turn the knob in either direction until the words *in sync* appear on the screen.

The second procedure is to adjust the brightness level with the "brightness" knob on the interface box. The sensitivity adjustment is done by giving another menu command and observing the successive image scans on the screen. Although the image may appear distorted on the screen, there's nothing to worry about, since your objective is to get the correct balance between "too light" and "too dark."

Once the sync and brightness controls have been adjusted properly, you can begin capturing images. There are five different capture commands available, and each requires a different amount of time to perform. Table 1 describes the different capture modes and their related information.

One of the idiosyncracies of the **Computer Eyes** program is that different capture commands require different brightness levels. For example, if you adjust the brightness control to yield a good image with a normal scan, you may have to readjust the brightness level if you then want to do an 8-level scan.

In addition to five capture modes, **Computer Eyes** allows you to save and retrieve files from disk, obtain a catalog

of files currently on the disk and get online help for any menu commands.

The 20-page manual is well written and provides all of the information that you're likely to need. There's even a section on the theory of operation and what to do in case of difficulty.

The only criticism I have of **Computer Eyes** is a minor one and easily fixed. The two cables that connect to the joystick ports are too short. When using an XL or XE which has the joystick ports on the side of the computer, it's not a big problem. But, with a 400 or 800 whose ports are on the front, I find there's no place to put the interface unit; I have no space in front of my Atari 800.

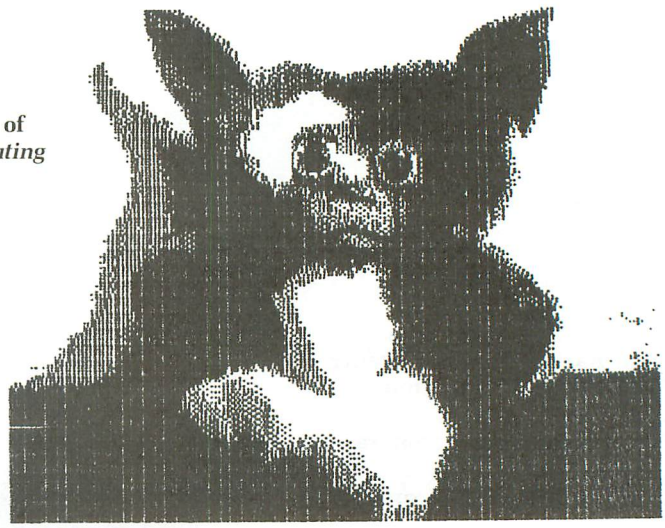
One *caveat* when performing video scans that require longer exposures is that any movement of the subject will result in a blurred image. This isn't significant when capturing freeze-framed videotape or laser disk images, but using a video camera for "live" scanning may be a problem.

Just about any screen dump program may be used to print the graphics 8 images on a dot-matrix printer. However, the graphics 7.5 images may require prior conversion to standard **Micropainter** picture file format. Also, when using the Koala or Atari touch tablets, images may be loaded by pressing the CLEAR key when the **Micro Illustrator** is on the screen. To do this, you must have first saved the digitized image to a filename called "Picture."

Dave Pratt of Digital Vision told me an interesting story. He said that **Computer Eyes** first came out for the Apple computer, then the Commodore C-64 and, finally, the Atari. He said the company had underestimated the demand for this type of product by the Atari user community, especially since Atari users are far more graphically oriented than others. If he had it to do over again, the Atari version would have been released first.

Dave also told me that software which will allow you to use **Computer Eyes** screens with Broderbund's **Print Shop** will be forthcoming for the Atari. A version of **Computer Eyes** will be available for the Atari ST computer sometime in the near future, although no exact date has been given. With the 400x600 pixel resolution on this machine, the ST version should be truly incredible.

**Computer Eyes** isn't a true digital image processor, in that it cannot do any noise reduction, edge detection or image enhancement. However, in its role as a video acquisition system, it performs well and offers the Atari owner a unique and fun addition to computing capabilities. □



**Computer Eyes sample printout.**

**(Gizmo courtesy of *ANALOG Computing* technical staff.)**

*Arthur Leyenberger is a human factors psychologist and free-lance writer living in New Jersey. He has been an Atari enthusiast for four years. When not computing, he enjoys playing with robotic toys.*

**Table 1.**

| Capture Mode | Time Required for Scan | Graphics Mode | Comments |
|---|---|---|---|
| N (Normal) | 6 seconds | 8 | Screen blanks during capture for this and all other modes. |
| 4 (4-level) | 25 seconds | 8 | Image generated from four high-contrast images corresponding to different gray levels. |
| 8 (8-level) | 50 seconds | 8 | Uses 8 synthesized gray levels. Best mode for printing on a dot-matrix printer. |
| H (High contrast) | 18 seconds | 7.5 | Provides four solid gray levels at the expense of horizontal resolution. |
| L (Low contrast) | 18 seconds | 7.5 | Different threshold values are used than high contrast image. |

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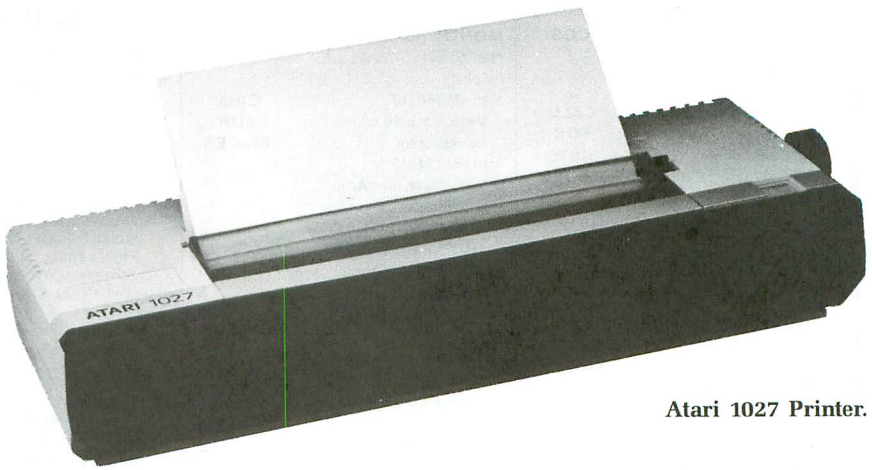
## by Robert Opitz




**Atari 1027 Printer.**

Atari's **1027** printer is no-frills hardware—the product that defines the bottom end in letter-quality printers. The **1027** is housed in a black and white cabinet that matches the XL series of computers and is only 6" deep and 3" high. The single control, the power switch, is readily accessible on the top.

The fully-formed characters are not on a daisywheel, but on a cylinder five letters wide that rides on a rod inside the printer. It spins to the correct letter, and a small strikeplate behind the paper presses the paper to the print cylinder. The cylinder is continuously inked by a small, replaceable ink cartridge.

With a single sheet of paper, the print quality is as good as many typewriters—more than adequate for most purposes. Compared to some dot-matrix printers, this is actually excellent.

However, the ink-cartridge printing is limited to normal typewriter quality. It will not give you the quality found with a carbon ribbon typewriter or printer. In fact, if a character is printed twice in a row, as in the word *letter*, the second has a lighter impression. Most readers will not notice this.

The printing mechanism lacks some of the versatility of a daisywheel printer. Multiple copies can be messy, and printing on a file card (sometimes desirable) is almost impossible—smudges from neighboring letters on the print cylinder are more abundant than print.

The boot-behind-the-paper method of printing is meant *strictly* for a single sheet of paper. The ink cartridge is also a problem. It doesn't last very long, compared to a ribbon, and I've had problems getting replacements locally. I've resorted to re-inking it with stamp pad ink, a messy (but cheap and workable) alternative.

What does this printer have? The *basic print mechanism with a couple of extras. It prints bidirectionally when using single spacing. It does have underlining, and a set of characters used by a number of European languages.*

The **1027** does not have proportional spacing or subscripts and superscripts. A single line advance is four small steps, so the latter are theoretically possible. If you have a word processor that allows you to halt and resume printing (unfortunately, my **AtariWriter** does not), you should be able to accomplish this.

The printer also lacks overstrike and adjustable characters per inch (set at twelve). Of course, it doesn't have any graphics. And it is slow (it's rated at ten characters per second and requires three to four minutes to print a typical page) and *very* noisy.

The **1027** is friction fed and cannot accept a tractor attachment. You can print continuous sheets by feeding in perforated paper that has been stripped of its tractor holes. For continuous printing (program listings, etc.), this works fine. For page-oriented printouts (word processing), the paper isn't exactly in register. It often requires some changes of the page length control and adjustment of the paper while you print.

Most of the shortcomings cannot be criticized, as Atari's apparent purpose has been to produce the least expensive letter-quality printer possible. However, a few items demand criticism.

First, there's the paper slot. It's just wide enough for a standard sheet. It would have been nice if they had designed the slot a little wider, so that, when you print out a letter, you can put a business envelope in and print out the address.

The character used as an apostrophe is actually an accent mark. This allows Atari to easily include the international character set, but proves difficult in English.

The **1027** is an adequate printer at a good price. If you need more speed in printing, or special features like superscripts, or are willing to spend another two hundred dollars, this probably isn't the printer for you.

But, if, like me, you need letter quality and cannot afford most letter-quality printers, it can be a worthwhile investment. It can even be an ideal second printer for someone who already has a fast dot-matrix printer and would like letter quality occasionally. □

*Robert Opitz is a chemist who became interested in microcomputers five years ago—he discovered word processing while writing his thesis. He is a three-year Atari owner.*

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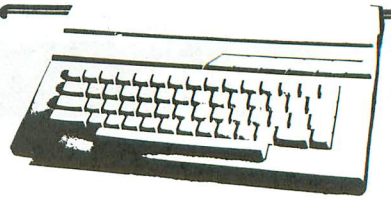

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CIRCLE #131 ON READER SERVICE CARD

# Printers Revisited

by Jim Pirisino

The purpose of this article is, in part, to define and describe the best printers available in a reasonable price range for your microcomputer. The best printers would maximize performance-to-price ratio. There are three types of printers to consider: letter-quality, thermal, or dot-matrix.

**Letter-quality.**

A letter-quality printer is a typewriter-quality printer. A letter-quality printer contains the same type of printing element as a good electric typewriter, such as a type-ball, thimble, or daisywheel.

A letter-quality printer is an impact printer; a preformed character strikes an inked ribbon to print the character on paper.

These printers come in three distinct price/performance ranges. Those costing over $1800 are full-featured, business printers that provide high throughput reliability, as well as speed (greater than 40 characters/second).

The mid-range letter-quality printers costing $1000-$1800 are fast (20-45 characters/second), reliable at a moderate throughput, and have many features. Low-cost letter-quality printers ($400-$800) are quite slow (13-20 characters/second), are limited in features, and are not recommended for high throughput.

Letter-quality printers are usually considered absolutely necessary for formal business correspondence, because the print quality is on a par with typewriter quality.

These printers may produce "letter quality," but otherwise they: are expensive, slow, big (take up a lot of office space), require a lot of maintenance, have limited features, and are heavy (nontransportable).

Therefore, the only reason to consider purchasing a letter-quality printer is to obtain typewriter quality. Everyone who has a letter-quality printer should also consider having a dot-matrix printer. The two can be connected to the computer at the same time to let you enjoy the benefits of the dot-matrix printer for 50-90% of your business printing, then switch to letter-quality when necessary.

**Thermal.**

The thermal printer uses a special treated paper which usually comes on a roll. It forms a character on this special paper by burning off the coating. The characters formed are dot-matrix characters; they consist of closely placed dots. This type of printer has one great advantage and one very large disadvantage.

The important advantage of a thermal printer is that it is virtually noiseless. Letter-quality and dot-matrix printers are both very noisy. However, the disadvantage of requiring nonstandard paper negates the advantage of noiseless operation. The specially treated paper is inappropriate for any correspondence and, in fact, has a tendency to deteriorate over time.

Another advantage to thermal printers is their price. But the price differential between a thermal printer and a full-featured dot-matrix printer is too small to justify the former's purchase.

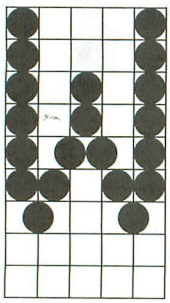
The thermal printer could be useful when printing material for yourself late at night, or might be useful in a classroom where thermal paper may be tolerated. If price is your main concern, it would still be wiser to save for an extra six months to get the full-featured dot-matrix printer, rather than get a thermal printer.

**Dot Matrix.**

The dot-matrix printer is an impact printer. Instead of preformed characters on a daisywheel, the dot-matrix printer head consists of a single column of tiny round- or square-faced impact rods.

The Epson FX print head consists of nine of these rods, one above the other. The rods are individually controlled. When "fired," the rods are forced forward and strike the ribbon against the paper to form one or more dots in a single column. If all nine rods are fired, a single column of dots will be printed on the page, like this:

How does a dot-matrix printer work? In a letter-quality printer, characters are printed in a single printing event. This is not the case with a dot-matrix printer. Since it can print only a single column of dots at a time, a character that is nine dot positions wide will require nine individual printing events. For example:



Here is the letter *W*. In the first print position, the top six rods are fired, producing six dots; in the second print position, only the seventh rod is fired to produce a dot at the bottom, etc. The important concept is that any combination of dots may be produced at any print position.

Notice that two print positions are equal to the width of one dot on the Epson FX. To put it another way, the letter *W* shown above contains nine print positions in dots for the width of one character. All printers' characters are the same width, ten characters per inch (or "pica" size), yet most dot-matrix printers use a different number of dots or different dot patterns to create these characters.

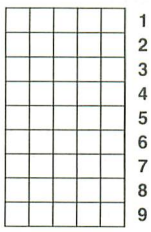
### What is a dot matrix?

A matrix is a mathematical term used to describe a group or array of elements (numbers, dots, etc.) which are arranged in a fixed number of rows and columns. A dot matrix describes a number of rows and columns where dots can be placed to form a character. As a general rule: the more dots that are used to form a character, the better the quality or appearance that character will have.

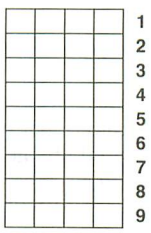
The goal that the dot-matrix printer is trying to reach is to create a character that appears as close to letter quality as possible. Characters formed by dots inherently will not have the smooth, continuous, rounded look of a letter-quality character, since closely placed dots will have spaces between them, and the rounded parts of letters will be broken and appear blocklike. Shown here are the dot matrices used by two different printers.

The characters produced on the Epson FX are designed to fit in a dot matrix consisting of nine columns (nine print positions) and nine rows. This is called a 9x9 dot matrix. The Prowriter characters are designed to fit in a 7x9 dot matrix (seven columns and nine rows).

By printing at half-dot intervals, the dot-matrix printer can produce a more well defined character, one that is sharper and clearer, with less visible space between the dots.

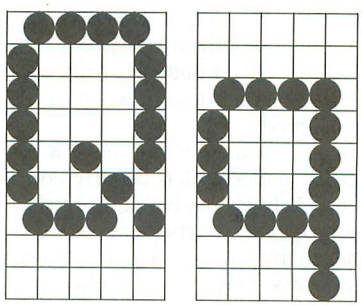



**9 x 9**
**Epson FX**




**7 x 9**
**Prowriter 8510A**

Although the Epson FX and the Prowriter can produce a single column of dots that is nine dots high, almost all of the characters produced are only seven dots high. The upper case letters use the top seven dots, and the lower case letters use the bottom seven dots.



**EPSON FX — 9 x 9.**

Notice that using the top seven and bottom seven dots in this manner allows the printing of some lower case letters that dip below the rest of the characters. These letters, *g, j, p, q* and *y*, possess lower case "descenders." This is one of the features of a dot matrix that distinguishes a good dot matrix from an inexpensive dot matrix.

### Dot-matrix printer features.

As opposed to letter-quality printers, dot-matrix printers are inexpensive, fast, compact, relatively maintenance free, loaded with features, light, transportable, and (in some cases) portable.

The two most important features of the dot-matrix printer for most people are price and speed. These are the features that make these printers so attractive.

Full-featured dot-matrix printers cost between $250-$599 with speeds from 80 to 160 characters per second. Most people who buy a printer for their microcomputer will buy a dot-matrix printer. Generally speaking, full-featured dot-matrix printers are less expensive than the *least expensive* letter-quality printers and faster than the *most expensive* letter-quality printers.

Full-featured dot-matrix printers have the following print capabilities.

(1) They can print all of the letters, numbers and other characters found on a standard typewriter.

(2) They can print all of these characters in several sizes (widths). The normal width is ten characters per inch (cpi). The most popular additional widths are double width (5 cpi) and condensed width (17 cpi).

(3) They can print all of these characters, in the various widths, in several densities. By striking each character twice or more, the density of dots and the quality of the character is increased. Some of these printing modes are called "bold," "emphasized" and "double strike."

(4) They can print the standard typewriter characters in additional styles other than the normal dot-matrix characters. Some optional styles on popular printers are italics, correspondence quality (near letter quality), proportional spacing and half-height characters for subscripts and superscripts. These are additional styles that are already programmed into the memory of the printer and are available to the user when the printer is purchased.

(5) They are capable of printing the standard typewriter characters in newly designed styles or fonts other than those provided by the

manufacturer. These new fonts can be designed by the individual or purchased, either on disk (software) or on an interface card (firmware).

(6) They can print other characters not found on typewriter keyboards. Optional characters include Greek characters, graphics or block characters, foreign characters, special character sets like the IBM set.

(7) They are capable of printing high-resolution graphics pictures. Graphic images consisting of dots as seen on a TV or monitor can be reproduced on a dot-matrix printer.

(8) They can print on computer or continuous form paper, as well as single sheets of paper, without any additional costs.

(9) They can control precise form spacing, for line spacing and horizontal and vertical tabbing.

Each full-featured dot-matrix printer has the above capabilities, but each has its own, unique combination of features. Most can print 5, 10 and 17 cpi, but others can also print 6 and 12 cpi. Some print 4.5, 7.5, 9 and 15 cpi, and still others even print 6.7 and 13.4 cpi.

The switch from one print style to another is accomplished by sending the printer instructions, which are called CONTROL or ESCAPE codes, or ASCII values. With these commands, the printer can switch different printing modes on and off without stopping, to create appealing pages of varied text styles.

A letter-quality printer, on the other hand, may advertise over 150 kinds of printwheels available, but changing the styles in the middle of a page requires that printing stop and that you physically remove the old printwheel and replace it with the new printwheel—and vice versa, to return to the normal style.

**Inexpensive and more expensive.**

Most of the dot-matrix printers available today fall in the $250-$599 price range, so we'll discuss this group.

The most popular, less expensive dot-matrix printer is one manufactured by Seikosha of Japan. This particular printer has been "cloned" often and has appeared in the American market as the Commodore 1525, the Leading Edge Gorilla Banana, the Seikosha GP100A, and probably many others. The Gorilla Banana is now being sold by DAK Industries of Canoga Park, California.

The less expensive dot-matrix printers cost between $129 (DAK's Gorilla Banana) and $299. They have very few dots per character, using a 5x7 dot matrix. There is a lot of space between dots, and there are no lower case descenders as previously described.

These printers use computer or continuous feed paper, and not single sheets or letterhead. They print graphics at 480 dots per line, whereas the Epson FX can print 480, 960 or 1920 dots per line.

These models have almost none of the printing features explained earlier. Since the full-featured Gemini 10X printer retails for only $399 (and can be found discounted to $219-$249), there is no reason, in today's market, to settle for one of these inexpensive printers.

The expensive dot-matrix printers can cost $799-$2995 or more. These are simply bigger, heavier and faster. Some features are even sacrificed to attain speeds in excess of 200 cps. The only other feature that makes these printers "better" than those in the $250-$599 range is the available "near letter quality" printing modes that many of them have.

**The Epson and compatibility.**

The Epson has become the unofficial standard in the industry, against which other dot-matrix printers are compared. Why is the Epson so highly rated?

The MX-80 was the first affordable, reliable graphics printer for the "personal" computer market, in 1981. It can be confidently stated that many 1981 Epson printers are still cranking out text today. (I know mine is!)

The Epson took another giant leap toward the label of "standard," when IBM chose an Epson model as their graphics printer. Epson has since introduced the Epson FX (with a speed of 160 cps), the Epson LQ1500 (200 cps, with a built-in "near letter quality" mode), and the Epson JX, a color printer.

Most dot-matrix printers use a different set of printer codes, which control all of the printer features. Since each printer has a different set of codes, it is difficult for authors to write software compatible with all of the printers.

New printer manufacturers have recognized Epson's status as the unofficial industry standard and have endowed their printers with codes that are compatible with the Epson.

The Star Micronics Gemini 10 was one of the first Epson-compatible printers. It could do everything the Epson MX printer could—*and* it cost several hundred dollars less.

The Gemini 10 has played a significant role in bringing the price of the dot-matrix printer close to $250, where the same features cost $799 only two years ago.

Many dot-matrix printers are boasting Epson compatibility today. Inforunner's Riteman series, the Panasonic, Legend, Mannesmann Tally, Smith Corona and BMC are all Epson-compatible.

**Is dot-matrix print acceptable?**

There are many people who are horrified at the thought of using dot-matrix printing for business. However, much of the printed material generated by a business does not have to be letter quality.

Dot-matrix printing is acceptable for all your printing needs except the most formal business documents and letters. The quality is adequate for most business reports and correspondence, and the speed and features of the dot-matrix printer far outweigh the loss of print quality. And, since dot-matrix printers are popular, their "acceptability" level will continue to rise.

If dot-matrix print is acceptable to you, then do not hesitate to use it for all of your printing needs. Remember that most of the dot-matrix printers in the $250-$599 price range can be enhanced to print near letter quality, and the next generation of dot-matrix printers will come with a near-letter-quality mode standard, which will be suitable for almost all of your printing needs.

**Near letter quality.**

"Near letter quality" describes a more precisely formed dot-matrix character that resembles a letter-quality character. An example of this style is that produced by Okidata in their "correspondence-quality mode."

In this mode, each line of characters is formed by making two passes of the printhead. Although the printing speed is reduced, the resultant quality makes up for time lost. A dot-matrix printer that can produce both dot matrix and near letter quality can satisfy many business needs without the purchase of a letter-quality printer.

The Okidata 92 can produce correspondence quality without any enhancements. The Epson, Gemini, Prowriter and NEC can be enhanced to produce near letter quality. These enhancements may cost $100 to $200, but can transform your very fast dot-matrix printer into a fast near-letter-quality printer.

**Other printers.**

There are other types of printers now being introduced: ink jet, color and thermal transfer. Do not confuse these with dot-matrix printers, the workhorses of text processing. The others offer some unique features, but do not yet compete with dot-matrix printers.

Color and thermal-transfer printers should be classified as novelties. Their unique color features make them wonderful additions to a computer system but they're not replacements for the dot-matrix printers.

A thermal-transfer printer is a cross between a dot-matrix printer and a thermal printer. It has a thermal-dot-matrix printhead, which contains the familiar column of elements to produce dots. But, instead of pressing against an inked ribbon, they burn a wax-based ink off the ribbon and onto the paper.

The thermal-transfer printer is quiet and can do color work. Most also have a good near-letter-quality mode. They may have features like different sized characters, foreign characters, underlining, and scripts. Thermal-transfer printers like the Okidata's Okimate are inexpensive, costing between $169 and $250.

This method's biggest disadvantage is the cost of its ribbon. This can be used only once at a price of $6-$7. The Okidata thermal-transfer printer is reported to print 120,000 characters per ribbon, or 75 pages of double-spaced text. It can also print 10 full-color graphics screens per ribbon—about $7.50 per picture. At approximately $.20 per page of single-spaced text, you aren't going to use this printer for more than a few pages per week; if you used a ribbon a week, you would spend $300-$350 a year on ribbons alone!

**Printing features.**

The dot-matrix printer does an excellent job of printing high quality text with blinding speed. However, if that's all you think it can do, you're not going to utilize the printer at its full performance level.

By manipulating the placement of character dots, the printer can alter the density or quality, the size (width) and the style of the printed character. Some examples follow.

**Print density or quality.**

The normal characters produced by the printer are clearly and visibly composed of individual dots. Top printing speed is attained while printing in the normal mode, because the minimum number of dots is being printed.

The density or number of dots per character can be doubled or even quadrupled. Increasing the density of dots per character increases the quality of the character, by making it darker and the individual dots less visible.

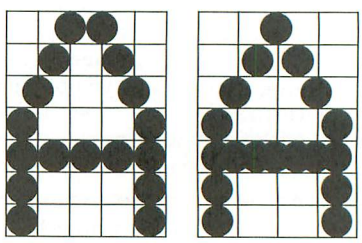
Of course, the printing speed is reduced accordingly. Therefore, you can print your rough drafts, business data and program listings in the normal, fast mode. The darker, better quality modes can be used for final drafts and more important correspondence.

There are several ways a dot-matrix printer can increase the number of dots per character. Speed and quality differ, with the maximum quality attained by using emphasized or bold print.

**Normal print mode.**

Here are samples of the normal print styles on several printers. Below these samples are the actual dot designs of the letter *A* on two different printers.

```
EPSON RX-80/FT
STAR MICRONICS SG-10
EPSON HOMEWRITER 10
```



**EPSON FX.** **PROWRITER.**

Although each printer produces the same set of upper case characters, you can see that each manufacturer has designed the dot patterns for their characters differently.

**Double strike or enhanced.**

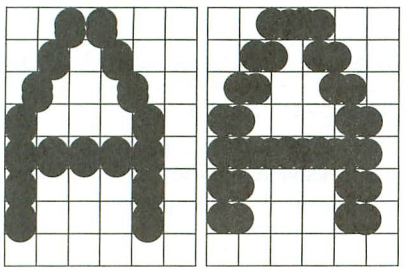
In the double-strike mode (shown below), each character is printed twice and will appear to be composed of lines, rather than of dots. In this mode, the printer will: (1) print an entire line of characters; (2) return to the beginning of a line; (3) advance the paper 1/216 inch

(exactly ⅓ dot); and (4) repeat.

The quality of double-strike characters is enhanced vertically much more than horizontally, because the second group of dots is placed directly under the first.

The printing speed is reduced by over 50% in double-strike mode. Not only are the lines printed twice, but each is printed left to right instead of in the normal manner, which is bidirectional.

```
This is Double-strike
This is Emphasized
```



**Double strike.** **Emphasized.**

**Emphasized or bold.**

In the emphasized or bold mode (as shown above), each character is again printed twice, with each dot of the character reprinted ½ dot space to the right. In this mode, the printer: (1) prints a single column of dots; (2) advances exactly ½ dot; and (3) repeats.

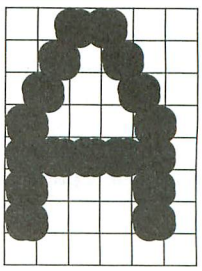
This method differs greatly from the double-strike mode. Emphasized characters produce the best overall quality on printers that do not have a correspondence or near-letter-quality mode. This style would be used for final drafts or correspondence.

The printing speed is reduced only about 33% in emphasized mode—much faster than double strike.

**Double strike/emphasized.**

These two print modes can be used at the same time, since they're quite different. For each dot in a normal character, there will now be four. In this mode, the printer: (1) prints a single column of dots; (2) advances exactly ½ dot space; (3) prints the same column of dots again; (4) continues steps 1-3 for each column of dots on one entire line; (5) moves back to the beginning of the same line; (6) advances the paper ⅓ dot; and (7) repeats.

```
This is Double-strike
+ Emphasized mode.
```



This style of print is usually too dark for normal correspondence, but is good for headings and titles. Note that printing speed is reduced by more than 67% and that printing four times as many dots will exert four times as much wear on the ribbon.

### Character width.

The width of the normal printed character, as mentioned earlier, is 10 characters per inch (cpi). This is "pica" size. On a normal 8½x11-inch page, up to 80 pica characters can be printed per line.

Another popular size of character that is often used on a typewriter is "elite." This has 12 cpi and can fit up to 96 characters on a line.

To switch from pica to elite on a typewriter, you must change the print element, as well as the spacing. A dot-matrix printer can go from pica to elite without changing any physical elements. It only requires that a command be sent to the printer.

Dot-matrix printers are able to print many different width characters besides pica and elite. A common dot-matrix printer size is called "condensed," which is 17 cpi. Up to 136 condensed characters can be printed per line on a normal page.

```
Expanded P
Expanded Eli
Expanded Condense
This is Pica printin
This is Elite printing
This is Condensed printing
Italics Pica
This is proportional
```

Since the dot-matrix character is composed of discrete, individual columns of dots, these columns can be compressed or expanded to create different width characters. The same dot patterns are printed for pica, elite and compressed, but the spacing between the columns is reduced.

Not only can character widths be reduced from pica to elite to condensed, but each can also be enlarged to twice its width. This is called "double width" or "expanded." Now you have three new size characters: double-width pica (5 cpi), double-width elite (6 cpi) and double-width condensed (8.5 cpi).

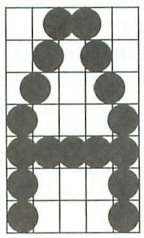
**Elite.**

The width of the elite character is, again, 12 cpi. It can be seen that the dot pattern for the elite *A* is the same as the normal size (pica), except that it is compressed. The printer does not have to store a whole new character set in memory; only the spacing between columns has been reduced.

An important consideration is that, since the space between the dots has been reduced, the quality of the character is increased. For dot-matrix printers, the elite mode is a better quality than pica, although somewhat slower.

Note that the elite mode is available on the Epson FX and RX, but not the MX model.

```
This is Elite printing
This is Condensed printing
```



ELITE.

CONDENSED.

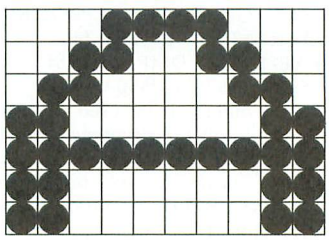
**Condensed.**

The width of the condensed character is 17 cpi, very much narrower than normal. Up to 136 condensed characters can be printed per line on a printer that's normally limited to 80 characters per line. On a wide (15 inch) printer, which normally prints 132 characters per line, it's possible to print 230 condensed characters per line.

**Double width.**

In this mode, each character takes exactly twice its normal amount of space. If you were printing in the normal pica mode and switched to double width, only 40 characters (instead of 80) would fit on a line.

```
Expanded
```



Double width works in combination with pica, elite and condensed, to produce three new sizes as mentioned earlier. If you're printing in the elite mode and switch to double width, then only 48 characters (instead of 96) would fit on one line. Condensed in double-width mode would yield 68 characters per line, instead of 136.

Double width is too large for normal text printing, but is ordinarily used for titles and headings, to make them interesting and prominent.

### Other features.

**Backspacing and underlining.**

If a dot-matrix printer has the ability to backspace, then you can print a character, have the printer backspace to the same initial position and print another character over the first. This is called "overstrike" and can be used to create characters like ≤, ± and ≥.

One of the most used functions of the backspace is to underline or underscore. To do this, each character is printed, then the printer backspaces and prints the underscore character below the letter character.

```
(Near Letter Quality)
This is a test of very small type
```

The NEC 8023A and the Prowriter can backspace, but they must first be in what is called the "incremental" mode. The Okidata 92 cannot backspace, but it does have continuous underlining.

The method used to obtain continuous underlining differs with the printer involved. For example, on the Epson MX, continuous underlining is printed at the same time that the characters are printed, on a single pass of the printhead. The only problem is that the bottom dot on the lower case letters *j, g, p, q* and *y* becomes part of the underline.

The Epson MX won't underline spaces preceding or following a word, but will underline the spaces between words. This is an advantage, because spaces that aren't supposed to be underlined (like the left margin) aren't. It's a disadvantage when you really want to have underlines as blanks to be filled in by the reader.

On the Epson FX, when continuous underlining is used, the entire line of characters is printed. The printer then advances one dot vertically and underlines everything, including leading and trailing spaces, on a second pass of the printhead. All spaces are underlined, whether you intended them to be or not.

The speed is reduced, because two passes of the printhead are required. However, the quality of the Epson FX underline is good, since it is one dot lower than all of the characters.

Without a doubt, there are more idiosyncracies associated with underlining than with any other dot-matrix feature.

**Bidirectional/unidirectional.**

Dot-matrix printers attain part of their speed by printing bidirectionally. This

*(continued on page 78)*

**16K Cassette or**
**24K Disk**


**by James Hague**

This month's assembly language game is **Bonk**, a fast-moving arcade game for one player. You control a small, green creature with joystick 1. Your object is to collect all of the flashing diamonds scattered around the board before time runs out. When you hit a diamond, a "ding" will be heard.

You're probably thinking, "What a stupid game! It sounds easy." Well, of course your green creature is not free to roam wherever it pleases. You're being chased by three electric whirlers that kill on contact. They don't sound friendly. . .and they aren't.

They will chase you wherever they can, trying to send you to that big arcade in the sky. But, luckily, they aren't extremely intelligent (in other words, their IQ is the same as their shoe size). When you're being chased, just put a wall between yourself and your relentless pursuers, and **Bonk**!—they'll slam into the wall and be thrown backwards.

After a while, they'll regain their senses, and you'll be in trouble again. If you plan your strategy correctly, you can get the whirlers trapped in corners, **Bonk**ing around. Just don't trap them near a jewel that you still need. Later in the game, the whirlers will recover from a **Bonk** sooner, and you'll have to use your other defenses. More on that in a minute.

### Typing it in.

Before typing anything, look at the listings accompanying this article.

**Listing 1** is the BASIC data and data checking routine. This listing is used to create both cassette and disk versions of **Bonk**. The data statements are listed in hexadecimal (base 16), so the program will fit in 16K cassette systems.

**Listing 2** is the assembly language source code for the game of **Bonk**, created with the OSS MAC/65 assembler. You *don't* have to type this listing to play the game! It is included for those readers interested in assembly language.

Follow the instructions below to make either a cassette or disk version of **Bonk**.

### Cassette instructions.

1. Type Listing 1 into your computer using the BASIC cartridge and verify your typing with **Unicheck** (see page 00).

2. Type *RUN* and press RETURN. The program will begin and ask:

```
MAKE CASSETTE (0) OR DISK (1)?
```

Type *0* and press RETURN. The program will begin checking the DATA statements, printing the line number of each as it goes. It will alert you if it finds any problems. Fix any incorrect lines and re-RUN the program, if necessary, until all errors are eliminated.

3. When all of your DATA lines are correct, the computer will beep twice and prompt you to *READY CASSETTE AND PRESS RETURN.* Now, insert a blank cassette in your recorder, press the RECORD and PLAY buttons simultaneously and hit RETURN. The message *WRITING FILE* will appear, and the program will create a machine language boot tape version of **Bonk**, printing DATA line numbers as it goes. When the *READY* prompt appears, the game is recorded and ready to play. CSAVE the BASIC program onto a separate tape before continuing.

4. To play, rewind the tape created by the BASIC program to the beginning. Turn your com-

puter OFF and remove all cartridges. Press the PLAY button on your recorder and turn ON your computer while holding down the START key. If you have a 600 or 800XL computer, you must hold the START and OPTION keys when you turn on the power. The computer will "beep" once. Hit the RETURN key, and **Bonk** will load and run automatically.

### Disk instructions.

1. Type Listing 1 into your computer, using the BASIC cartridge and verify your typing with **Unicheck** (see page 00).

2. **Type** *RUN* and press RETURN. The program will ask:

```
MAKE CASSETTE (0) OR DISK (1)?
```

Type *1* and press RETURN. The program will begin checking the DATA lines, printing the line number of each statement as it goes. It will alert you if it finds any problems. Fix incorrect lines and re-RUN the program, if necessary, until all errors are eliminated.

3. When all the DATA lines are correct, you will be prompted to *INSERT DISK WITH DOS, PRESS RETURN*. Put a disk containing DOS 2.0S into drive #1 and press RETURN. The message *WRITING FILE* will appear, and the program will create an AUTORUN.SYS file on the disk, displaying each DATA line number as it goes. When the READY prompt appears, the game is ready to play. Be sure the BASIC program is SAVEd before continuing.

4. To play the game, insert the disk containing the AUTORUN.SYS file into drive #1. Turn your computer OFF, remove all cartridges and turn the computer back ON. **Bonk** will load and run automatically.

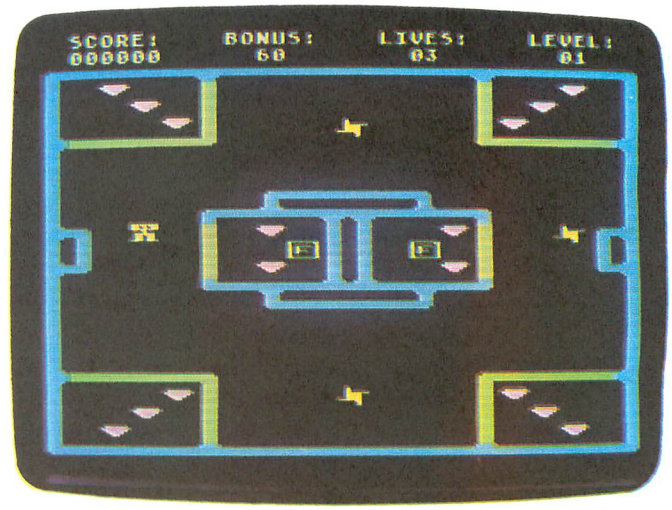
### Bonking.

In order to play, you must have a joystick plugged into port 1. If, after you've loaded **Bonk**, the title screen does not appear, try to locate your error. To start on a level other than 1, press the SELECT key. To begin play, press START (of course).

First of all, you'll probably notice that the walls are two different colors. If you cruise into a blue one, *bzzzzt*—you're fried. But, if you hit a green one, it will disappear. This opens up all sorts of strategic possibilities. Use them wisely.

Also, there are small boxes lying around, marked with an *F*. If you hit one of these, the whirlers will be frozen for a couple of seconds (by now, you've figured out that the *F* is for "freeze"). There are very few of these boxes, so don't waste them. They can come in handy when you're *surrounded*.

The scoring in **Bonk** is relatively simple. Bagging a jewel is worth 70 points. Hitting a freeze box is worth 100, plus the handy freeze effect. Wiping out the green walls doesn't give you any points, but it's a good way to sneak by the whirlers.




**Bonk.**

When you finish a board, 10 points will be added to your score for each second left on the timer. Then it's on to the next board—there are three. After you complete the third board, you gain an extra life.

Good luck and happy **Bonk**ing! □

*James Hague is a junior at Berkner High School in Richardson, Texas. After graduation, he plans to major in computer science.*

**Listing 1.**
**BASIC listing.**

```
10 REM *** BONK ***
20 TRAP 20:? "MAKE CASSETTE (0), OR DI
SK (1)";:INPUT DSK:IF DSK>1 THEN 20
30 TRAP 40000:DATA 0,1,2,3,4,5,6,7,8,9
,0,0,0,0,0,0,0,10,11,12,13,14,15
40 DIM DAT$(91),HEX(22):FOR X=0 TO 22:
READ N:HEX(X)=N:NEXT X:LINE=990:RESTOR
E 1000:TRAP 120:? "CHECKING DATA"
50 LINE=LINE+10:? "LINE:";LINE:READ DA
T$:IF LEN(DAT$)<>90 THEN 220
60 DATLIN=PEEK(183)+PEEK(184)*256:IF D
ATLIN<>LINE THEN ? "LINE ";LINE;" MISS
ING!":END
70 FOR X=1 TO 89 STEP 2:D1=ASC(DAT$(X)
)-48:D2=ASC(DAT$(X+1))-48:BYTE=HEX(D1)
*16+HEX(D2)
80 IF PASS=2 THEN PUT #1,BYTE:NEXT X:R
EAD CHKSUM:GOTO 50
90 TOTAL=TOTAL+BYTE:IF TOTAL>999 THEN
TOTAL=TOTAL-1000
100 NEXT X:READ CHKSUM:IF TOTAL=CHKSUM
 THEN 50
110 GOTO 220
```

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CIRCLE #134 ON READER SERVICE CARD

```
120 IF PEEK(195)<>6 THEN 220
130 IF PASS=0 THEN 170
140 IF  NOT DSK THEN 160
150 PUT #1,224:PUT #1,2:PUT #1,225:PUT
 #1,2:PUT #1,0:PUT #1,40:CLOSE #1:END
160 FOR X=1 TO 34:PUT #1,0:NEXT X:CLOS
E #1:END
170 IF  NOT DSK THEN 200
180 ? "INSERT DISK WITH DOS, PRESS RET
URN";:DIM IN$(1):INPUT IN$:OPEN #1,8,0
,"D:AUTORUN.SYS"
190 PUT #1,255:PUT #1,255:PUT #1,0:PUT
 #1,40:PUT #1,181:PUT #1,53:GOTO 210
200 ? "READY CASSETTE AND PRESS RETURN
";:OPEN #1,8,128,"C:":RESTORE 230:FOR
X=1 TO 40:READ N:PUT #1,N:NEXT X
210 ? :? "WRITING FILE":PASS=2:LINE=99
0:RESTORE 1000:TRAP 120:GOTO 50
220 ? "BAD DATA: LINE ";LINE:END
230 DATA 0,28,216,39,255,39,169,0,234,
234,234,169,60,141,2,211,169,0,141,231
,2,133,14,169,56,141,232,2
240 DATA 133,15,169,0,133,10,169,40,13
3,11,24,96
1000 DATA 2065E4A95085C1A91D85C2A202A5
C29D3222A5C19D0022186914B5C19002E6C2E8
E018D0E8A9008584AABD00E0,756
1010 DATA 9D0020BDFFE09DFF20E8D0F1A920
8DF402A277BDF42D9D0820CA10F7A207BD6C2E
9DD820CA10F7A900858D2072,718
1020 DATA 2A20852AA9038D3002A92F8D3102
A9C88DC402A9788DC502A9468DC602AD1FD06A
90206AB0F7E684A584C909D0,955
1030 DATA 04A900858418690109108D642FAD
1FD0C905F0F9D0DAAD1FD06A90FAA900858085
8185828586A9038587A58485,373
1040 DATA 838585A900858DA583F8186901D8
8583A685E00FF002E685A686E003F004E686D0
0CA2018686A587C909F002E6,278
1050 DATA 87A685BD732E85A3A90585A5BD82
2E859CBD912E85A2A686BDA02E85AAA9B98D30
02A92E8D31022085 2AA90085,618
1060 DATA 8D858A85AB85A98D1ED085948595
85A485A68589859D859E859FA685BDA32E8588
A0CBA22AA907205CE4A5860A,687
1070 DATA AABDB12E85C1BDB22E85C2A000B1
C199501DC8C0F0D0F618A5C169F085C19002E6
C2A000B1C199401EC8C0F0D0,453
1080 DATA F6A9688DC402A9C88DC502A9008D
C602A9868DC702A227BDDB2E9D001DA9009D28
1DCA10F220802C20692C208E,430
1090 DATA 2CA583A04A206D2CA5860A0AAABD
8F2F858CBD9B2F858BE8A002BD8F2F998E00BD
9B2F999100A9009999009996,528
1100 DATA 00E88810E820722AA9208D07D4A9
028D1DD0A93E8D2F02A9018D6F02A9DA8DC002
A91A8DC1028DC2028DC302A5,380
1110 DATA 8C8D00D0A48BA200BDAB2F95B999
0024C8E8E008D0F2A209BDEB2F95AFCA10F820
9F2AA9AA8D01D2A205BD1D30,167
1120 DATA 8D00D2A905204B2DCA10F220852A
A928204B2DA9FF858D20192B20802C20692CAD
1FD06A902DADFC02C921D00E,645
1130 DATA A9FF8DFC02458D858DD003208F2A
A58DF0E1A58AD00DA588F009A5ABC5AAD0CA4C
BB2D4C612D4C5428A900AA9D,556
1140 DATA 00249D00259D00269D0027E8D0F1
60A90085AC85AD85A085AE8D01D28D03D28D05
D28D07D28D08D260A90085C5,708
1150 DATA A92585C6A90085A7A6A7E003F0D3
B58E9D01D0B491A200B5AF91C5C8E8E00AD0F6
E6A7E6C64CAB2AD8A58DF00F,610
1160 DATA 20EB2B20D62C20122D20E52A2094
2C8D1ED04C62E4A207A48BA900854D990024C8
CA10F9AE780286A9A58C187D,373
1170 DATA 1E30858C8D00D0A58B187D293085
8BA207A8B5B9990024C8CA10F760A5A0D011A5
A4F003C6A460A5A385A4A5A6,76
1180 DATA F003C6A660A5A585A6A200209C2B
B596F005D6964C812BB58EC58C900AD004A900
F006A9FFD002A9018594B591,841
1190 DATA C58B900AD004A900F006A9FFD002
A9018595A008A594D93930D00CA595D94230D0
059895991003B810EAB599A8,286
1200 DATA B58E18793930958EB59118794230
9591E8E003D09C4C9F2AB599A8B58E38F94B30
4A4A4A8594B59138F954304A,722
1210 DATA 4A4AA8B9002285C1B9322285C2A4
94B1C1293FF069C91BF065C90FF061A59C9596
A9108D00D2A9068D01D285AC,420
1220 DATA AD0AD22903A8B95D30959910B1A5
8B38E91C4A4A4AA8B9002285C3B9322285C4A5
8C38E92C4A4A4AA8B1C3293F,506
1230 DATA F022C90FF032C91BF01BB1C329C0
C940D012A90385AEA9F08D06D2A9C88D07D2A9
0091C360A97020552CA91085,214
1240 DATA ADA9828D02D2E6AB4C2B2C202B2C
A5A285A0A90585A1A9A68D05D2A950F8186580
8580A900658185 81A9006582,573
1250 DATA 8582D860A588A03648386A4A4A4A
99001DC868290F091099001D60A202A02AB580
206D2CC8CA10F760A587A040,109
1260 DATA D0D9A4ACF0068884AC8C01D2A4AD
F0098884AD9809A08D03D2A5A0F019A4A1B961
308D04D2C6A1D00DA90585A1,257
1270 DATA C6A0D005A9008D05D2A5AEF009C6
AED005A9008D07D260E69FA59FC914D010A900
859FA968CDC402D002A90A8D,974
1280 DATA C402E689A589C93CD00DA9008589
A588F838E901D88588AD0CD0858AAD04D02908
F002858A60A59D18690AC932,505
1290 DATA D002A900859DA8A209B9EB2F95AF
C8CA10F7A5A9C90FF009A59E186908C940D002
A900859EA8A207B9AB2F95B9,237
1300 DATA C8CA10F76085A7A9008514A514C5
A7F0BAAD1FD0C907F0F34C5428A900858D2085
2AC687208E2CA9CC8D01D2A2,986
1310 DATA 28E68CA58C8D00D0AD0AD28D00D2
A901204B2DC68CA58C8D00D0AD0AD28D00D2A9
01204B2DCA10D920852AA587,116
1320 DATA F0034C0829A209BD67309D311ECA
10F720722AA9FF204B2D4C5428A900858D2085
2AA588F838E9018588D82069,771
1330 DATA 2CA91020552C20802CA9328D00D2
A0A48C01D2A901204B2D88C0A0D0F3A588D0D4
20852A4CB7280000FFFFFFFF,118
1340 DATA 00003C3C3C3C3C3C3C3C0000F8FC
FCFC3C3C00001F3F3F3F3C3C3C3CFCFCFCF800
003C3C3F3F3F1F00003C7CFC,962
1350 DATA FCFCFC7C3C3C3C3E3F3F3F3F3E3C00
00FFFFFFFF7E3C3C7EFFFFFFFF000000183C3C
3C3C3C3C3C3C3C3C3C3C1800,578
1360 DATA 0000FCFEFEFC000000003F7F7F3F
0000FF81BDA1B9A181FF007EFF7E3C18000028
25231F1D1918171615141312,369
1370 DATA 1110322D281E191919191919191919
191919191817161514131211100F0E0D0C0B10
0E1A606055555050454540 40,956
1380 DATA 4040404040713029 32E133707070
42001D0246501D06606060606060606060606060
6060606060606060606041B92E,838
1390 DATA 000033232F3225 1A00000000222F
2E35331A0000000002C29362533 1A000000002C
2536252C1A000070707070 70,396
1400 DATA 70707070471B2F70067007700670
060641032F0000000000000000226F2E6B0000
0000008080808080A3AFB0B9B2,270
1410 DATA A9A7A8B4809199989480A2B99A80
8000000002A212D2533000028212735250000000
0000000000000006C6576656C,511
1420 DATA 1A0011008080808080808080B3A5AC
A5A3B480A6AFB280ACA5B6A5AC8080808080B3
B4A1B2B480B4AF80A2A5A7A9,897
1430 DATA AE8080804 87E7EB8806098805050
92B87848C07848606060D0D2A866880FED6FE107C
6C6CEEFED6FE107C6CEC0EFE,333
```

```
1440 DATA D6FE107CEC0C0EFED6FE107C6CEC
0EFED6FE107C6C6CEEFED6FE107C6C6EE0FED6
FE107C6E60E0FED6FE107C6C,305
1450 DATA 6EE00020203F3C3CFC0404000010
103C3FFC3C0808000008083CFC3F3C10100000
0404FC3C3C3F202000008142,814
1460 DATA 3C3C3C3C428100A000A0828C9601
010100FFFFFF0000000001FF000001FF000001
FF0000001010100FFFFFF00,293
1470 DATA FFFF0001010100FF2C2C2A2A2A2C
2E2E2E1C1E1E1C1A1A1A1C1E02040600800C8DC
D2E69627212D2500002F3625,31
1480 DATA 32C4C1C1C1C1C9C1C1C1C1C1C1C1
C1C9C1C1C1C3C2C01B4040424040404040404040
40404240401BC0C2C2C0C01B,293
1490 DATA 4042404040404040404042401BC0
C0C2C2C0C0C01B4240404040404040404021BC0
C0C0C2C84141414145404040,629
1500 DATA 4040404040464141414141C7C2C0C0
C0C0C0C0C0C0C0C0C0C0C0C0C0C0C0C0C0C2C2C0
C0C0C0C0C0C0C0C0C0C0C0C0,12
1510 DATA C0C0C0C0C0C0C2C2C0C0C0C0C0C0C4
C1C1C1C1C3C0C0C0C0C0C0C2C2C0C0C0C0C4C1
CAC1C9C9C1CAC1C3C0C0C0C0,720
1520 DATA C2C8C3C0404042401BC0C2C2C0C0
1B42404040C4C7C2C240404042404FC2C2C0
4F4042404040C2C2C8C5C0C0,433
1530 DATA 4042401BC0C2C2C0C01B42404040
C6C7C2C0C0C0C0C6C1C9C1CACAC1C9C1C5C0C0
C0C0C2C2C0C0C0C0C0C0C6C1,934
1540 DATA C1C1C1C5C0C0C0C0C0C0C2C2C0C0
C0C0C0C0C0C0C0C0C0C0C0C0C0C0C0C0C2C2C0
C0C0C0C0C0C0C0C0C0C0C0C0,590
1550 DATA C0C0C0C0C0C2C2C0C0C0C0C0C0C0
C0C0C0C0C0C0C0C0C0C0C0C2C84141414143400
4040404040404044141414141,955
1560 DATA C7C2C0C0C01B4240404040404040
40421BC0C0C0C2C2C0C01B4042404040404040
404042401BC0C0C2C2C01B40,851
1570 DATA 4042404040404040404042404 01B
C0C2C6C1C1C1C1CAC1C1C1C1C1C1C1C1CAC1C1
C1C1C5C4C1C1C1C1C1C1C1C1C1,727
1580 DATA C1C1C1C1C1C1C1C1C1C1C3C2C01B
C0C0C0C0C0C0C0C0C0C0C0C0C0C01BC0C2C2C0
C0C0C0C0C0C0C0C0C0C0C0C0,56
1590 DATA C0C0C0C0C0C2C2C0C0C4C1C1C1C3
C0C0C0C0C4C1C1C3C0C0C0C2C2C0C0C2C01B40
4C4040404041BC0C2C0C0C0,525
1600 DATA C2C2C0C0C2C0C0C0C0C0C0C0C0C0
C0C0C2C0C0C0C2C2C0C0CCC0C0C0C0CBC0C0CB
C0C0C0CCC0C0C0C2C2C0C0C0,227
1610 DATA C0C0C0C0C2C01BC8C1CDC0C0C0C0
C0C2C2C0C0C0C0C0CEC1C7C0C042C0C0C0C0C0
C0C0C2C2C0C0C0C0C01B4048,217
1620 DATA 414147401BC0C0C0C0C0C2C2C0C0
C0C0C0C0C0424040C8C1CDC0C0C0C0C0C0C2C2C0
C0C0C0C0CEC1C71BC0C2C0C0,696
1630 DATA C0C0C0C0C0C2C2C0C0C0C0C0C0C0
CCC0C0CCC0C0C0C0C0C0C0C0C2C2C0C0C01BC0C0
C0C0C0C0C0C0C01BC0C0C0C0,38
1640 DATA C2C2C0C0C0C0C0C04B4040404040 4B
4040404040404C2C2C0C0C0C0C0C0C0C2C0C0C0C0
C2C0C0C0C0C0C0C0C2C2C0C0C0,180
1650 DATA C0C01BC2C0C0C0C0C21BC0C0C0C0
C0C2C2C0C0C0C0CEC1C5C0C0C0C0C0C6C1CDC0C0
C0C0C2C2C0C0C0C0C0C0C0C0,542
1660 DATA C0C0C0C0C0C0C0C0C0C0C2C84143
4040404040404040404F4040404040404441C7C21B
4240404040404040404040404040,222
1670 DATA 404040421BC2C6C1CAC1C1C1C1C1
C1C1C1C1C1C1C1C1C1C1CAC1C5C4C1C1C1C1C1C9
C1C1C1C1C1C1C9C1C1C1C1C1C1,274
1680 DATA C3C21B001B001B42404040404040
C2C0252E24C0C2C2C01B001B404240401BC0C0
C0C8C1C1C1C1C1C7C21B001B,998
1690 DATA 001B424040C4C3C0C0C2C01B001B
C0C2C84141414141C7C0C0C2424040C2C0C01B
C0C0C2C2C0C0C0C0C0C0C2C0C0,231
1700 DATA 42C2C0C0C2C01B001BC0C2C2C0C0
1BC0C0C2C0C0C6C5C0C0C2C0C01BC0C0C2C2C0
C0C0C0C0C2C0C0C0C0C0404042,540
1710 DATA 4040404040C2C2C0C0CBC0C0C2C0
C0C0C04F4042404040404040C2C2C0C0C2C01BC2
C0C0C0C0C0C0C0424040404040,627
1720 DATA C2C2C0C0C2C0C0C0C2C0C0C4C3C0C0
C2C0C0C0C0C0C0C2C2C0C0C2C0C0C0C2404042C2C0
C0C21B00001BA0C2C21BC0C2,9
1730 DATA C0C0C2C0C0C0C242401BC84D404040
4EC7C2C0C0CCC0C0C2C0C0C6C5C0C0C2C0C0C0
C0C0C2C2C0C0C0C0C0C0C2C0C0,671
1740 DATA C0C0C0C0C2C0C0C0C0C0C0C2C2C0C0
C0C0C0C2C0C0C0C0C0C0C2C0C0C0C0C0C0C2C2C0
C0C0C0C0C8C1C1C1434040C8,963
1750 DATA 4141414141C7C84141414141C7C0
1B4042404042404040404042C2C2C0C04F404042
401B404240404C4040404040,864
1760 DATA C2C2C0C0C0C0C0C042401B40424040
4040401BC0C0C2C2C0C0C0C0C042401B404240
4040404040404042C2C6C1C1C1,348
1770 DATA C1C1CAC1C1C1CAC1C1C1C1C1C1C1
C1C5000000000000000000000000000000000000
0000000000000000000000000,458
```

●

CHECKSUM DATA.
(see page 18)

```
10 DATA 448,351,496,811,423,729,556,60
3,555,573,694,613,29,205,210,7296
160 DATA 748,198,962,618,491,30,155,46
7,165,760,113,879,923,777,23,7309
1060 DATA 138,984,965,112,978,312,868,
310,927,150,834,45,885,708,941,9157
1210 DATA 870,975,732,742,737,95,15,88
6,63,969,878,773,919,180,518,9352
1360 DATA 774,171,67,50,100,154,850,15
5,732,347,503,962,698,199,909,6671
1510 DATA 160,619,966,57,564,415,784,2
68,933,177,24,21,266,787,104,6145
1660 DATA 223,117,603,747,876,568,822,
77,33,171,459,52,4748
```

●

Listing 2.
Assembly listing.

```
;******************************
;*            BONK            *
;*      Copyright  1984       *
;* Programmed by James Hague  *
;*  Using MAC/65 by OSS Inc.  *
;******************************
;
;HARDWARE REGISTERS
;
RANDOM   =   $D20A   ;Random #s
GRACTL   =   $D01D   ;Graphic ctrl
AUDC1    =   $D201   ;Audio controls
AUDC2    =   $D203
AUDC3    =   $D205
AUDC4    =   $D207
AUDF1    =   $D200   ;Audio frequency
AUDF2    =   $D202
AUDF3    =   $D204
AUDF4    =   $D206
AUDCTL   =   $D208
HPOSP0   =   $D000   ;P1. 0 horiz.
HPOSP1   =   $D001   ;P1. 1 horiz.
P0PF     =   $D004   ;P0 to PF coll.
P0PL     =   $D00C   ;P0 to PL coll.
HITCLR   =   $D01E   ;Collision clear
CONSOL   =   $D01F   ;Console buttons
PMBASE   =   $D407
SETVBV   =   $E45C   ;VBLANK vectors
XITVBV   =   $E462   ;VBLANK exit
SIOINV   =   $E465   ;Initialize SIO
;
```

```
;SHADOW REGISTERS
;
CLOCK   =   $14     ;Real time clock
ATTRACT =   $4D
DMACTL  =   $022F   ;DMA control
SDLSTL  =   $0230   ;Dlist pointer
GPRIOR  =   $026F
STICK   =   $0278   ;Joystick 0
COL0    =   $02C4   ;Color regs.
COL1    =   $02C5
COL2    =   $02C6
COL3    =   $02C7
PCOL0   =   $02C0   ;Player colors
PCOL1   =   $02C1
CHBAS   =   $02F4   ;Character base
CH      =   $02FC   ;Keyboard buffer
;
        *=  $80
;
;GAME VARIABLES
;
SCORE   .DS 3       ;Player's score
LEVEL   .DS 1       ;Current level
SLEVEL  .DS 1       ;Starting level
BLEVEL  .DS 1       ;Binary level
BOARD   .DS 1       ;Current board
LIVES   .DS 1       ;Remaining lives
TIME    .DS 2       ;Bonus timer
DIE     .DS 1       ;Death flag
P0Y     .DS 1       ;Pl0 y position
P0X     .DS 1       ;Pl0 X position
GAMCTL  .DS 1       ;Game control
ENXPOS  .DS 3       ;Enemy X pos.
ENYPOS  .DS 3       ;Enemy Y pos.
ENXADD  .DS 1       ;Enemy X add
ENYADD  .DS 1       ;Enemy Y add
ENBOUN  .DS 3       ;En bounce flags
ENDIR   .DS 3       ;Enemy direction
BDIST   .DS 1       ;Bounce distance
ENAN    .DS 1       ;Enemy pointer
PLAN    .DS 1       ;Play. pointer
FLASH   .DS 1       ;Treas. flasher
FREEZE  .DS 2       ;Freeze timers
FTIME   .DS 1       ;Freeze time
WAIT    .DS 4       ;Time delay
TEMP    .DS 2       ;Temp storage
DIR     .DS 1       ;Jstick direct.
TOTAL   .DS 1       ;Jewels/board
COUNT   .DS 1       ;Jewels/taken
BONK    .DS 1       ;Bounce sound
DING    .DS 1       ;Bell sound
WSND    .DS 1       ;Eat wall sound
ENEMY   .DS 10      ;Enemy image
PLAYER  .DS 9       ;Player image
LO      .DS 2       ;General pointer
VLO     .DS 2       ;Ditto
POINT   .DS 2       ;Play. pointer
;
;RESERVED MEMORY
;
        *=  $2000
;
PM      .DS $0400   ;Pmbase
PL0     .DS $0100
PL1     .DS $0100
PL2     .DS $0100
PL3     .DS $0100
;
DISP    =   $1D00   ;Display area
CHSET   =   $2000   ;New char set
LOTBL   =   $2200   ;Plotter table
HITBL   =   LOTBL+50
;
        *=  $2800   ;Program start
;
;SET-UP PLOTTER
;
GAME    JSR SIOINV  ;Init sounds
        LDA # <DISP+80
        STA LO
        LDA # >DISP+80
        STA LO+1
        LDX #2
SEPL    LDA LO+1
        STA HITBL,X
        LDA LO
        STA LOTBL,X
        CLC
        ADC #20
        STA LO
        BCC SEP2
        INC LO+1
SEP2    INX
        CPX #24
        BNE SEPL
        LDA #0
        STA SLEVEL
;
;REDEFINE CHARSET
;
        TAX         ;Move set
MSET    LDA $E000,X
        STA CHSET,X
        LDA $E0FF,X
        STA CHSET+$FF,X
        INX
        BNE MSET
        LDA # >CHSET ;Install it
        STA CHBAS
        LDX #119    ;Redefine set
RDEF    LDA CDAT,X
        STA CHSET+8,X
        DEX
        BPL RDEF
        LDX #7
RDEF2   LDA CDAT2,X
        STA CHSET+216,X
        DEX
        BPL RDEF2
;
GO      LDA #0      ;Turn off VBI
        STA GAMCTL
        JSR PMCLR   ;No players
        JSR QUIET   ;No sound
;
;TITLE SCREEN
;
        LDA # <TDL  ;Point to title
        STA SDLSTL  ;screen display
        LDA # >TDL  ;list.
        STA SDLSTL+1
        LDA #200    ;Set up title
        STA COL0    ;colors.
        LDA #120
        STA COL1
        LDA #70
        STA COL2
;
START   LDA CONSOL  ;Start key
        ROR A       ;pressed?
        BCC ST1     ;Yes!
;
;LEVEL SELECTION
;
        ROR A       ;Select pressed?
        BCS START   ;No, skip this.
        INC SLEVEL  ;Yes, start at
        LDA SLEVEL  ;next level.
        CMP #9      ;Highest level?
        BNE Z1      ;No, continue.
        LDA #0      ;Yes, reset and
        STA SLEVEL  ;store it.
Z1      CLC         ;Add 1 to start-
        ADC #1      ;ing level #
        ORA #16     ;Add color
        STA TITLE+73 ;and show it
Z2      LDA CONSOL  ;Get keys again
        CMP #5      ;Key released?
        BEQ Z2      ;No, wait for it
        BNE START   ;Branch always!
;
ST1     LDA CONSOL
        ROR A
        BCC ST1
        LDA #0      ;Set variables
        STA SCORE   ;that are set
        STA SCORE+1 ;once per game.
        STA SCORE+2
        STA BOARD
        LDA #3      ;3 lives
        STA LIVES
        LDA SLEVEL  ;Set level
        STA LEVEL
        STA BLEVEL
;
NEWLEV  LDA #0      ;Turn off VBI
        STA GAMCTL
        LDA LEVEL   ;Get BCD level
        SED
        CLC
        ADC #1      ;And raise it
        CLD
        STA LEVEL   ;Then store.
        LDX BLEVEL  ;Get bin. level
        CPX #15     ;Highest level?
        BEQ SAMEL   ;Yes, keep it.
        INC BLEVEL  ;No, raise it.
SAMEL   LDX BOARD   ;Get board #
        CPX #3      ;Highest board?
        BEQ BRD1    ;Yes, reset
        INC BOARD   ;and store
        BNE SETLEV  ;Branch always!
;
BRD1    LDX #1      ;Reset board #
        STX BOARD
        LDA LIVES   ;And give extra
        CMP #9      ;life
        BEQ SETLEV
        INC LIVES
SETLEV  LDX BLEVEL  ;Binary level
        LDA DEL1-1,X ;Set up delay
        STA WAIT
        LDA #5
        STA WAIT+2
        LDA BOUN-1,X ;Get bounces
        STA BDIST
        LDA FTM-1,X ;Get freeze time
        STA FTIME
        LDX BOARD   ;Board #
        LDA TOT-1,X ;Get jewels
        STA TOTAL
        LDA # <DL   ;Install DL
        STA SDLSTL
        LDA # >DL
        STA SDLSTL+1
;
NEWLIFE JSR QUIET   ;No sound.
        LDA #0      ;Zero items
        STA GAMCTL  ;that must be
        STA DIE     ;zeroed for each
        STA COUNT   ;new life
        STA DIR
        STA HITCLR
        STA ENXADD
        STA ENYADD
        STA WAIT+1
        STA WAIT+3
        STA TIME+1
        STA ENAN    ;Reset pointers
        STA PLAN
        STA FLASH
        LDX BLEVEL  ;Set timer
        LDA TIM-1,X
        STA TIME
        LDY # <VBI  ;Deferred VBI
        LDX # >VBI
        LDA #7
        JSR SETVBV
;
;DRAW SCREEN
;
        LDA BOARD   ;Get board #
        ASL A       ;Times 2
        TAX         ;use as index
        LDA BDTBL-2,X ;Board lo byte
        STA LO
        LDA BDTBL-1,X ;Hi byte of it
        STA LO+1
        LDY #0      ;Draw 1st part
DR1     LDA (LO),Y  ;Get screen byte
        STA DISP+80,Y ;and show it
        INY
        CPY #240
        BNE DR1
        CLC
        LDA LO      ;point to part 2
        ADC #240
        STA LO
        BCC DR2
        INC LO+1
DR2     LDY #0
DR3     LDA (LO),Y  ;Get byte
        STA DISP+320,Y
        INY
        CPY #240
        BNE DR3
;
;INITIALIZE
;
        LDA #104    ;Color 0 is
        STA COL0    ;purple
        LDA #200    ;Color 1 is
        STA COL1    ;green
        LDA #0      ;Color 2 is
        STA COL2    ;black
        LDA #134    ;Color 3 is
        STA COL3    ;blue
        LDX #39     ;Print score
PS      LDA SCL,X   ;line
        STA DISP,X
        LDA #0
        STA DISP+40,X
        DEX
        BPL PS
        JSR SHOSC   ;Show score
        JSR SHOBO   ;Show bonus
        JSR SHOLI   ;Show lives
        LDA LEVEL   ;Show level
        LDY #74
        JSR BCD
        LDA BOARD   ;Set initial
        ASL A       ;player
        ASL A       ;positions.
        TAX
        LDA IX-4,X  ;Set player X
        STA P0X
        LDA IY-4,X  ;and Y
        STA P0Y
        INX
        LDY #2      ;Set all enemy
SET     LDA IX-4,X  ;X
        STA ENXPOS,Y
        LDA IY-4,X  ;Y
        STA ENYPOS,Y
        LDA #0
        STA ENDIR,Y ;Zero enemy
        STA ENBOUN,Y ;status
        INX
        DEY
        BPL SET     ;Finish up
;
;P/M SET UP
;
        JSR PMCLR   ;Clear players
        LDA # >PM   ;Point to PM
        STA PMBASE  ;area
        LDA #2      ;Set gractl
        STA GRACTL
        LDA #62     ;Set dmactl
        STA DMACTL
        LDA #1      ;Set priority
        STA GPRIOR
        LDA #218    ;Set pl0 color
        STA PCOL0
        LDA #26     ;Set enemy color
        STA PCOL1
        STA PCOL1+1
        STA PCOL1+2
        LDA P0X     ;Draw player
        STA HPOSP0  ;Set x pos.
        LDY P0Y     ;Get y
        LDX #0
PD      LDA PDAT,X  ;Get player byte
        STA PLAYER,X
        STA PL0,Y   ;And show it
        INY
        INX
        CPX #8
        BNE PD
        LDX #9      ;Copy enemy data
CD      LDA EDAT,X  ;from memory to
        STA ENEMY,X ;animation table
        DEX
        BPL CD
        JSR DRAWEN  ;Draw enemy
        LDA #170    ;Introduction
        STA AUDC1
        LDX #5
IN      LDA MUSIC,X
        STA AUDF1
        LDA #5
        JSR DELAY
        DEX
        BPL IN
        JSR QUIET
        LDA #40
        JSR DELAY
        LDA #$FF    ;Turn on the
        STA GAMCTL  ;VBI
;
;MAIN LOOP
;
MAIN    JSR ENMOVE  ;Move enemy
        JSR SHOSC   ;Show score
        JSR SHOBO   ;Show bonus
M1      LDA CONSOL  ;Start pressed?
        ROR A
        BCC M4      ;Yes.
        LDA CH
        CMP #$21    ;Space bar?
        BNE M2      ;No.
        LDA #$FF
```

# Bonk *continued*

```
          STA CH        ;Reset keycode
          EOR GAMCTL    ;Flip pause
          STA GAMCTL
          BNE M2
          JSR HUSH      ;Peace and...
M2        LDA GAMCTL
          BEQ M1
          LDA DIE       ;Player dead?
          BNE M3        ;Yes.
          LDA TIME      ;Time up?
          BEQ M3
          LDA COUNT     ;Level done?
          CMP TOTAL
          BNE MAIN
          JMP LDONE
M3        JMP KILL      ;Auuughh!
M4        JMP GO
;
;CLEAR PM
;
PMCLR     LDA #0
          TAX
PC        STA PL0,X
          STA PL1,X
          STA PL2,X
          STA PL3,X
          INX
          BNE PC
DE3       RTS
;
;SOUND OFF
;
QUIET     LDA #0        ;Turn off sound
          STA BONK
          STA DING
          STA FREEZE
          STA WSND
HUSH      STA AUDC1
          STA AUDC2
          STA AUDC3
          STA AUDC4
          STA AUDCTL
          RTS
;
;DRAW ENEMY
;
DRAWEN    LDA # <PL1    ;Draw all 3
          STA POINT     ;enemy
          LDA # >PL1
          STA POINT+1
          LDA #0
          STA TEMP
DE1       LDX TEMP
          CPX #3
          BEQ DE3
          LDA ENXPOS,X  ;Set x position
          STA HPOSP1,X
          LDY ENYPOS,X
          LDX #0
DE2       LDA ENEMY,X
          STA (POINT),Y
          INY
          INX
          CPX #10
          BNE DE2
          INC TEMP
          INC POINT+1
          JMP DE1
;
;VBI
;
VBI       CLD           ;Kill decimal!
          LDA GAMCTL    ;Do this VBI?
          BEQ EXIT      ;No! Get out!
          JSR PCHK      ;Check player
          JSR STUFF     ;Do work
          JSR ANIM      ;Animate
          JSR PLMOVE    ;Move player
          JSR SOUND     ;Make noise
EXIT      STA HITCLR    ;Clear all hits
          JMP XITVBV    ;Go home!
;
;MOVE PLAYER
;
PLMOVE    LDX #7        ;1st- erase
          LDY P0Y       ;player
          LDA #0
          STA ATTRACT   ;Kill attract
ERPL      STA PL0,Y
          INY
          DEX
          BPL ERPL
          LDX STICK     ;2nd- get new
          STX DIR       ;player position
          LDA P0X       ;Get x position
          CLC           ;then add offset
          ADC XOFF-5,X  ;to old coord
          STA P0X       ;Save new pos.
          STA HPOSP0    ;and show it
          LDA P0Y       ;Now repeat for
          CLC           ;y position.
          ADC YOFF-5,X
          STA P0Y
          LDX #7        ;3rd- redraw
          TAY
DRPL      LDA PLAYER,X
          STA PL0,Y
          INY
          DEX
          BPL DRPL
          RTS
;
;ENEMY HANDLER
;
ENMOVE    LDA FREEZE    ;Frozen?
          BNE TWX       ;Yup, ice cold.
          LDA WAIT+1    ;Get 1st timer
          BEQ TWO       ;If 0, do next.
          DEC WAIT+1    ;Decrement 1st
          RTS           ;And leave.
;
TWO       LDA WAIT      ;Reset 1st timer
          STA WAIT+1
          LDA WAIT+3    ;Get 2nd timer
          BEQ MOVE      ;If 0, move 'em
          DEC WAIT+3    ;Decrement 2nd
TWX       RTS
;
MOVE      LDA WAIT+2    ;Reset 2nd
          STA WAIT+3
          LDX #0        ;Main counter
DOMOR     JSR CHECK     ;Check enemy
          LDA ENBOUN,X  ;Bouncing?
          BEQ NOB       ;No, continue.
          DEC ENBOUN,X  ;Yes,
          JMP OUT       ;Do next enemy.
;
NOB       LDA ENXPOS,X  ;Get x pos
          CMP P0X       ;Comp with play
          BCC XLES      ;Less than?
          BNE XMOR      ;More than?
          LDA #0        ;Equal to, stop
          BEQ DOY       ;movement.
XMOR      LDA #$FF      ;More than, move
          BNE DOY       ;left.
XLES      LDA #1        ;Less than, move
DOY       STA ENXADD    ;right.
          LDA ENYPOS,X  ;Get y pos
          CMP P0Y       ;Comp with play
          BCC YLES      ;Less than?
          BNE YMOR      ;More than?
          LDA #0        ;Equal to, stop
          BEQ FINI      ;movement.
YMOR      LDA #$FF      ;More than, move
          BNE FINI      ;left.
YLES      LDA #1        ;Less than, move
FINI      STA ENYADD    ;right.
          LDY #8        ;Convert to dir
CDIR      LDA ENXADD    ;Is x direction
          CMP ENX,Y     ;correct?
          BNE AGA       ;No, check more.
          LDA ENYADD    ;Is y direction
          CMP ENY,Y     ;correct?
          BNE AGA       ;Nope.
          TYA
          STA ENDIR,X   ;It's correct!
          BPL OUT       ;Branch always!
;
AGA       DEY           ;Continue
          BPL CDIR      ;searching
OUT       LDA ENDIR,X   ;Get direction
          TAY
          LDA ENXPOS,X  ;Update x pos
          CLC
          ADC ENX,Y
          STA ENXPOS,X
          LDA ENYPOS,X  ;Update y
          CLC
          ADC ENY,Y
          STA ENYPOS,X
          INX
          CPX #3
          BNE DOMOR
          JMP DRAWEN    ;Draw enemy
;
CHECK     LDA ENDIR,X   ;Check if the
          TAY           ;enemy hit
          LDA ENXPOS,X  ;anything
          SEC           ;1st, scan on
          SBC SCX,Y     ;x axis
          LSR A
          LSR A
          LSR A
          STA ENXADD
          LDA ENYPOS,X  ;2nd, scan on
          SEC           ;y axis
          SBC SCY,Y
          LSR A
          LSR A
          LSR A
          TAY           ;Now, get point
          LDA LOTBL,Y
          STA LO
          LDA HITBL,Y
          STA LO+1
          LDY ENXADD
          LDA (LO),Y
          AND #$3F      ;Mask off color
          BEQ L0        ;Hit anything?
          CMP #27       ;Hit diamond?
          BEQ L0        ;Yup, forget it
          CMP #$0F      ;Hit freezer?
          BEQ L0        ;Yup, who cares
          LDA BDIST     ;A hit! Make the
          STA ENBOUN,X  ;enemy bounce!
          LDA #16       ;Set sound
          STA AUDF1
          LDA #6
          STA AUDC1
          STA BONK
          LDA RANDOM    ;Get new direct.
          AND #3
          TAY
          LDA BDIR,Y
          STA ENDIR,X
          BPL CHECK     ;Check it out!
;
;CHECK PLAYER
;
PCHK      LDA P0Y       ;Get y pos
          SEC           ;And convert to
          SBC #28       ;screen position
          LSR A
          LSR A
          LSR A
          TAY           ;Get address
          LDA LOTBL,Y
          STA VLO
          LDA HITBL,Y
          STA VLO+1
          LDA P0X       ;Now convert x
          SEC
          SBC #44
          LSR A
          LSR A
          LSR A
          TAY
          LDA (VLO),Y   ;Get point
          AND #$3F      ;Mask out color
          BEQ L0        ;Nothing there
          CMP #$0F      ;Hit freezer?
          BEQ HITFR     ;Yup, handle it
          CMP #$1B      ;Hit diamond?
          BEQ HITDI     ;Yup, fix it
          LDA (VLO),Y   ;Get point
          AND #192      ;Get color used
          CMP #64       ;Hit weak wall?
          BNE L0        ;No, leave.
;
;Hit weak wall
;
          LDA #3        ;Set sound
          STA WSND
          LDA #240
          STA AUDF4
          LDA #200
          STA AUDC4
HITX      LDA #0        ;Erase wall
          STA (VLO),Y
L0        RTS
;
;Hit diamond
;
HITDI     LDA #$70      ;Give points
          JSR ADD
          LDA #16       ;Set sound
          STA DING
          LDA #130
          STA AUDF2
          INC COUNT     ;Count it
          JMP HITX
;
;Hit freezer
;
HITFR     JSR HITX      ;Erase freezer
          LDA FTIME     ;Set freeze time
          STA FREEZE
          LDA #5
          STA FREEZE+1
          LDA #166      ;Set sound
          STA AUDC3
          LDA #$50      ;Give points
;
;SCORE ROUTINES
;
ADD       SED           ;Add points to
          CLC           ;score
          ADC SCORE
          STA SCORE
          LDA #0
          ADC SCORE+1
          STA SCORE+1
          LDA #0
          ADC SCORE+2
          STA SCORE+2
          CLD
          RTS
;
SHOBO     LDA TIME      ;Show bonus
          LDY #54
;
BCD       PHA           ;Show 1 bcd
          SEC
          ROR A
          LSR A
          LSR A
          LSR A
          STA DISP,Y
          INY
          PLA
          AND #$0F
          ORA #$10
          STA DISP,Y
          RTS
;
SHOSC     LDX #2        ;Show score
          LDY #42
SS        LDA SCORE,X
          JSR BCD
          INY
          DEX
          BPL SS
          RTS
;
SHOLI     LDA LIVES     ;Show lives
          LDY #64
          BNE BCD
;
;SOUND ROUTINES
;
SOUND     LDY BONK      ;Bounce sound?
          BEQ T1        ;No
          DEY
          STY BONK
          STY AUDC1
T1        LDY DING      ;Ball sound?
          BEQ T2        ;No
          DEY
          STY DING
          TYA
          ORA #$A0
          STA AUDC2
T2        LDA FREEZE    ;Freezer sound?
          BEQ T3        ;No
          LDY FREEZE+1
          LDA FSND,Y
          STA AUDF3
          DEC FREEZE+1
          BNE T3
          LDA #5
          STA FREEZE+1
          DEC FREEZE
          BNE T3
          LDA #0
          STA AUDC3
T3        LDA WSND      ;Wall sound?
          BEQ T4        ;No
          DEC WSND
          BNE T4
          LDA #0
          STA AUDC4
T4        RTS
```

```
;
;FLASH JEWELS
;
STUFF   INC FLASH    ;Handle flash
        LDA FLASH    ;timers.
        CMP #20
        BNE S1
        LDA #0
        STA FLASH
        LDA #104
        CMP COL0
        BNE S2
        LDA #10
S2      STA COL0
;
;HANDLE TIME
;
S1      INC TIME+1   ;Count down
        LDA TIME+1
        CMP #60      ;We interrupt
        BNE S3       ;this program
        LDA #0       ;for an import-
        STA TIME+1   ;ant news
        LDA TIME     ;bulletin:
        SED          ;  HI MOM!
        SEC
        SBC #1
        CLD
        STA TIME
S3      LDA P0PL     ;Check player
        STA DIE      ;collisions
        LDA P0PF
        AND #8
        BEQ S4
        STA DIE
S4      RTS
;
;ANIMATE
;
ANIM    LDA ENAN     ;Animate enemy.
        CLC          ;Hey guys, look!
        ADC #10      ;Your names are
        CMP #50      ;in print :
        BNE A1       ; David Hague
        LDA #0       ; Robbie Hague
A1      STA ENAN     ; Martin Beck
        TAY          ; Nathan Zink
        LDX #9       ;and everyone's
A2      LDA EDAT,Y   ;favorite:
        STA ENEMY,X  ; A. ZLOTNICK!
        INY          ;Tron to you!
        DEX          ;(No you don't
        BPL A2       ;get paid)
        LDA DIR      ;Animate player
        CMP #15      ;by storing a
        BEQ A3       ;different image
        LDA PLAN     ;in the player
        CLC          ;animation table
        ADC #8
        CMP #64
        BNE A4       ;Is this game
A3      LDA #0       ;better than
A4      STA PLAN     ;The Electroids?
        TAY
        LDX #7
A5      LDA PDAT,Y
        STA PLAYER,X
        INY
        DEX
        BPL A5
        RTS
;
;TIME DELAY
;
DELAY   STA TEMP     ;Enter with
        LDA #0       ;length of pause
        STA CLOCK    ;(in jiffies) in
D0      LDA CLOCK    ;the accumulator
        CMP TEMP
        BEQ S4
        LDA CONSOL
        CMP #7
        BEQ D0
        JMP 80
;
;DIE
;
KILL    LDA #0       ;Stop movement
        STA GAMCTL
        JSR QUIET    ;No sound
        DEC LIVES    ;Take a life
        JSR SHOLI    ;And show them.
        LDA #204
        STA AUDC1
        LDX #40      ;Kill player
K1      INC P0X      ;1st shift
        LDA P0X
        STA HPOSP0
        LDA RANDOM
        STA AUDF1
        LDA #1
        JSR DELAY
        DEC P0X      ;2nd shift
        LDA P0X
        STA HPOSP0
        LDA RANDOM
        STA AUDF1
        LDA #1
        JSR DELAY
        DEX
        BPL K1       ;Repeat again.
        JSR QUIET
        LDA LIVES    ;Any lives?
        BEQ OVR
        JMP NEWLIFE
;
;GAME OVER
;
OVR     LDX #9       ;Show GAME OVER
O1      LDA GOVR,X
        STA DISP+305,X
        DEX
        BPL O1
        JSR PMCLR
        LDA #255
        JSR DELAY
        JMP 80
;
;LEVEL DONE
;
LDONE   LDA #0       ;Stop movement
        STA GAMCTL
        JSR QUIET    ;No sound
C1      LDA TIME     ;Give 10 points
        SED          ;for each second
        SEC          ;left on the
        SBC #1       ;timer.
        STA TIME
        CLD
        JSR SHOBD    ;Add points for
        LDA #$10     ;time remaining
        JSR ADD      ;and make bell
        JSR SHOSC    ;tones by vary-
        LDA #50      ;ing the volume
        STA AUDF1    ;of voice 1.
        LDY #164
C2      STY AUDC1
        LDA #1
        JSR DELAY
        DEY
        CPY #160
        BNE C2
        LDA TIME
        BNE C1
        JSR QUIET    ;Kill noise
        JMP NEWLEV   ;Start new level
;
;CHARACTER DATA
;
CDAT    .BYTE 0,0,255,255,255,255,0
        .BYTE 0,60,60,60,60,60,60
        .BYTE 60,60,0,0,248,252,252
        .BYTE 252,60,60,0,0,31,63,63
        .BYTE 63,60,60,60,60,252,252
        .BYTE 252,248,0,0,60,60,63
        .BYTE 63,63,31,0,0,60,124
        .BYTE 252,252,252,252,124,60
        .BYTE 60,62,63,63,63,63,62
        .BYTE 60,0,0,255,255,255,255
        .BYTE 126,60,60,126,255,255
        .BYTE 255,255,0,0,0,24,60,60
        .BYTE 60,60,60,60,60,60,60
        .BYTE 60,60,60,24,0,0,0,252
        .BYTE 254,254,252,0,0,0,0,63
        .BYTE 127,127,63,0,0,255,129
        .BYTE 189,161,185,161,129
        .BYTE 255
CDAT2   .BYTE 0,126,255,126,60,24,0
        .BYTE 0
;
;LEVEL DATA
;
DEL1    .BYTE 40,37,35,31,29,25
        .BYTE 24,23,22,21,20,19,18
        .BYTE 17,16
BOUN    .BYTE 50,45,40,30,25,25
        .BYTE 25,25,25,25,25,25,25
        .BYTE 25,25
FTM     .BYTE 25,24,23,22,21,20
        .BYTE 19,18,17,16,15,14,13
        .BYTE 12,11
TOT     .BYTE 16,14,26
TIM     .BYTE $60,$60,$55,$55,$50
        .BYTE $50,$45,$45,$40,$40
        .BYTE $40,$40,$40,$40,$40
BDTBL   .WORD BD1,BD2,BD3
;
;INSTALL DISPLAY LIST
;
DL      .BYTE $70,$70,$70,$42
        .WORD DISP
        .BYTE 2,$46
        .WORD DISP+80
        .BYTE 6,6,6,6,6,6,6,6,6,6,6,6
        .BYTE 6,6,6,6,6,6,6,6,6,6,6,6
        .BYTE $41
        .WORD DL
;
SCL     .SBYTE "  SCORE:     BONUS: "
        .SBYTE "   LIVES:     LEVEL:"
        .SBYTE "  "
;
TDL     .BYTE $70,$70,$70,$70,$70
        .BYTE $70,$70,$70,$70,$47
        .WORD TITLE
        .BYTE $70,6,$70,7,$70,6
        .BYTE $70,6,6,$41
        .WORD TDL
;
TITLE   .SBYTE "         BoNk      "
        .SBYTE +$80,"    COPYRIGH"
        .SBYTE +$80,"T 1984 BY:   "
        .SBYTE "   JAMES  HAGUE   "
        .SBYTE "        level: 1 "
        .SBYTE +$80,"       SELEC"
        .SBYTE +$80,"T FOR LEVEL "
        .SBYTE +$80,"    START TO"
        .SBYTE +$80," BEGIN    "
;
IX      .BYTE 72,126,126,184
        .BYTE 128,96,152,128
        .BYTE 80,80,146,184
IY      .BYTE 120,72,192,120
        .BYTE 72,96,96,208
        .BYTE 210,168,104,128
;
; PLAYER, ENEMY, MUSIC DATA
;
PDAT    .BYTE 254,214,254,16,124,108
        .BYTE 108,238,254,214,254
        .BYTE 16,124,108,236,14,254
        .BYTE 214,254,16,124,236,12
        .BYTE 14,254,214,254,16,124
        .BYTE 108,236,14,254,214,254
        .BYTE 16,124,108,108,238,254
        .BYTE 214,254,16,124,108,110
        .BYTE 224,254,214,254,16,124
        .BYTE 110,96,224,254,214,254
        .BYTE 16,124,108,110,224
;
EDAT    .BYTE 0,32,32,63,60,60,252
        .BYTE 4,4,0,0,16,16,60,63
        .BYTE 252,60,8,8,0,0,8,8,60
        .BYTE 252,63,60,16,16,0,0,4
        .BYTE 4,252,60,60,63,32,32,0
        .BYTE 0,129,66,60,60,60,60
        .BYTE 66,129,0
MUSIC   .BYTE 160,0,160,130,140,150
;
;X,Y OFFSETS + MISC.
;
XOFF    .BYTE 1,1,1,0,$FF
        .BYTE $FF,$FF,0,0,0,0
YOFF    .BYTE 1,$FF,0,0
        .BYTE 1,$FF,0,0,1,$FF,0
ENX     .BYTE 0,0,1,1,1,0,$FF,$FF
        .BYTE $FF
ENY     .BYTE 0,$FF,$FF,0,1,1,1,0
        .BYTE $FF
SCX     .BYTE 44,44,42,42,42,44,46
        .BYTE 46,46
SCY     .BYTE 28,30,30,28,26,26,26
        .BYTE 28,30
BDIR    .BYTE 2,4,6,8
FSND    .BYTE 0,200,220,210,230,150
GOVR    .SBYTE "GAME  OVER"
;
;BOARD DATA
;
BD1     .SBYTE +$A0,"DAAAAIAAAAAAAA"
        .SBYTE +$A0,"IAAAACB@"
        .SBYTE ";"
        .SBYTE +$20,"@@B@@@@@@@@B@@@"
        .SBYTE ";"
        .SBYTE +$A0,"@BB@@"
        .SBYTE ";"
        .SBYTE +$20,"@B@@@@@@@@B@"
        .SBYTE ";"
        .SBYTE +$A0,"@@BB@@@"
        .SBYTE ";"
        .SBYTE +$20,"B@@@@@@@@B"
        .SBYTE ";"
        .SBYTE +$A0,"@@@BH"
        .SBYTE +$20,"AAAAE@@@@@@@@F"
        .SBYTE +$20,"AAAA"
        .SBYTE +$A0,"GB@@@@@@@@@@@@"
        .SBYTE +$A0,"@@@@@@@BB@@@@@@"
        .SBYTE +$A0,"@@@@@@@@@@@@@BB"
        .SBYTE +$A0,"@@@@@@@DAAAAC@@@"
        .SBYTE +$A0,"@@@@@BB@@@@@DAJA"
        .SBYTE +$A0,"IIAJAC@@@@@BHC@"
        .SBYTE +$20,"@@B@"
        .SBYTE ";"
        .SBYTE +$A0,"@BB@@"
        .SBYTE ";"
        .SBYTE +$20,"B@@@"
        .SBYTE +$A0,"DGBB"
        .SBYTE +$20,"@@@B@@@D"
        .SBYTE +$A0,"BB@"
        .SBYTE +$20,"D@B@@@"
        .SBYTE +$A0,"BBHE@@"
        .SBYTE +$20,"@B@"
        .SBYTE ";"
        .SBYTE +$A0,"@BB@@"
        .SBYTE ";"
        .SBYTE +$20,"B@@@"
        .SBYTE +$A0,"FGB@@"
        .SBYTE +$A0,"@@FAIAJJAIAE@@"
        .SBYTE +$A0,"@@BB@@@@@@FAAA"
        .SBYTE +$A0,"AE@@@@@@BB@@@@"
        .SBYTE +$A0,"@@@@@@@@@@@@@@"
        .SBYTE +$A0,"BB@@@@@@@@@@@@"
        .SBYTE +$A0,"@@@@@@BB@@@@@@"
        .SBYTE +$A0,"@@@@@@@@@@@@BH"
        .SBYTE +$20,"AAAAC@@@@@@@@D"
        .SBYTE +$20,"AAAA"
        .SBYTE +$A0,"GB@@@"
        .SBYTE ";"
        .SBYTE +$20,"B@@@@@@@@B"
        .SBYTE ";"
        .SBYTE +$A0,"@@@BB@@"
        .SBYTE ";"
        .SBYTE +$20,"@B@@@@@@@@B@@"
        .SBYTE ";"
        .SBYTE +$A0,"@@BB@@"
        .SBYTE ";"
        .SBYTE +$20,"@@B@@@@@@@@B@@@"
        .SBYTE ";"
        .SBYTE +$A0,"@BFAAAAJAAAAAA"
        .SBYTE +$A0,"AAJAAAAE"
;
BD2     .SBYTE +$A0,"DAAAAAAAAAAA"
        .SBYTE +$A0,"AAAAAACB@"
        .SBYTE ";"
        .SBYTE +$A0,"@@@@@@@@@@@@@@"
        .SBYTE ";"
        .SBYTE +$A0,"@BB@@@@@@@@@@@@"
        .SBYTE +$A0,"@@@@@@@"
        .SBYTE +$A0,"BB@@DAAAC@@@@"
        .SBYTE +$A0,"DAAC@@@BB@@@B@"
        .SBYTE ";"
        .SBYTE +$20,"@L@@@@L"
        .SBYTE ";"
        .SBYTE +$A0,"@B@@@@BB@@@@@@@"
        .SBYTE +$A0,"@@@@@@@@B@@@@BB"
        .SBYTE +$A0,"@@L@@@@K@@K@@"
        .SBYTE +$A0,"@L@@@BB@@@@@@@"
        .SBYTE +$A0,"@B@"
        .SBYTE ";"
        .SBYTE +$A0,"HAM@@@@@BB@@@@"
        .SBYTE +$A0,"@@NA@@@"
        .SBYTE +$20,"B"
        .SBYTE +$A0,"@@@@@@@BB@@@@@@"
        .SBYTE ";"
        .SBYTE +$20,"@HAA@@"
        .SBYTE ";"
        .SBYTE +$A0,"@@@@@BB@@@@@@@@"
        .SBYTE +$20,"B@@"
        .SBYTE +$A0,"HAM@@@@@BB@@@@"
        .SBYTE +$A0,"@@NA@"
        .SBYTE ";"
        .SBYTE +$A0,"@B@@@@@@@@BB@@@@"
        .SBYTE +$A0,"@@@@L@@L@@@@@@"
        .SBYTE +$A0,"@@BB@@@"
```

# Bonk *continued*

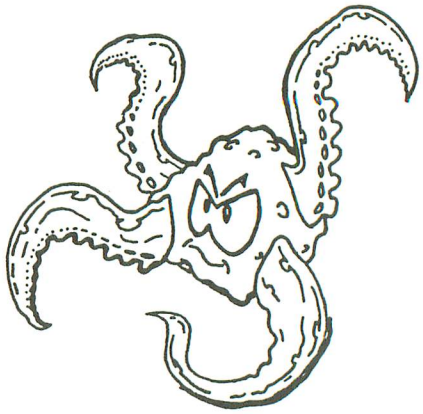
```
.SBYTE "¡"
.SBYTE +$A0,"@@@@@@@@@@"
.SBYTE "¡"
.SBYTE +$A0,"@@@@BB@@@@@@"
.SBYTE +$20,"K@@@@K@@@@@@"
.SBYTE +$A0,"BB@@@@@@BB@@@@"
.SBYTE +$A0,"B@@@@@@@BB@@@@@@"
.SBYTE "¡"
.SBYTE +$A0,"B@@@@@B"
.SBYTE "¡"
.SBYTE +$A0,"@@@@@BB@@@@@NAE"
.SBYTE +$A0,"@@@@FAM@@@@BB@"
.SBYTE +$A0,"@@@@@@@@@@@@@@"
.SBYTE +$A0,"@@@BH"
.SBYTE +$20,"AC@@@@@@@@D@@@"
.SBYTE +$20,"@@@DA"
.SBYTE +$A0,"@B"
.SBYTE "¡"
.SBYTE +$20,"B@@@@@@@@@@@@@"
.SBYTE +$20,"@@B"
.SBYTE "¡"
.SBYTE +$A0,"BFAJAAAAAAAAA"
.SBYTE +$A0,"AAAAAJAE"

BD3
.SBYTE +$A0,"DAAAAAIAAAAAAI"
.SBYTE +$A0,"AAAAACB"
.SBYTE "¡ ¡"
.SBYTE +$20,"B@@@@@@@"
.SBYTE +$A0,"B@"
.SBYTE "END"
.SBYTE +$A0,"@BB@"
.SBYTE "¡ ¡"
.SBYTE +$20,"@B@@"
.SBYTE "¡"
.SBYTE +$A0,"@@@HAAAAAGB"
.SBYTE "¡ ¡"
.SBYTE +$20,"B@@"
.SBYTE +$A0,"DC@@B@"
.SBYTE "¡ ¡"
.SBYTE +$A0,"@BH"
.SBYTE +$20,"AAAAA"
.SBYTE +$A0,"G@@B"
.SBYTE +$20,"B@@"
.SBYTE +$A0,"B@@"
.SBYTE "¡"
.SBYTE +$A0,"@@BB@@@@@B@@"
.SBYTE +$20,"B"
.SBYTE +$A0,"B@@B@"
.SBYTE "¡ ¡"
.SBYTE +$A0,"@BB@@"
```

```
.SBYTE "¡"
.SBYTE +$A0,"@@B@@FE@@B@@"
.SBYTE "¡"
.SBYTE +$A0,"@@BB@@@@@B@@@@"
.SBYTE +$20,"@@B@@@@@"
.SBYTE +$A0,"BB@@K@@B@@@@"
.SBYTE +$20,"O@B@@@@@"
.SBYTE +$A0,"BB@@B@"
.SBYTE "¡"
.SBYTE +$A0,"B@@@@@@"
.SBYTE +$20,"B@@@@@"
.SBYTE +$A0,"BB@@B@@B@@@DC@@"
.SBYTE +$A0,"B@@@@@BB@@@B@@@B"
.SBYTE +$20,"@@B"
.SBYTE +$A0,"B@@@B"
.SBYTE "¡ ¡"
.SBYTE +$A0," BB"
.SBYTE "¡"
.SBYTE +$A0,"@B@@B@@@B"
.SBYTE +$20,"B@"
.SBYTE "¡"
.SBYTE +$A0,"H"
.SBYTE +$20,"M@@@N"
.SBYTE +$A0,"GB@@L@@B@@FE@"
.SBYTE +$A0,"@B@@@@@BB@@@@@"
.SBYTE +$A0,"@B@@@@@@B@@@@"
.SBYTE +$A0,"@BB@@@@@B@@@@"
.SBYTE +$A0,"@@BB@@@@@BB@@@"
.SBYTE +$A0,"@@HAAA"
.SBYTE +$20,"C@@"
.SBYTE +$A0,"H"
.SBYTE +$20,"AAAAA"
.SBYTE +$A0,"GH"
.SBYTE +$20,"AAAAA"
.SBYTE +$A0,"G@"
.SBYTE "¡"
.SBYTE +$20,"@B@@B@@@@@"
.SBYTE +$A0,"BB@@"
.SBYTE +$20,"O@@B@"
.SBYTE "¡"
.SBYTE +$20,"@B@@L@@@@@"
.SBYTE +$A0,"BB@@@@@"
.SBYTE +$20,"B@"
.SBYTE "¡"
.SBYTE +$20,"@B@@@@@"
.SBYTE "¡"
.SBYTE +$A0,"@@BB@@@@@"
.SBYTE +$20,"B@"
.SBYTE "¡"
```

```
.SBYTE +$20,"@B@@@@@@@@"
.SBYTE +$A0,"BFAAAAAJAAA"
.SBYTE +$A0,"JAAAAAAAAE"

*=  $02E0
.WORD GAME
.END
```



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**Graphics:** 7 vertical dots — maximum 480 columns. Dot addressable.
**Character codes:** CBM ASCII code.
**Print speed:** 60 characters per second.
**Maximum columns:** 80 columns.
**Character spacing:** 10 characters per inch.
**Line feed spacing:** 6 lines per inch in character mode or 8 lines per inch selectable. 9 lines per inch in graphics mode.
**Line feed speed:** 5 lines per second in character mode. 7.5 lines per second in graphics mode.
**Paper feed:** Friction feed.
**Paper width:** 4.5" to 8.5" width.
**Multiple copies:** Original plus maximum of two copies.
**Dimensions:** 13"W x 8"D x 3¼"H. Wt.: 6½ lbs. **Power:** 120V AC, 60 Hz.

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|---|---|---|---|---|---|---|---|---|
| Maximum Speed (CPS) | 10 | 20 | 40 | 86 | 50 | 120 | 105 | 160 |
| Buffer Size | none | none | none | 1K | 1K | 2K | 2K | none |
| Print Size (CPI) | 10 standard | 12 | 5, 10 16 | 10 17 | 10 13.3 | 5, 6, 8.5, 10 12, 17.1 | 5, 6, 8.5, 10 12, 17.1 | 5, 8, 10 13, 16.5 |
| Characters Per Column | 40 | 80 | 40-132 | 80-136 | 80-106 | 80-136 | 80-136 | 80-136 |
| Standard Print Matrix | — | — | 9x7 | 7x9 | 7x8 | 11x9 | 11x9 | 9x9 |
| Number of Fonts | 1 | 1 | 1 | 6 | 1 | 6 | 6 | 6 |
| Interface | Direct to Serial Port | Direct to Serial Port | Direct to Serial Port | Direct to Serial Port | Direct to Serial Port | Serial Parallel | Serial Parallel | Serial |
| Graphics Matrix | none | none | none | 80x80 | 80x80 | 80x80 160x80 | 60x72 120x144 | 60x72 120x144 240x144 |
| Extra Features | Color Plotter | Letter Quality | — | Unihammer Printhead | 4-Color w/Software | — | RAM Char. Set | Long-life Printhead |
| Suggested Retail Price | $299 | $349 | $549 | $319 | $599 | $595 | $395 | $499 |

*No longer being manufactured, but still available at many retailers.

means that one line is printed from left to right, and the next is printed right to left. This saves the time it would normally take for the printhead to return to the left margin between each line.

You may be wondering how the printer can print a line from right to left. It is receiving the information to be printed from the computer and gets an entire line at a time, assembled to print. Once that line is readied, it doesn't matter if it's printed backward or forward.

There will be times when it's necessary to turn off the bidirectional mode and print only unidirectionally. Two examples are: when you're printing graphics, or when you're lining up columns of numbers containing decimal points. Also, all of the alternate character sets requiring two passes of the printhead (like subscripts on the Epson and correspondence quality on the Okidata) are automatically printed unidirectionally.

**Line space and forms control.**

You can control every movement of a printer from the computer keyboard. You can instruct the printer to change the line spacing from the normal 6 lines per inch to 8 lines per inch. Actually, line spacing can be changed to anywhere from $1/216$ inch to $255/216$ inch. This can be accomplished in both the forward and reverse line feed modes.

Vertical and horizontal tabs can be controlled from the computer. Entire series of tabs can be programmed. Other forms controls include setting of form length and skipping over perforations.

**Summary.**

Unlike the typewriter or letter-quality printer, which can only print the characters and symbols found on the print element, the dot-matrix printer is capable of printing any character or symbol that can be designed as a pattern of dots. The different styles of characters available make the dot-matrix printer an exciting instrument—one that you can "play" at the keyboard of your computer.

For those who have not yet purchased a printer, this issue should give you the information that you need to decide which features you absolutely require in a dot-matrix printer, and which printer contains those features.

The printers listed in this article are some of the most popular in today's mar-

| Features | EPSON | | | MANNESMANN TALLY | | STAR MICRONICS | | PANA-SONIC |
|---|---|---|---|---|---|---|---|---|
| | FX-80+ | RX-80 F/T+ | Homewriter 10 | Spirit | MT160L | SG-15 | SG-10 | KX-P1091 |
| Maximum Speed (CPS) | 160 | 100 | 100 | 80 | 160 | 120 | 120 | 120 |
| Buffer Size | 2K | none | none | 2K | 2K | 16K | 2K<br>6K opt. | 1K<br>5K opt. |
| Print Size (CPI) | 5, 6, 8.5<br>10, 12, 17 | 5, 6, 8.5<br>10, 12, 17 | 5, 6, 8.5<br>10, 12, 17 | 10, 16.5<br>20 | 10, 12<br>16.5, 20 | 5, 6, 8.5<br>10, 12, 17 | 5, 6, 8.5<br>10, 12, 17 | 5, 6, 8.5<br>10, 12, 17 |
| Characters Per Column | 80-132 | 80-132 | 80-132 | 80-142 | 80-160 | 80-233 | 40-136 | 80 |
| Standard Print Matrix | 6x9 | 6x9 | 7x8 | 9x8 | 7x9 | 9x9 | 9x11 | 7x9 |
| Number of Fonts | 5 | 5 | 6 | 4 | 1 | 6 | 6 | 5 |
| Interface | Serial (opt.)<br>Parallel | Serial (opt.)<br>Parallel | Direct using Opt. Cartr. | Serial (opt.)<br>Parallel | Serial<br>Parallel | Serial (opt.)<br>& Parallel | Serial (opt.)<br>& Parallel | Serial (opt.)<br>& Parallel |
| Graphics Matrix | 60x72<br>120x144<br>240x144 | 60x72<br>120x144<br>240x144 | none | 80x82<br>160x82 | 80x82<br>160x82 | 60x72<br>120x144<br>240x144 | 60x72<br>120x144<br>240x144 | 80x80 |
| Extra Features | — | — | Near Letter Quality | Block Matrix | — | Near Letter Quality | Near Letter Quality | — |
| Suggested Retail Price | $569 | $369 | $329 | $269 | $798 | $499 | $299 | $399 |

ket. They certainly aren't the only printers available, as new machines are introduced almost every day. These printers, however, have withstood the test of time and are sold by most retail computer stores.

For those who've already bought a dot-matrix printer, we hope that we have helped you discover some new printing features. □

*Excerpts from the* Minute Manual for the Dot Matrix Printer, *with permission from the publisher, MinuteWare, P.O. Box 2392, Columbia, MD 21045, (301-995-1166). The manual is available from B. Dalton bookstores, or from MinuteWare at $12.95 plus $2.00 shipping.*

# ATARI PRINTER CHART

We have included the discontinued Atari 1020, 1025 and 1027 printers in the above comparison chart, because of their continued availability, compatibility and low, discounted prices.

Also, all other printers have bit-graphics and are bidirectional. The prices listed are suggested retail; you will find the printers selling for quite a bit less from most of **ANALOG Computing**'s advertisers.

*Jim Pirisino is the publisher at MinuteWare Publishing. In 1982, he began publishing Minute Manuals,® to help people understand and use computers, printers and software.*

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  - — Net Present Value
  - — Future Value
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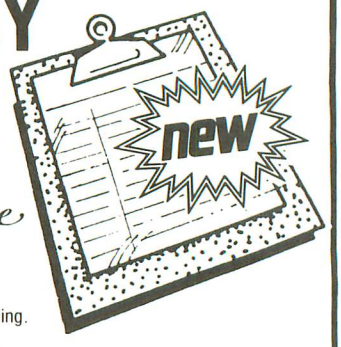


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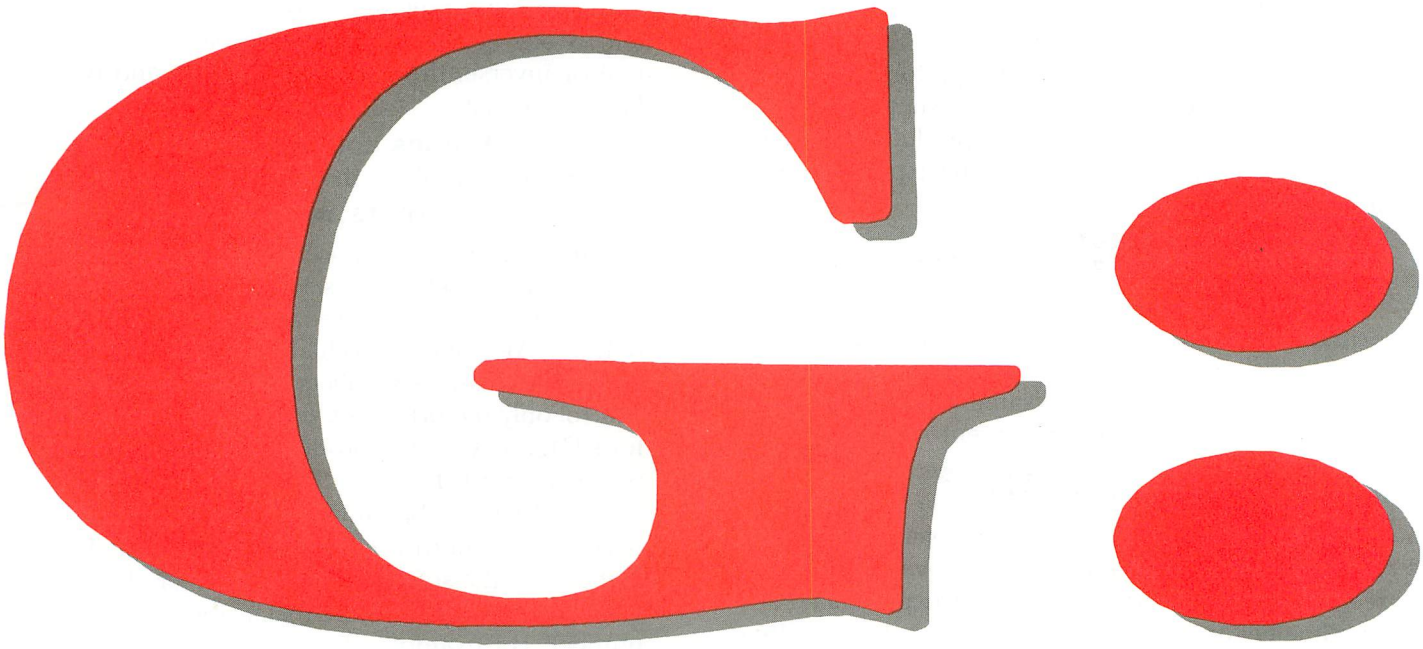


# A printing device for Epson (with Graftrax) or Gemini printers

by Charles F. Johnson

One of the first things you find out about your printer is that it can't print out many of the "special" characters in the Atari character set (e.g., the cursor characters, clear screen, all the CTRL graphics characters, all inverse characters, and so forth). If you send any of these to your printer, all kinds of odd things start happening.

Many of the special characters are interpreted as control codes by the printer, causing line feeds, form feeds, different fonts, etc. Unfortunately, a lot of Atari BASIC programs use these characters quite liberally, so if you type a simple *LIST "P:"* command, you might see your listing unexpectedly shift into Japanese katakana in the middle of a program line.

Printing pictures from graphics mode 8 or 7+ (15 on XL computers) can be a fairly complicated procedure, as well. Translating the screen data to printer format is not an easy task for a beginning or intermediate programmer.

### It can be done!

There's a way to print any character your Atari can display on-screen; you must use your printer's graphics mode and convert every character in the text you are sending into the graphics data that will draw that character on the printer. There are several programs on the market that will do this (**Printwiz, Megafont II, Lister-Plus**), but all of these require that the program (or text) to be printed be stored on disk in an ATASCII file.

These lister programs all read text from this disk file one line at a time, convert it to printer graphics and print it. This disk-based method is rather slow and necessitates an intermediate step in the listing process—making the disk file. Most of these utilities also have some provision for printing pictures.

### A new device.

This program represents another approach to the problem. The **G:** device is loaded into memory at boot-up time as an AUTORUN.SYS file. It will work

*(continued on next page)*

with BASIC, the Assembler/Editor cartridge, BASIC XL and MAC/65.

You can LOAD, SAVE, ENTER and LIST files to and from disk, edit programs and perform any function in the usual manner with **G:** present. The difference is that, any time you want to produce a graphics listing of a BASIC or assembly language program, you just type:

```
LIST "G:"   (BASIC)
LIST #G:    (MAC/65, ASSEMBLER/EDITOR)
```

This will list whatever you have in memory to the printer, but with all inverse and graphics characters exactly as they appear on-screen. You can list only certain line numbers, in the same way you would to any other device, with a statement such as:

```
LIST "G:",10,290   or
LIST #G:,1220
```

The **G:** device will automatically set the left margin five spaces in and set the skip-over-perforation feature. I recommend positioning the printhead approximately two line feeds below the perforation line to start your listing.

### Four flavors.

Now, what would you pay? But wait. . .there's still more! **G:** comes in four flavors—G1: (the default), G2:, G3: and G4:. Here's what the different device numbers do.

**G1:** (or just **G:** — This prints an entire 114-character program line on one line with single-width characters.

**G2:** — This prints each line of text exactly as it would appear on the screen (left margin set at 2), using single-width characters.

**G3:** — Same as G2:, but with double-width characters.

**G4:** — Prints a 60-character line of double-width characters.

### Custom fonts and screen dumps, too?

Now, what would you pay? But wait. . .**G:** also prints custom character sets! When you're printing text, **G:** will use whatever character set memory location 756 (hex $2F4) is pointing to.

Character set modification has been covered in many places, so I won't go into the whole subject here. There are many public domain and commercial character editors for the Atari, to help in creating any font you can imagine. **Create-A-Font** by Vince Erceg in **ANALOG Computing**'s issue 16 is a good one.

**G:** also has a very flexible XIO function, which will print an exact copy of a graphics mode 0, 8 or 7+ (mode E) screen display. A mode 0 screen can be printed with either single- or double-width characters. Mode 8 or 7+ screens can be printed in normal or inverse, three different widths and two different heights!

### The ins and outs of XIO.

To print a graphics mode 0 screen, type:

```
XIO 16,#1,0,0,"G:"
```

This is probably most useful in the program mode, where you can set up the screen in whatever way you like, then execute the XIO command (say, with a press of the START button). When using XIO with graphics 0, the **G:** device numbers (G1:, G2:, G3:, and G4:) control only the print size, not the line length. Therefore, G1: and G2: will produce the same printout, as will G3: and G4:.

If the first number after *XIO* (the command number) is *16*, the entire screen will be printed. To print just part of the screen, add the number of lines you want to print to 16 and use that as the XIO command number. For example, if you want to print the first five lines using double-width characters, add 5 to 16 (21), and the XIO command might look like:

```
XIO 21,#1,0,0,"G4:"
```

### Printing pictures.

To print a graphics 8 or 7+ screen, first set up your hi-res display, then execute the command:

```
XIO 64,#1,0,0,"G:"
```

This will print a single-width, single-height picture. To print your screen in inverse (like a photographic negative), set the auxiliary byte (the second number past the channel number) to 255. The XIO command would be:

```
XIO 64,#1,0,255,"G:"
```

When you're printing a hi-res screen, the **G:** device numbers control the height of the picture. Here's how they work:

G1: or G2: . . . . . Single height.
G3: or G4: . . . . . Double height.

The width of the picture is controlled by the value of the first byte past the channel number in the XIO statement. In the first two examples above, this byte is 0. Here are the width values:

0 or 1 . . . . . Single width.
2 . . . . . Double width.
3 . . . . . Triple width.

I'll give several examples to illustrate the use of the XIO 64 command.

*(continued on next page)*

```
XIO 64,#1,0,255,"G4" -- Single width,
inverse, double height.
XIO 64,#1,2,0,"G2:" --- Double width,
normal, single height.
XIO 64,#2,3,255,"G3:" - Triple width,
inverse, double height.
XIO 64,#1,1,0,"G:" ---- Single width,
normal, single height.
```

As you can see, there are quite a few ways to print a hi-res picture with the **G:** device. Some experimentation will probably be necessary to find the best way to print each picture.

And, by the way, the **G:** device automatically centers your picture on the page (on 80-column printers). Now, how much would you pay?

### MAC/65 or Assembler/Editor.

If you use MAC/65 or the Assembler/Editor cartridge, you can also send assembly listings to **G:** with the ASM command, or print to **G:** (no line numbers) with the PRINT command. The syntax would be:

```
ASM,#G:  or
PRINT #G:
```

### BASIC or BASIC XL.

In BASIC or BASIC XL, you can open a channel to **G:** with a statement like:

```
OPEN #1,8,0,"G:"
```

and then treat it exactly as any other output device—print strings, numbers, etc. with PUT # or PRINT # commands. This enables you to set up special title pages for documents with mixed print modes and mixed character fonts, draw borders, graph lines. . .or whatever you wish!

You can open more than one channel to **G:** at a time (e.g., G1: and G4:) and print alternate lines in different character widths. Unfortunately, at this point there's no way to change print modes on the same line. The channel numbers that you use must be between one and seven, as with any other device.

**G:** even provides a way for you to control your printer's line spacing. There are three preset line feed values, and you may also set the line feed to *n*/72 inches, *n* being a number between 3 and 127. The preset values are:

0 (default) . . . . . 8/72 (1/9) inch line feed.
1 . . . . . 9/72 (1/8) inch line feed.
2 . . . . . 12/72 (1/6) inch line feed.

In addition to these three presets, any number *(n)* greater than 2 is taken to mean a line feed of *n*/72 inches. We use the OPEN auxiliary byte to pass the line feed value to the **G:** driver, like this:

```
OPEN #1,8,2,"G4:"  or
XIO 16,#1,0,10,"G:"
```

The auxiliary byte is the second number past the channel number in both examples (the same one we use for inverse with the XIO function). In the first example, it's 2. This will set the printer to 1/6 inch line feeds. In the second example, we're telling the printer we want line feeds of 10/72 inch.

The **G:** device uses the serial bus to send data to the printer, through SIOV at $E459. This means that if you have some kind of printer interface utilizing the joystick ports (as I used to), you can't use this version of **G:**.

It's possible to modify **G:** to use an IOCB channel to access the printer, but then the **G:** device will actually use two IOCB channels while it's open, and you could no longer have more than one channel open to **G:** simultaneously.

### SYSTEM RESET-proof!

**G:** is protected from SYSTEM RESET; it will remain available to you until you turn your computer off (or type *DOS*). You can go to DOS in the usual manner, but, if you do, **G:** will no longer work when you return to the cartridge.

**G:** doesn't touch the much-abused page 6. Instead, **G:** reserves about 10 pages (2560 bytes) of low memory and sets the MEMLO pointer past itself, so that it can't be overwritten. The reason **G:** uses so much memory is that, for every 1 character byte we want to print, we must send 8 bytes of graphics data. This means a large buffer to hold the converted graphics string. (The program itself is a little over 4 pages long, while the buffer is 5 pages—1280 bytes!)

If you have any very large programs, it's possible that there may no longer be enough free RAM to load them. This should be a rare occurrence; if it happens, you can always break your program into two parts and list them separately.

The version of **G:** presented here should work with any DOS, including Happy Warp DOS. It is assembled at an origin of $25D0. If you want to change this (perhaps to free up some more memory), you must enter in the source code with MAC/65 and reassemble with the different origin.

One last word. . .In the text mode, **G:** is a line-oriented device; in other words, it expects to be sent a line of text terminated by a RETURN (ATASCII 155). This means that you shouldn't use PRINT # statements that end in a semi-colon, because **G:** won't send anything to the printer until it sees a RETURN. Similarly, if you use PUT # commands to send data to **G:**, nothing will be printed until you send a 155 ($9B).

### Typing it in.

The BASIC program, with all those DATA statements that accompany this article, creates an AUTORUN.SYS file on disk that will automatically load and initialize the **G:** driver.

Type in the BASIC listing and SAVE it to disk before you RUN it. Then RUN the program, and your AUTORUN.SYS file will be created. When this is done, the **G:** device will be automatically installed whenever you boot up with this disk.

If you have MAC/65, you can type in the assembly listing and create the AUTORUN.SYS file with the command *ASM,#-,#D:AUTORUN.SYS*. □

---

*Charles F. Johnson is a musician by trade, currently working for Al Jarreau. A self-taught guitarist and programmer, he grew up in Hawaii and has been programming for three and a half years. This is his first published program.*

---

**Listing 1.**
**BASIC listing.**

```
10 REM *** G: GRAPHICS PRINTER ***
20 DATA 0,1,2,3,4,5,6,7,8,9,0,0,0,0,0,
0,0,10,11,12,13,14,15
30 DIM DAT$(91),HEX(22):FOR X=0 TO 22:
READ N:HEX(X)=N:NEXT X:LINE=990:RESTOR
E 1000:TRAP 110:? "CHECKING DATA"
40 LINE=LINE+10:? "LINE:";LINE:READ DA
T$:IF LEN(DAT$)<>90 THEN 150
50 DATLIN=PEEK(183)+PEEK(184)*256:IF D
ATLIN<>LINE THEN ? "LINE ";LINE;" MISS
ING!":END
60 FOR X=1 TO 89 STEP 2:D1=ASC(DAT$(X)
)-48:D2=ASC(DAT$(X+1))-48:BYTE=HEX(D1)
*16+HEX(D2)
70 IF PASS=2 THEN PUT #1,BYTE:NEXT X:R
EAD CHKSUM:GOTO 40
80 TOTAL=TOTAL+BYTE:IF TOTAL>999 THEN
TOTAL=TOTAL-1000
90 NEXT X:READ CHKSUM:IF TOTAL=CHKSUM
THEN 40
100 GOTO 150
110 IF PEEK(195)<>6 THEN 150
120 IF PASS=2 THEN END
130 ? "INSERT DISK WITH DOS, PRESS RET
URN";:DIM IN$(1):INPUT IN$:OPEN #1,8,0
,"D:AUTORUN.SYS"
140 ? :? "WRITING FILE":PASS=2:LINE=99
0:RESTORE 1000:TRAP 110:GOTO 40
150 ? "BAD DATA: LINE ";LINE:END
1000 DATA FFFFD025F52520FFFFA50A8D8B29
A50B8D8C29A50C8DD1258D8D29A50D8DD2258D
8E29A9D0850CA925850D60E2,546
1010 DATA 02E302D325D3258A29A200BD1A03
F005E8E8E8D0F6A9479D1A03A9019D1B03A926
9D1C03A910850AA926850BA9,253
1020 DATA FC8DE702A92E8DE802601C268726
9E269F269C26CD274C9D26A203BD8B29950ACA
10F86C0A00088A4A4A4A4A8,793
1030 DATA 883004C0079004A086D057A621CA
8EA929BDDF2999D829A52BC9FFD002A900C903
B004AABDE3298DF729A522C9,416
1040 DATA 40D017A52AC902B004A91CD00AC9
03B004A90ED002A9018DF4292036298DAB29A2
0ABDED299DC003CA10F72041,122
1050 DATA 29300520102 9A00128602036 29A9
1B8DC003A9408DC103A99B8DC203204129A001
60088EA52948A207B5D49D9B,190
1060 DATA 29CA10F8ADA32985D4ADA42985D5
68ACAB29F013C040D016A52B8DA829A9B885D6
A92985D7D038C99BD0034C5D,192
1070 DATA 27A0008CA82984D70A6EA8294AAC
AB29D00FC920B00469409007C960B00338E920
A0030A26D788D0FA85D6ADF4,411
1080 DATA 0205D785D7A0078CA629B1D6ACA8
29F00249FFA0074A48B1D46A91D4688810F5CE
A629ACA62910E2A007B1D4C9,294
1090 DATA 9BD004A99791D48810F318A5D469
088DA32985D49005EEA429E6D4EEFA29AEA929
F06BADFA29DDE629D063A000,654
1100 DATA A99B91D48CAA29A2030EFA292EFB
29CAD0F7ADAB29C940D004A94CD00CADA5294A
4A4A4AAACABDD8298DF929A9,571
1110 DATA F885DAA92985DB203629A8B1DA99
C003C99BD0058DAA29F010C8C028D0ED18A5DA
692885DA9002E6DB204129AD,633
1120 DATA AA29F0D6201029A207BD9B2995D4
CA10F828A001608EA529201D26C001D051A904
8DA929A5885D88DB2298DB0,797
1130 DATA 29A55985D98DB3298DB129A5228D
AB29C940F032C911B004A918D002E9108DAD29
A9008DAC29ACAC29B1D8AEA5,314
1140 DATA 2920A026EEAC29ADAC29C928D0EB
204F29CEAD29D0DE4C8826A52AC902900DC903
B004A905D002A9068DA929A5,384
1150 DATA 21C903900B8DB729A2A0A000A930
D00BA9008DB729A240A001A9188EB4298CB529
8DB629A9008DAE29A9008DAF,272
1160 DATA 29ADB22985D8ADB32985D9A200A0
00B1D89DB829ACB729F0039DB929204F29E8C0
039001E8E008D0E4A52AC902,950
1170 DATA 9030205B29A207BDC0299DB829CA
10F720A026A207BDC8299DB829CA10F720A026
A52AC903D00EA207BDD0299D,47
1180 DATA B829CA10F720A026EEB229D003EE
B329EEAF29ADAF29C928D08D18ADB0296DB429
8DB0298DB229ADB1296DB529,710
1190 DATA 8DB1298DB329EEAE29ADAE29CDB6
29F0034C6928A9058DF4294C8826A900AA9DFC
299DFC2A9DFC2B9DFC2C9DFC,567
1200 DATA 2DE8D0EE8DFA298DFB29A9FC8DA3
29A9298DA42960A227A9009DC003CA10FA60A2
0BBD8F299D0003CA10F74C59,195
1210 DATA E418A5D8692885D89002E6D960A2
17A9009DC029CA10FAA207A9078DA729BDB829
4A48A42A087EC0297EC8297E,543
1220 DATA D0292888D0F268CEA72910E8CA10
DD608F29FB2940015780C0030500280004E0000
0000000000000000000000,793
1230 DATA 0000000000000000000000000000
0000000000000000000000000000000000000000
0000000000000000000000,793
1240 DATA 0000000000000000004C4C4B4B
08090C0026263C2850781B401B4E051B4D051B
41081B000000E002E102D325,638
```

●

**CHECKSUM DATA.**

*(see page 18)*

```
10 DATA 398,957,808,428,727,554,599,55
3,272,698,610,939,947,33,162,8685
1000 DATA 212,774,53,996,836,583,177,8
94,2,187,432,8,909,76,23,6162
1150 DATA 882,903,58,167,418,199,13,28
9,319,189,3437
```

●

## Listing 2.
## Assembly listing.

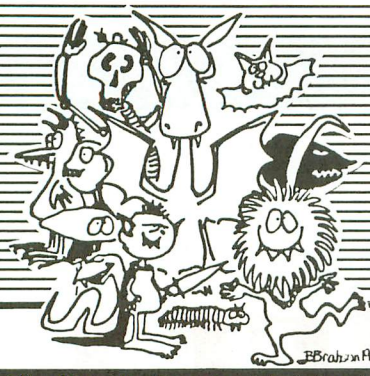
```
; ********************************
;
;     A GRAPHICS PRINTING DEVICE
;  G:  FOR EPSON OR GEMINI PRINTERS
;
; ********************************
;
;
; (c) 1985 by CHARLES JOHNSON
; and Little Green Footballs
;
; G1: --- 80 Column Normal
; G2: --- 40 Column Normal
; G3: --- 40 Column Double-Width
; G4: --- 60 Column Double-Width
;
; XIO 16,#1,0,0,"G:" ---
; print a GRAPHICS 0 screen.
; Any XIO command # larger than
; 16 will be used as the # of
; screen lines to print +16.
;
; XIO 64,#1,0,0,"G:" ---
; print a GRAPHICS 8 or 7+ (E)
; screen.
;
; Auxiliary byte 2 values:
; (These go in ICAX2)
;
; 0 - 8/72 in. line feed
; 1 - 9/72 in. LF
; 2 - 12/72 in. LF
; 255 - INVERSE PRINT (XIO 64)
;
; Any number (n) larger than 2
; will be used as n/72 in. LF
;
;
; ---------------
; System equates
; ---------------
;
DOSVEC   =   $0A
DOSINI   =   $0C
ICDNOZ   =   $21
ICCOMZ   =   $22
ICAX1Z   =   $2A
ICAX2Z   =   $2B
SAVMSC   =   $58
ZPOUTP   =   $D4
FNTPTR   =   $D6
SCRPTR   =   $D8
POINTR   =   $DA
;
RUNAD    =   $02E0
INITAD   =   $02E2
MEMLO    =   $02E7
CHBAS    =   $02F4
;
DDEVIC   =   $0300
HATABS   =   $031A
PRNBUF   =   $03C0
SIOV     =   $E459
;
; ----------------------------
; Make this routine RESET-proof
; ----------------------------
;
         *=  $25D0
;
START    JSR $FFFF
PILFER   LDA DOSVEC
         STA DVSAVE
         LDA DOSVEC+1
         STA DVSAVE+1
         LDA DOSINI   ;Steal the DOS
         STA START+1  ;init vectors
         STA DVSAVE+2 ;and put them
         LDA DOSINI+1 ;in my code
         STA START+2
         STA DVSAVE+3
         LDA # <START ;Put address
         STA DOSINI   ;of G: init code
         LDA # >START ;in DOSINI
         STA DOSINI+1
         RTS
;
         *=  INITAD
;
         .WORD PILFER
;
; ---------------------
; Install the G: device
; ---------------------
;
         *=  PILFER
;
INSTAL   LDX #0
SEARCH   LDA HATABS,X ;Look for the
         BEQ ADDG     ;end of the
         INX          ;handler table
         INX
         INX
         BNE SEARCH
;
ADDG     LDA #'G      ;Add G: to the
         STA HATABS,X ;device table
         LDA # <GDRIVER
         STA HATABS+1,X
         LDA # >GDRIVER
         STA HATABS+2,X
         LDA # <GDVEC ;Reset DOS
         STA DOSVEC   ;vectors
         LDA # >GDVEC
         STA DOSVEC+1
         LDA # <PND   ;Reset the MEMLO
         STA MEMLO    ;pointer
         LDA # >PND
         STA MEMLO+1
         RTS
;
; ----------------------
; The table of addresses
; ----------------------
;
GDRIVER  .WORD GOPEN-1
         .WORD GCLOSE-1
         .WORD GGETB-1
         .WORD GPUTB-1
         .WORD GSTAT-1
         .WORD GXIO-1
         JMP GINIT
;
; DOS commands go through here
;
GDVEC    LDX #3
GDV2     LDA DVSAVE,X ;Restore DOS
         STA DOSVEC,X ;vectors
         DEX
         BPL GDV2
         JMP (DOSVEC) ;Go to DOS!
;
; ***********************
; THE G: HANDLER ROUTINES
; ***********************
;
; ----------------
; The OPEN routine
; ----------------
;
GOPEN    PHP
         TXA          ;Calling IOCB #
         LSR A        ;Divide by 16
         LSR A        ;to use as index
         LSR A
         LSR A
         TAY          ;Move to Y
         DEY          ;-1
         BMI SETERR   ;<0 = error
         CPY #7       ;>6 = error
         BCC G02
SETERR   LDY #$86     ;Bad IOCB #
         BNE GORTS
;
G02      LDX ICDNOZ   ;Get device #
         DEX          ;Subtract 1
         STX SPLIT    ;Store it
         LDA GRNUM,X  ;Put gr mode in
         STA GRTBL,Y  ;table
         LDA ICAX2Z   ;Get LF value
         CMP #$FF     ;Inverse pic?
         BNE G03      ;No, skip
         LDA #0       ;Reset for LF
G03      CMP #3       ;>=3?
         BCS SETLFT   ;Yes, skip
         TAX          ;Move index to X
         LDA LFNUM,X  ;Get preset LF
SETLFT   STA LNFEED   ;Put LF in init
         LDA ICCOMZ   ;Get command #
         CMP #64      ;Picture dump?
         BNE CLP1     ;No, skip
         LDA ICAX1Z   ;Get width
         CMP #2       ;Single width?
         BCS NOTSNG   ;No, skip
         LDA #28      ;Margin at 28
         BNE SETMGN
;
NOTSNG   CMP #3       ;Double width?
         BCS NOTDBL   ;No, skip
         LDA #14      ;Margin at 14
         BNE SETMGN
;
NOTDBL   LDA #1       ;Margin at 1
SETMGN   STA MARGN    ;Set margin
CLP1     JSR CLPBUF   ;Clear buffer
         STA XIO?     ;Clear XIO flag
         LDX #ICLEN-1
CCODES   LDA ICODES,X ;Copy init
         STA PRNBUF,X ;codes to SIO
         DEX          ;buffer
         BPL CCODES
         JSR DOSIO    ;Send init codes
         BMI GORTS    ;Error, skip
         JSR INIT
         LDY #1
GORTS    PLP
         RTS
;
; -----------------
; The CLOSE routine
; -----------------
;
GCLOSE   JSR CLPBUF
         LDA #27      ;Reset printer
         STA PRNBUF   ;and send one
         LDA #64      ;line feed
         STA PRNBUF+1
         LDA #155
         STA PRNBUF+2
         JSR DOSIO
GSTAT
GINIT    LDY #1
GGETB    RTS
;
; -----------------
; PUT BYTE routine
; -----------------
;
GPUTB    PHP
         STX XSAVE
         PHA
         LDX #7
GP1      LDA ZPOUTP,X ;Save zero page
         STA ZPSAVE,X ;locations
         DEX
         BPL GP1
         LDA OUTPTR   ;Set zero page
         STA ZPOUTP   ;pointer to
         LDA OUTPTR+1 ;gr buffer
         STA ZPOUTP+1
         PLA
         LDY XIO?     ;Is this XIO?
         BEQ GP1.2    ;No, skip
         CPY #64      ;Gr 8 dump?
         BNE GP2      ;No, skip
         LDA ICAX2Z   ;Set inverse
         STA INVERS   ;flag
         LDA # <GRBUF ;Set pointer to
         STA FNTPTR   ;graphics buffer
         LDA # >GRBUF
         STA FNTPTR+1
         BNE BYTE1
;
GP1.2    CMP #$9B     ;End of line?
         BNE GP2      ;No, skip
         JMP DOPRINT  ;Go print it!
;
GP2      LDY #0
         STY INVERS
         STY FNTPTR+1
         ASL A        ;Clear inverse
         ROR INVERS   ;bit and save
         LSR A
         LDY XIO?
         BNE CONVERT
         CMP #$20     ;Convert from
         BCS CK2      ;ATASCII to
         ADC #$40     ;internal code
         BCC CONVERT
CK2      CMP #$60
         BCS CONVERT
         SEC
         SBC #$20
;
CONVERT  LDY #3
GETINDEX ASL A        ;Get index into
         ROL FNTPTR+1 ;char set table
         DEY
         BNE GETINDEX
;
         STA FNTPTR   ;Set pointer to
         LDA CHBAS    ;char storage
         ORA FNTPTR+1
         STA FNTPTR+1
;
BYTE1    LDY #7       ;Eight bytes
         STY BYTCNT   ;per character
BYTELOOP LDA (FNTPTR),Y ;Get a byte
         LDY INVERS   ;Inverse char?
         BEQ B2       ;No, skip
         EOR #$FF     ;Reverse bits
B2       LDY #7       ;8 bits per byte
BITLOOP  LSR A        ;Bit to carry
         PHA          ;Save byte
         LDA (ZPOUTP),Y ;Roll bit
         ROR A        ;sideways into
         STA (ZPOUTP),Y ;each byte
         PLA          ;Restore byte
         DEY          ;Next bit
         BPL BITLOOP
;
         DEC BYTCNT   ;Count bytes
         LDY BYTCNT   ;More?
         BPL BYTELOOP ;Yes, go back
;
         LDY #7
CKRET    LDA (ZPOUTP),Y
         CMP #$9B     ;Check for EOLs
         BNE NOTRET   ;in output
         LDA #$97     ;Replace
         STA (ZPOUTP),Y
NOTRET   DEY
         BPL CKRET
;
         CLC
         LDA ZPOUTP   ;Increment ptr
         ADC #8       ;to print buffer
         STA OUTPTR   ;by 8 bytes
         STA ZPOUTP
         BCC SKIP
         INC OUTPTR+1
         INC ZPOUTP
SKIP     INC OUTCNT   ;Count chars
         LDX SPLIT    ;Is this 80-col?
         BEQ EXIT     ;Yes, exit
         LDA OUTCNT   ;Have we done
         CMP SPVAL,X  ;one line?
         BNE EXIT     ;No, more bytes
;
DOPRINT  LDY #0       ;Put EOL at end
         LDA #$9B     ;of print buffer
         STA (ZPOUTP),Y
         STY DONE     ;Clear done flag
         LDX #3
MULT8    ASL OUTCNT   ;Multiply the #
         ROL OUTCNT+1 ;of characters
         DEX          ;by 8 to get the
         BNE MULT8    ;# of gr bytes
         LDA XIO?
         CMP #64
         BNE NOTPIC
         LDA #76
         BNE SETM
;
NOTPIC   LDA XSAVE    ;Get IOCB #
         LSR A        ;Divide by 16
         LSR A
         LSR A
         LSR A
         TAX          ;Move to X
         DEX          ;-1
         LDA GRTBL,X  ;Get gr mode
SETM     STA GRMODE   ;Put in header
         LDA # <HEADER ;Set pointer
         STA POINTR   ;to start of
         LDA # >HEADER ;header and
         STA POINTR+1 ;print buffer
SENDEM   JSR CLPBUF   ;Clear SIO buf
         TAY
SEND2    LDA (POINTR),Y ;Move chars
         STA PRNBUF,Y ;40 at a time
         CMP #$9B     ;to SIO buffer
         BNE SEND3    ;(or until EOL)
         STA DONE     ;Set done flag
         BEQ PRNT     ;Skip
```

```
;
SEND3   INY
        CPY #40
        BNE SEND2
          CLC           ;Increment zero
        LDA POINTR      ;page pointer by
        ADC #40         ;40
        STA POINTR
        BCC PRNT
        INC POINTR+1
PRNT    JSR DOSIO       ;Send 40 bytes
        LDA DONE        ;Done?
        BEQ SENDEM      ;No, do the rest
        JSR INIT        ;Re-init
EXIT    LDX #7
EXi     LDA ZPSAVE,X    ;Restore zero
        STA ZPOUTP,X    ;page locations
        DEX
        BPL EX1
        PLP
        LDY #1          ;=Successful
        RTS
;
; ----------------------------
; The XIO screen dump routine
; ----------------------------
;
GXIO    STX XSAVE       ;Save IOCB #
        JSR GOPEN       ;Open G:
        CPY #1          ;Open OK?
        BNE GXXIT       ;No, exit
        LDA #4          ;Set line length
        STA SPLIT
        LDA SAVMSC      ;Set pointers
        STA SCRPTR      ;to start of
        STA COLPTR      ;screen memory
        STA ROWPTR
        LDA SAVMSC+1
        STA SCRPTR+1
        STA COLPTR+1
        STA ROWPTR+1
        LDA ICCOMZ      ;Get command #
        STA XIO?        ;Store it
        CMP #64         ;Gr 8 dump?
        BEQ GR8         ;Yes, go to it
        CMP #17         ;Full screen?
        BCS SHORT       ;No, skip
        LDA #24         ;Set 24 lines
        BNE SETLIN      ;Skip
```



```
;
SHORT   SBC #16         ;Subtract 16
SETLIN  STA LINNUM      ;Set # of lines
;
STLINE  LDA #0          ;Clear byte
        STA LINIX       ;index
PRSCRN  LDY LINIX       ;Get byte from
        LDA (SCRPTR),Y  ;screen mem
        LDX XSAVE
        JSR GPUTB       ;Send to G:
        INC LINIX       ;Inc index
        LDA LINIX
        CMP #40         ;Done one line?
        BNE PRSCRN      ;No, go back
        JSR NEXTLN      ;Inc pointer
        DEC LINNUM      ;Count lines
        BNE STLINE      ;Not done yet
GXXIT   JMP GCLOSE
;
GR8     LDA ICAX1Z      ;Get width
        CMP #2          ;Single?
        BCC CKHT        ;Yes, skip
        CMP #3          ;Double width?
        BCS CKW2        ;No, skip
        LDA #5          ;Length index
        BNE CKW3        ;Skip
;
CKW2    LDA #6          ;Length index
CKW3    STA SPLIT
CKHT    LDA ICDNOZ
        CMP #3          ;>2=Dbl height
        BCC NOT4        ;Not dbl, skip
        STA DBLHT       ;Set flag
        LDX # <4*40     ;Set offset to
        LDY # >4*40     ;next row
        LDA #48         ;Set # of rows
        BNE SET88
;
NOT4    LDA #0          ;Not dbl height
        STA DBLHT       ;Clear flag
        LDX # <8*40     ;Offset
        LDY # >8*40
        LDA #24         ;# of rows
SET88   STX ROWADD
        STY ROWADD+1
        STA ENDROW
        LDA #0          ;Clear row count
        STA ROWCNT
GR8.1   LDA #0          ;Set column to 0
        STA COLCNT
GR8.2   LDA COLPTR      ;Set pointer to
        STA SCRPTR      ;screen
        LDA COLPTR+1
        STA SCRPTR+1
        LDX #0
GET8B   LDY #0
        LDA (SCRPTR),Y  ;Move bytes
        STA GRBUF,X     ;to buffer
        LDY DBLHT       ;Double height?
        BEQ GET8.1      ;No, skip
        STA GRBUF+1,X   ;Double it!
GET8.1  JSR NEXTLN      ;Inc pointer
        INX
        CPY #3          ;Double height?
        BCC GET8.2      ;No, skip
        INX
GET8.2  CPX #8          ;Done 8 bytes?
        BNE GET8B       ;No, do the rest
        LDA ICAX1Z      ;Get width
        CMP #2          ;>1?
        BCC NOTDBW      ;No, skip
        JSR EXPAND      ;Expand 'em
        LDX #7
DBW1    LDA WIDBUF,X    ;These sections
        STA GRBUF,X     ;copy the wide
        DEX             ;buffer to the
        BPL DBW1        ;gr print buffer
        JSR GPUTB       ;& send it to G:
        LDX #7
DBW2    LDA WIDBUF+8,X
        STA GRBUF,X
        DEX
        BPL DBW2
        JSR GPUTB
        LDA ICAX1Z
        CMP #3
        BNE NOTDB2
        LDX #7
DBW3    LDA WIDBUF+16,X
        STA GRBUF,X
        DEX
        BPL DBW3
NOTDBW  JSR GPUTB       ;Send to G:
NOTDB2  INC COLPTR      ;Move pointer to
        BNE GR8.3       ;next column
        INC COLPTR+1
GR8.3   INC COLCNT      ;Count columns
        LDA COLCNT
        CMP #40         ;Done 40?
        BNE GR8.2       ;No. Do the rest
        CLC
        LDA ROWPTR      ;Set row pointer
        ADC ROWADD      ;to the next row
        STA ROWPTR
        STA COLPTR      ;Also store here
        LDA ROWPTR+1
        ADC ROWADD+1
        STA ROWPTR+1
        STA COLPTR+1
        INC ROWCNT      ;Count rows
        LDA ROWCNT
        CMP ENDROW      ;Done all?
        BEQ GR8XIT      ;Yes, skip
        JMP GR8.1
;
GR8XIT  LDA #5          ;Reset margin
        STA MARGN
        JMP GCLOSE
;
; -----------
; Subroutines
; -----------
;
```

```
INIT    LDA #0          ;Clear the
        TAX             ;output buffer
CLRBUF  STA OUTBUF,X
        STA OUTBUF+$0100,X
        STA OUTBUF+$0200,X
        STA OUTBUF+$0300,X
        STA OUTBUF+$0400,X
        INX
        BNE CLRBUF
        STA OUTCNT      ;Clear character
        STA OUTCNT+1    ;counter
        LDA # <OUTBUF   ;Set pointer
        STA OUTPTR      ;to buffer start
        LDA # >OUTBUF
        STA OUTPTR+1
        RTS
;
CLPBUF  LDX #39         ;Clear the SIO
        LDA #0          ;print buffer
CLP2    STA PRNBUF,X
        DEX
        BPL CLP2
        RTS
;
DOSIO   LDX #$0B
COPY    LDA PRNCOM,X    ;Copy print
        STA DDEVIC,X    ;commands to
        DEX             ;the DCB
        BPL COPY
        JMP SIOV
;
NEXTLN  CLC             ;Increment scrn
        LDA SCRPTR      ;pointer by one
        ADC #40         ;line; 40 bytes
        STA SCRPTR
        BCC NLN2
        INC SCRPTR+1
NLN2    RTS
;
EXPAND  LDX #23         ;Clear the wide
        LDA #0          ;buffer
CLWBUF  STA WIDBUF,X
        DEX
        BPL CLWBUF
        LDX #7          ;Expand 8 bytes
EXP1    LDA #7          ;7 bits per byte
        STA BITCNT
        LDA GRBUF,X     ;Get byte
EXP2    LSR A           ;Shift bit
        PHA             ;Save byte
        LDY ICAX1Z      ;Get width
EXP3    PHP             ;Save status reg
        ROR WIDBUF,X    ;Roll carry
        ROR WIDBUF+8,X  ;thru 3 bytes
        ROR WIDBUF+16,X
        PLP             ;Restore status
        DEY             ;Width count
        BNE EXP3        ;Not done
        PLA             ;Restore byte
        DEC BITCNT      ;Count bits
        BPL EXP2        ;Not done yet
        DEX             ;Count bytes
        BPL EXP1        ;Not done yet!
        RTS             ;DONE!!!
;
; -------------------
; Miscellaneous data
; -------------------
;
DVSAVE  .DS 4           ;DOS vectors
PRNCOM  .BYTE $40       ;Printer
        .BYTE 1         ;Device number
        .BYTE $57       ;Write
        .BYTE $80       ;Output
        .WORD PRNBUF    ;Buffer address
        .WORD 5         ;Timeout
        .WORD $28       ;Buffer length
        .BYTE $4E       ;Normal print
        .BYTE 0         ;Unused
ZPSAVE  .WORD 0,0,0,0
OUTPTR  .WORD 0         ;Ptr to buffer
XSAVE   .BYTE 0         ;Calling IOCB #
BYTCNT  .BYTE 0         ;Byte counter
BITCNT  .BYTE 0         ;Bit counter
INVERS  .BYTE 0         ;Inverse flag
SPLIT   .BYTE 0         ;Length index
DONE    .BYTE 0         ;Line done flag
XIO?    .BYTE 0         ;XIO flag
LINIX   .BYTE 0         ;Screen index
LINNUM  .BYTE 0         ;# of lines
ROWCNT  .BYTE 0         ;Row counter
COLCNT  .BYTE 0         ;Column counter
ROWPTR  .WORD 0         ;Row pointer
COLPTR  .WORD 0         ;Column pointer
ROWADD  .WORD 0         ;Offset to row
ENDROW  .BYTE 0         ;# of rows
DBLHT   .BYTE 0         ;Dbl height flag
GRBUF   .BYTE 0,0,0,0,0,0,0,0
WIDBUF  .WORD 0,0,0,0,0,0,0,0
        .WORD 0,0,0,0
GRTBL   .BYTE 0,0,0,0,0,0,0,0
GRNUM   .BYTE 76,76,75,75
LFNUM   .BYTE 8,6,12
SPVAL   .BYTE 0,38,38,60,40,80,120
ICODES  .BYTE 27,64     ;Init printer
        .BYTE 27,78,5   ;Skip perf
        .BYTE 27,77
MARGN   .BYTE 5         ;Left margin
        .BYTE 27,65
LNFEED  .BYTE 8         ;LF (n/72 in.)
;
ICLEN   =   *-ICODES
;
HEADER  .BYTE 27
GRMODE  .BYTE 0
OUTCNT  .WORD 0
;
OUTBUF  .DS $0500       ;Print buffer
;
PND     =   *
;
        *=  RUNAD
        .WORD INSTAL
        .END
```



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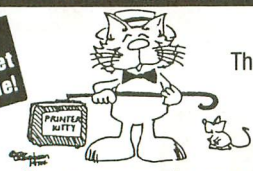


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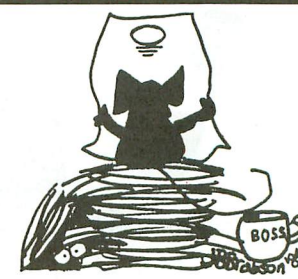


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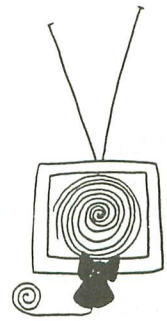

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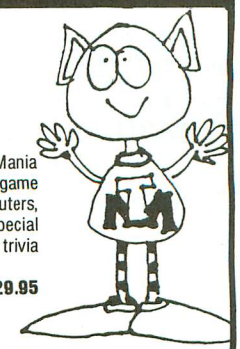

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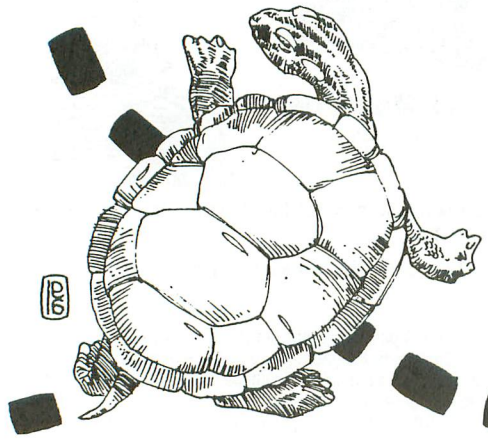


by Jason Leigh

The Atari 1020 printer/plotter is an excellent Atari product as shown by Tom Hudson's **Solid States** in **ANALOG Computing**, issue 16.

To an aspiring young programmer, the plotter is a marvelous drawing tool. However, unless one knows a little trigonometry, it can be difficult to produce those intriguing circular patterns created by such languages as Logo and Pilot.

### The turtle interpreter.

**Turtle 1020** is an interpreted language written in Atari BASIC. The interpreter is a mixture of Pilot, Logo and BASIC commands—TURN from Pilot, FORWARD from Logo and variable use as in BASIC.

### The editor.

**Turtle 1020** uses the standard Atari editor, in that you can edit a line by cursoring up and over to the desired line. All the usual INSERT and DELETE functions still work, except each turtle line is limited to 40 characters in length. The editor assumes that any command without a line number is an immediate command, and that those preceded by a line number from 1 to 199 are program lines.

### The commands.

All commands are three characters long, with the exception of LOAD and SAVE.

LISxx — Lists lines xx to the end of the program (xx is optional).

RUN — Executes the turtle program in memory. This will blank off the screen to speed up the drawing.

SAVE — Saves the program in memory to cassette or disk. You will be prompted for a filename, of which C selects cassette and *D:filename* selects disk.

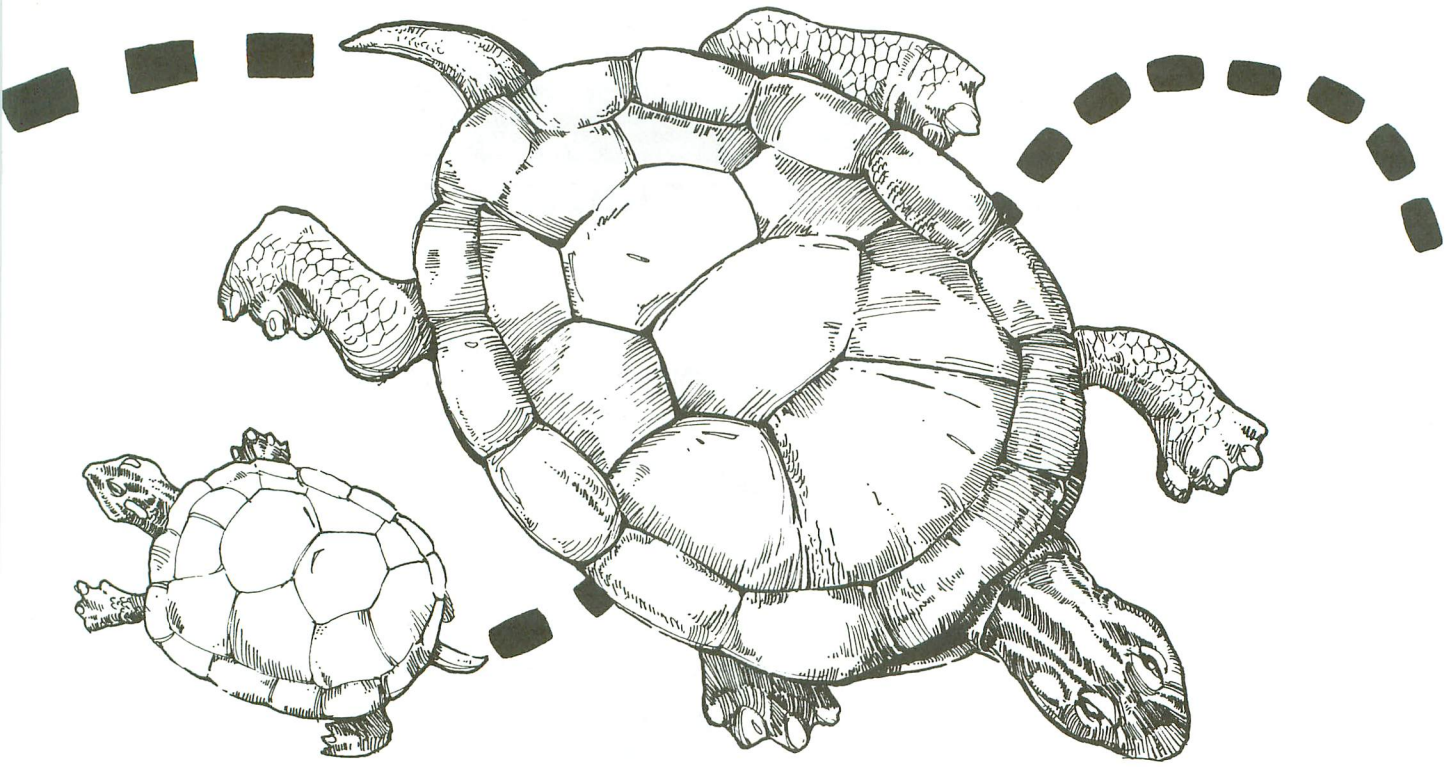
LOAD — Loads the program from cassette or disk. LOAD only loads **Turtle 1020** files and no other. Each turtle program is headed by 2 header bytes of 1s as an identifier. LOAD is operated in the same manner as SAVE.

NEW — Clears all variables and erases the turtle source code.

LIP — Lists the entire turtle program to the printer/plotter.

TON — Stands for Trace ON, which allows you to see each line as it is processed.

TOF — Turns the Trace function OFf.



MEM — Displays the number of 40-character program lines free. The command takes some time to compute, so please be patient.

SEE — Displays the X and Y position of the pen/turtle, as well as the color and angle at which the turtle is facing.

CAT — This was included for the benefit of disk users. It will allow you to see the disk directory without going to the Disk Utility Package. Variables for **Turtle 1020** are limited to single-character names from *A* to *Z*. The contents of the variables can be displayed by pressing the appropriate key and pressing RETURN.

DEL — Deletes a range of line numbers. After typing *DEL* and pressing RETURN, you will be prompted to enter certain parameters, such as starting and ending line to delete.

Be aware that the above commands can only be used in immediate mode. This may make **Turtle 1020** seem rather limited, however it was written primarily to allow easy creation of pictures on the 1020 plotter and not as competition for Action! in any way.

### Turtle instructions.

These instructions are all accessible in both immediate and program modes.

A typical turtle line begins with a line number, a three-letter instruction and any other data required by the instruction, like this:

```
10 SET20,20
```

Note that no spaces are allowed between an instruction and its parameters. Spaces are allowed between two different instructions and between a line number and its instruction. Each line can only hold one instruction, except when a comparison of true and false states is involved.

```
IFT GT01
```

This reads *IF TRUE GOTO Line 1*. The two instructions are *IF TRUE* and *GOTO*. The interpreter understands the following turtle instructions:

REM — This instruction acts as in BASIC. It's there to allow insertion of comments and is not executed by the turtle program.

```
10 REM My first program
```

TXT — The TeXT instruction puts text onto the printer in standard 40-column print.

```
10 TXT How to program in TURTLE
```

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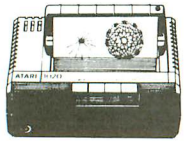

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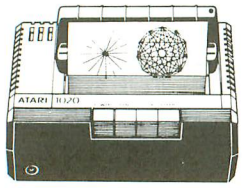

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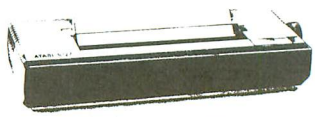

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# Turtle 1020 *continued*

PFN — The Print FunctioN allows use of the standard printer commands as described in the Atari 1020 manual.

```
10 PFN#4   Sets printer for 80 columns
```

GRH — GRapHics sets the printer to plotter mode.

```
10 GRH
```

COL — COLor sets the color of the pen to any of the four pen colors.

```
10 COL1     Sets color to 1
10 COLA     Sets color to number
            in variable A
```

PND — PeN Down puts the pen down, so that the plotter will actually draw.

PNU — PeN Up pulls the pen up, so that the pen cartridge/turtle only moves; it doesn't draw.

```
10 PND      and      10 PNU
```

HME — HoME sets the pen to home position (240,0).

```
10 HME
```

ORG — This instruction sets the pen to 0,0.

SET — This places the pen at a specified location. If the pen is down when SET is issued, a line will be drawn to this new position.

```
10 SET1,2   Sets the pen to location
            1 across and 2 down.
10 SETA,B   Sets the pen to location
            A across and B down.
```

Note that turtle uses the Cartesian plane when drawing, so a positive Y-value is up and a negative is down.

TRN — TuRN causes the angle to increase or decrease, depending on the sign.

```
10 TRN10    Turn 10 degrees clockwise.
10 TRN-10   Turn 10 degrees counter-
            clockwise.
10 TRNX     Turn X degrees.
```

TTO — Turn TO makes the turtle point at an exact direction.

```
10 TTO20    and    TTOF
```


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# Turtle 1020 *continued*

FOR — FORward moves the pen forward a specified number of steps.

```
10 FOR20    and    FORC
```

BAC — BACkward operates in the same way as FOR, except in the opposite direction.

GTO — GoTO places program control to a certain line number.

```
10 GTO20    Goto line 20
10 GTOB     Goto line B
```

CLR — CLeaR sets all variables to 0.

END — This simply returns control to the user, terminating the turtle program.

ACC — ACCept acts like INPUT as in BASIC. It puts your numerical input into a variable.

```
10 ACCX     Your entry will be stored
            in variable X
```

TST — TeST checks whether the following comparison is true or false.

```
10 TSTA>B   Test if A is greater than B
10 TSTC=D   Test if C equals D
```

The tests allowed are >, < and =.

IFT — IF True allows the following instruction on the same line to be executed if the TST was successful.

```
10 TSTA=0
20 IFT TXT A equals zero
```

IFF — IF False acts in the same way as IFT, except the instruction is executed only if the TST condition was false.

REP — The REPeat instruction allows a certain range of lines to be repeatedly executed. The instruction requires a variable and a number to specify the number of repeats.

```
10 REPY10   Repeat 10 times; variable
            Y is used to keep track
            of which loop is executing.
```

ELP — End LooP closes the above loop.

```
20 ELPY     Close the repeat loop
            opened by Y in line 10.
```

### Math pack.

**Turtle 1020** supports: addition (+), subtraction (-), multiplication (*), division (/) and exponentiation (^). These are used in the same way as in BASIC (e.g., A=2+3*4). However, it does not follow true algebraic logic and, hence, performs the operator as it detects it. In the above example, 2 will be added to 3 before being multiplied by 4. Further examples: 10 A=B^C; and 20 Z=A+B-C*D/E.

To generate a random number, use RND and a number (e.g., X=RND10). This yields a random number between 1 and 10, to be stored in variable X.

*(continued on next page)*

### Turtle error messages.

All errors are translated into English, except for the input/output errors from disk or cassette. You'll have to consult your BASIC manual for the definition of these errors.

The errors which are translated into English are:

Command error — This occurs when you attempt to use an unknown command or instruction.

Illegal variable — This occurs when you attempt to use a variable other than those between A and Z.

Printer error — This occurs if you execute a printer command or turtle program without the printer being in its proper state of operation.

Illegal function — You will encounter this error if you use a mathematical function not in the categories mentioned earlier.

Line too long — This occurs when your turtle program line length exceeds 40 characters.

Overflow — Any variable holding a number either too large for BASIC to handle or divided by 0 will cause this error.

Illegal input — This occurs when you attempt to enter a non-numerical input.

Illegal line number — If your line number exceeds 199 or is less than 0, this error message will be issued.

All errors will be signaled by a bell, and the line at which the error occurred will be returned if in program execution mode.

### Final words.

That's **Turtle 1020** in its entirety. If for any reason there's a program error or you pressed the BREAK key, you may resume **Turtle 1020** by typing:

```
GOTO 90
```

If this doesn't help, you'll have to RUN the BASIC program from the start.

I've included two turtle programs for you to try out using **Turtle 1020**. The first performs a TO SQUIRAL, a procedure recognized by many Logo and Pilot users. The second is a kaleidoscope generator, in which each design generated is completely different. It will prompt you for an input to represent the number of loops it's to perform. □

*Jason Leigh graduated from King George V School in Hong Kong two years ago and is now a Computer Science student at the University of Utah. He's been working enthusiastically with the Atari since he was a pupil at Kowloon Junior School.*

Listing 1.
BASIC listing.

```
10 REM TURTLE 1020 By Jason Leigh
20 REM
30 DEG :READ BEEP,PROMPT,CR,BELL,K1,K2
,K3,K4,K27,K40,K65:DATA 1080,90,155,25
3,1,2,3,4,27,40,65
40 DIM PROG$(8000):PROG$=CHR$(CR):PROG
$(8000)=PROG$:PROG$(K2)=PROG$
50 DIM LINE$(255),DAT$(255),NO$(K4),A(
26),B(26),C(26),A$(K4),C$(39),D$(128)
60 C$=CHR$(CR):C$(39)=C$:C$(K2)=C$
70 FOR T=K0 TO 26:A(T)=K0:B(T)=K0:C(T)
=K0:NEXT T
80 ? CHR$(125);"TURTLE 1020":?
90 EXE=K0:GOSUB 1110:POKE 82,K1:? CHR$
(30);CHR$(K27);CHR$(31);:POKE 82,K2:IN
PUT #16,LINE$
100 IF  NOT LEN(LINE$) THEN GOTO PROMP
T
110 IF LEN(LINE$)=K1 THEN A=ASC(LINE$)
:IF A>47 AND A<58 THEN 140
120 TRAP 540:IF LEN(LINE$)=K1 THEN A=A
(ASC(LINE$)-K65):? LINE$;"=";A:GOTO PR
OMPT
130 IF LINE$="DEL" THEN 1900
140 IF LINE$="CAT" OR LINE$="DIR" THEN
 1810
150 IF LINE$="TON" THEN TR=K1:TRON=34:
GOTO BEEP
160 IF LINE$="TOF" THEN TR=K0:TRON=K0:
GOTO BEEP
170 IF LINE$="NEW" THEN RUN
180 IF LINE$="MEM" THEN 1650
190 IF LINE$="LOAD" THEN 1440
200 IF LINE$="SAVE" THEN SA=K1:GOTO 14
40
210 A=ASC(LINE$):IF A>47 AND A<58 THEN
 730
220 IF LINE$="RUN" THEN 850
230 IF LINE$(K1,K3)="LIS" THEN A=K0:GO
SUB 560:GOTO BEEP
240 IF LINE$(K1,K3)="LIP" THEN TRAP 62
0:CLOSE #K3:OPEN #K3,8,K0,"P:":A=K3:GO
SUB 560:GOTO BEEP
250 IF LINE$="SEE" THEN ? "X=";INT(X);
" Y=";INT(Y);" COLOR=";C;" ANGLE=";ANG
LE:GOTO BEEP
260 DAT$=LINE$:NO$=DAT$(K1,K3):TRAP 62
0
270 IF NO$="REM" THEN GOTO BEEP
280 IF NO$="TXT" THEN CLOSE #K2:OPEN #
K2,8,K0,"P:":? #K2;DAT$(K4):? #K2;CHR$
(K27);CHR$(7):GOTO BEEP
290 IF NO$="PFN" THEN ? #K2;DAT$(K4):G
OTO BEEP
300 IF NO$="GRH" THEN ? #K2;CHR$(K27);
CHR$(7):GOTO BEEP
310 IF NO$(K2,K2)="=" THEN 1120
320 TRAP 940:IF NO$="COL" THEN C=VAL(D
AT$(K4)):TRAP 620:? #K2;"C";C:GOTO BEE
P
330 IF NO$="PND" THEN P=K1:GOTO BEEP
340 IF NO$="PNU" THEN P=K0:GOTO BEEP
350 TRAP 620:IF NO$="HME" THEN X=240:Y
=K0:ANGLE=K0:? #K2;"M";X;",";Y:GOTO BE
EP
360 IF NO$="SET" THEN 990
370 TRAP 950:IF NO$="TRN" THEN ANGLE=A
NGLE+VAL(DAT$(K4)):GOTO BEEP
380 TRAP 960:IF NO$="TTO" THEN ANGLE=V
AL(DAT$(K4)):GOTO BEEP
390 TRAP 970:IF NO$="BAC" THEN 630
400 TRAP 980:IF NO$="FOR" THEN 680
410 TRAP 520:IF NO$="GTO" THEN EXE=K1:
TRAP 1890:I=(VAL(DAT$(K4))-K1)*K40:GOT
O BEEP
```

```
420 IF NO$="REP" THEN E=(ASC(DAT$(K4))
-K65):C(E)=VAL(DAT$(5)):B(E)=I:A(E)=K0
:GOTO BEEP
430 IF NO$="ELP" THEN E=(ASC(DAT$(K4))
-K65):A(E)=A(E)+K1:IF A(E)<C(E) THEN I
=B(E):GOTO BEEP
440 IF NO$="ELP" THEN GOTO BEEP
450 TRAP 620:IF NO$="ORG" THEN X=K0:Y=
K0:? #K2;"H":GOTO BEEP
460 IF NO$="CLR" THEN FOR T=K0 TO 26:A
(T)=K0:B(T)=K0:C(T)=K0:NEXT T:GOTO BEE
P
470 IF NO$="TST" THEN 1670
480 IF NO$="IFF" THEN 1750
490 IF NO$="IFT" THEN 1780
500 IF NO$="END" THEN EXE=K0:GOTO BEEP
510 TRAP 550:IF NO$="ACC" THEN POKE 55
9,34:A=ASC(DAT$(K4))-K65:INPUT B:TRAP
540:A(A)=B:POKE 559,TRON:GOTO BEEP
520 ? CHR$(BELL);"Command error":GOTO
1420
530 ? CHR$(BELL);"Illegal line number"
:GOTO 1420
540 ? CHR$(BELL);"Illegal variable":GO
TO 1420
550 IF PEEK(195)=8 THEN ? CHR$(BELL);"
Illegal input":GOTO 1420
560 TRAP BEEP:? #A:T=K0:IF LEN(LINE$)>
K3 THEN T=(VAL(LINE$(K4))-K1)*K40
570 T=T+K40:IF ASC(PROG$(T))<>CR THEN
600
580 GOSUB 1400:IF T>7960 OR T>PRO THEN
 RETURN
590 GOTO 570
600 ? #A;T/K40;" ";:FOR R=T TO T+39:IF
 ASC(PROG$(R))<>CR THEN NEXT R:? #A;PR
OG$(T,T+39):GOTO 580
610 ? #A;PROG$(T,R-K1):GOTO 580
620 ? CHR$(BELL);"Printer error":GOTO
PROMPT
630 LONG=VAL(DAT$(K4))
640 TRAP 620:DEG :Y1=COS(ANGLE)*LONG:X
1=SIN(ANGLE)*LONG
650 IF P THEN ? #K2;"D";X-X1;",";Y-Y1
660 IF  NOT P THEN ? #K2;"M";X-X1;",";
Y-Y1
670 X=X-X1:Y=Y-Y1:GOTO BEEP
680 LONG=VAL(DAT$(K4))
690 TRAP 620:DEG :Y1=COS(ANGLE)*LONG:X
1=SIN(ANGLE)*LONG
700 IF P THEN ? #K2;"D";X+X1;",";Y+Y1
710 IF  NOT P THEN ? #K2;"M";X+X1;",";
Y+Y1
720 X=X+X1:Y=Y+Y1:GOTO BEEP
730 IF LEN(LINE$)<K3 THEN 750
740 IF LEN(LINE$)>39 THEN ? CHR$(BELL)
;"Line too long":GOTO PROMPT
750 L=LEN(LINE$):LINE$(L+K1)=CHR$(CR)
760 FOR T=K1 TO L:A=ASC(LINE$(T)):IF A
>47 AND A<58 THEN NEXT T
770 LINE=VAL(LINE$(K1,T)):L1=T
780 IF LINE>199 OR LINE<K1 THEN ? CHR$
(BELL);"Illegal line number":GOTO PROM
PT
790 PROG$(LINE*K40,LINE*K40+39)=C$
800 IF L<L1 THEN GOTO PROMPT
810 IF ASC(LINE$(L1))=32 THEN L1=L1+K1
:GOTO 810
820 IF LEN(LINE$)-L1<K3 THEN 520
830 PROG$(LINE*K40,LINE*K40+L-L1+K1)=L
INE$(L1):IF LINE*K40>PRO THEN PRO=LINE
*K40
840 GOTO PROMPT
850 TRAP 620:CLOSE #K2:OPEN #K2,8,K0,"
P:":POKE 559,TRON
860 I=K0:EXE=K1:ANGLE=K0:X=K0:Y=K0:FOR
 T=K0 TO 26:A(T)=K0:B(T)=K0:C(T)=K0:NE
XT T:C=K0:P=K0
870 TRAP 530:LINE$="":E=K0:I=I+K40:IF
ASC(PROG$(I))<>CR THEN 900
880 IF I>7960 OR I>PRO THEN EXE=K0:GOT
O PROMPT
890 GOTO 870
900 FOR R=I TO I+39:IF ASC(PROG$(R))<>
CR THEN E=E+K1:LINE$(E,E)=PROG$(R):S=K
1:NEXT R:GOTO 920
910 IF S THEN S=K0:GOTO 920
920 GOSUB 1400:IF TR THEN ? I/K40;" ";
LINE$
930 GOTO 260
940 TRAP 620:C=A(ASC(DAT$(K4))-K65):?
#K2;"C";C:GOTO BEEP
950 TRAP 520:ANGLE=ANGLE+A(ASC(DAT$(K4
))-K65):GOTO BEEP
960 TRAP 520:ANGLE=A(ASC(DAT$(K4))-K65
):GOTO BEEP
970 TRAP 520:LONG=A(ASC(DAT$(K4))-K65)
:GOTO 640
980 TRAP 520:LONG=A(ASC(DAT$(K4))-K65)
:GOTO 690
990 T1=K1:A=ASC(DAT$(K4))-K65:IF A>=K0
 AND A<K27 THEN 1040
1000 FOR T=K4 TO LEN(DAT$):IF DAT$(T,T
)<>"," THEN NEXT T
1010 T1=T+K1:X=VAL(DAT$(K4,T-K1))
1020 A=ASC(DAT$(T1))-K65:IF A>=K0 AND
A<K27 THEN 1050
1030 Y=VAL(DAT$(T1)):GOTO 1060
1040 X=A(A):T1=6:GOTO 1020
1050 Y=A(A)
1060 TRAP 620:IF P THEN ? #K2;"D";X;",
";Y
1070 IF  NOT P THEN ? #K2;"M";X;",";Y
1080 IF ANGLE>360 OR ANGLE<-360 THEN A
=INT(ANGLE/360):ANGLE=ANGLE-A*360
1090 IF EXE THEN 880
1100 ? :? "Okay":POKE 752,K0:GOTO PROM
PT
1110 FOR T=10 TO K0 STEP -K1:SOUND K1,
240,10,T:NEXT T:POKE 559,34:RETURN
1120 TRAP 1130:IF DAT$(K3,5)="RND" THE
N 1850
1130 V=ASC(NO$)-K65:ACC=K0
1140 IF V<K0 THEN 540
1150 Z=K3:GOSUB 1290:ACC=N:T2=T1:NEG=K
0
1160 Z=T1+K1:GOSUB 1290:N2=N:T3=T1:NEG
=K0
1170 A$=DAT$(T2,T2)
1180 TRAP 1250
1190 IF A$="+" THEN ACC=ACC+N2:GOTO 12
60
1200 IF A$="-" THEN ACC=ACC-N2:GOTO 12
60
1210 IF A$="/" THEN ACC=ACC/N2:GOTO 12
60
1220 IF A$="*" THEN ACC=ACC*N2:GOTO 12
60
1230 IF A$="^" THEN ACC=ACC^N2:GOTO 12
60
1240 ? CHR$(BELL);"Illegal function":G
OTO PROMPT
1250 ? CHR$(BELL);"Overflow":GOTO PROM
PT
1260 T2=T3:T1=T3
1270 IF S THEN A(V)=ACC:GOTO BEEP
1280 GOTO 1160
1290 TRAP 1390:A=ASC(DAT$(Z))-K65:IF A
>=K0 AND A<K27 THEN 1360
1300 NEG=K0:A$=DAT$(Z,Z):IF A$="-" OR
A$="+" THEN Z=Z+K1:NEG=K1:A=ASC(DAT$(Z
))-K65:IF A>=K0 AND A<K27 THEN 1360
1310 S=K0:FOR T=Z TO LEN(DAT$):A=ASC(D
AT$(T)):IF A=46 OR A>47 AND A<59 THEN
NEXT T
1320 IF NEG THEN Z=Z-K1:NEG=K0
```

```
1330 N=VAL(DAT$(Z,T-K1)):T1=T
1340 IF T>=LEN(DAT$) THEN S=K1
1350 RETURN
1360 V1=A:IF NEG AND A$="-" THEN N=-A(
V1):GOTO 1380
1370 N=A(V1)
1380 T1=Z+K1:T=T1-K1:GOTO 1340
1390 S=K1:GOTO 1270
1400 IF PEEK(764)<>255 THEN POKE 764,2
55:? "Break":GOTO 1420
1410 POKE 764,255:RETURN
1420 IF EXE THEN ? "at line #";I/K40:E
XE=K0
1430 GOTO PROMPT
1440 ? "Enter Filename->";:INPUT #16,D
AT$
1450 TRAP 1550:CLOSE #K3:IF SA THEN SA
=K0:GOTO 1570
1460 OPEN #K3,K4,K0,DAT$:A=K0
1470 GET #K3,I:GET #K3,K
1480 IF I<>K1 OR K<>K1 THEN ? :? CHR$(
BELL);"Not a TURTLE 1020 file":GOTO BE
EP
1490 GET #K3,PRO:PRO=PRO*K40
1500 GET #K3,LINE
1510 GET #K3,D:IF D=255 THEN 1540
1520 PROG$(LINE*K40+A,LINE*K40+A)=CHR$
(D):A=A+K1
1530 GOTO 1510
1540 A=K0:GOTO 1500
1550 IF PEEK(195)<>136 THEN ? :? CHR$(
BELL);"I/O error # ";PEEK(195)
1560 GOTO BEEP
1570 OPEN #K3,8,K0,DAT$:A=K0:T=K0
1580 PUT #K3,K1:PUT #K3,K1
1590 PUT #K3,PRO/K40
1600 T=T+K40:IF ASC(PROG$(T))<>CR THEN
 1630
1610 IF T>7960 OR T>PRO THEN CLOSE #3:
GOTO BEEP
1620 GOTO 1600
1630 PUT #K3,T/K40:FOR R=T TO T+39:IF
ASC(PROG$(R))<>CR THEN PUT #K3,ASC(PRO
G$(R)):S=K1:NEXT R:GOTO 1610
1640 IF S THEN S=K0:PUT #K3,255:GOTO 1
610
1650 R=K0:FOR T=K40 TO 8000 STEP K40:I
F ASC(PROG$(T))=CR THEN R=R+K1
1660 NEXT T:? R;" LINES FREE":GOTO BEE
P
1670 TRAP 520:A=ASC(DAT$(K4))-K65:A=A(
A)
1680 B=ASC(DAT$(6))-K65:IF B>-K1 AND B
<26 THEN B=A(B):GOTO 1700
1690 B=VAL(DAT$(6))
1700 C=ASC(DAT$(5)):STA=K0
1710 IF C=60 THEN STA=A<B:GOTO BEEP
1720 IF C=62 THEN STA=A>B:GOTO BEEP
1730 IF C=61 AND A=B THEN STA=K1:GOTO
BEEP
1740 GOTO BEEP
1750 TRAP 520:T=K4:IF STA THEN GOTO BE
EP
1760 IF DAT$(T,T)=" " THEN T=T+K1:GOTO
 1760
1770 LINE$="":LINE$=DAT$(T):GOTO 260
1780 TRAP 520:T=K4:IF  NOT STA THEN GO
TO BEEP
1790 IF DAT$(T,T)=" " THEN T=T+K1:GOTO
 1790
1800 LINE$="":LINE$=DAT$(T):GOTO 260
1810 ? :? "   DISK CATALOG":?
1820 TRAP 1550:CLOSE #K3:OPEN #K3,6,K0
,"D:*.*":TRAP 1840
1830 INPUT #K3,D$:? D$:GOTO 1830
1840 ? :GOTO BEEP
1850 TRAP 520
1860 V=ASC(DAT$(6))-K65:IF V>=K0 AND V
<K27 THEN A=A(V):GOTO 1880
1870 A=VAL(DAT$(6))
1880 V=ASC(NO$)-K65:A(V)=INT(RND(K0)*A
)+K1:GOTO BEEP
1890 V=ASC(DAT$(K4))-K65:I=(A(V)-K1)*K
40:GOTO BEEP
1900 ? "DELETE FROM LINE #->";:INPUT L
:? "TO LINE #->";:INPUT L1
1910 IF L>=L1 THEN ? CHR$(BELL);"Illeg
al values":GOTO PROMPT
1920 IF L1>199 OR L<K1 THEN L=K1:L1=K0
:GOTO 1910
1930 ? "DELETE LINE ";L;" TO ";L1;" (Y
/N)";:INPUT LINE$
1940 IF LINE$(K1,K1)="Y" THEN ? "DELET
ING":GOTO 1960
1950 GOTO PROMPT
1960 FOR T=L*K40 TO L1*K40 STEP K40:PR
OG$(T,T)=CHR$(CR):NEXT T:GOTO BEEP
```

●

## CHECKSUM DATA.

*(see page 18)*

```
10 DATA 957,253,195,882,49,155,153,876
,710,297,922,100,778,659,363,7349
160 DATA 355,981,801,498,336,188,580,2
94,362,345,22,283,542,21,54,5662
310 DATA 818,364,699,716,888,318,591,8
06,428,476,368,387,271,276,527,7933
460 DATA 690,188,113,136,883,768,53,15
4,613,543,757,280,363,747,61,6349
610 DATA 89,628,112,518,546,97,805,127
,533,521,76,784,581,369,964,6750
760 DATA 834,77,432,575,93,655,916,296
,382,969,625,133,251,759,786,7783
910 DATA 657,561,728,944,344,549,786,7
99,385,870,141,218,803,118,341,8244
1060 DATA 875,560,822,456,401,166,45,1
72,689,153,197,617,682,19,21,5875
1210 DATA 30,11,220,540,981,237,256,72
3,233,128,534,989,755,819,793,7249
1360 DATA 117,603,840,688,273,397,706,
545,789,530,423,1,12,33,243,6200
1510 DATA 115,961,721,672,106,927,61,2
86,573,520,40,722,211,55,322,6292
1660 DATA 139,984,561,608,202,594,599,
286,931,424,540,670,938,546,666,8688
1810 DATA 588,639,775,235,868,217,611,
814,157,119,645,901,835,632,562,8598
1960 DATA 110,110
```

●

Listing 2.

```
1 GRH
2 COL2
3 SET240,-500
4 PND
5 REPA90
6 FOR5
7 TRN89
8 S=S+2
9 ELPA
```

●

Listing 3.

```
4 ACCY
6 GRH
8 C=RND4
9 S=RND60
10 C=C-1
12 COLC
14 TTO0
16 D=RND5
18 D=D-1
20 F=D*10+100
22 REPB6
24 PNU
26 SET240,-500
27 TRN60
28 FOR5
30 PND
32 GTOF
36 ELPB
38 T5TZ>Y
40 IFTGTO46
42 Z=Z+1
44 GTO8
46 END
100 TRN-30
101 REPA3
102 FOR5
103 TRN120
104 ELPA
105 TRN30
106 GTO36
110 TRN-45
111 REPA4
112 FOR5
113 TRN90
114 ELPA
115 TRN45
116 GTO36
120 TRN-67.5
121 REPA8
122 E=5/2
123 FORE
124 TRN45
125 ELPA
126 TRN67.5
127 GTO36
130 TRN-18
131 REPA5
132 FOR5
133 TRN144
134 ELPA
135 TRN18
136 GTO36
140 TRN-60
141 FOR5
142 TRN60
143 FOR5
144 TRN120
145 FOR5
146 TRN-60
147 FOR5
148 TRN120
149 FOR5
150 TRN60
151 FOR5
152 TRN120
153 GTO36
```

●

# ON-LINE

## Getting in on the Action!

by Russ Wetmore

This article, both part one (**ANALOG Computing**, issue 32) and this month's segment, was written for advanced programmers. Don't feel badly if you've dabbled a little in Action! and can't make any sense out of the examples in this article. Some of the concepts are quite advanced and are mainly aimed at the experienced programmer who wants to squeeze more functionality out of the Action! cartridge.

### Modularizing.

I recently completed a major undertaking in Action!—an integrated three-program package called **HomePak**. All together, these three programs take up about 64K of disk space, not counting the various global subprograms required, like an RS232 handler, character sets, etc.

Two of the programs were too large to compile using standard methods. I faced an interesting decision: recode substantial portions of the program in assembly language (avoiding such being one major reason I did it in a high-level language to begin with) or leave out possible features in order to save space.

I hit upon another option: compiling the program in pieces. In fact, this saved me time, as I didn't have to compile the whole program every time. Let's face it. Many portions of an Action! program are static variables and arrays that almost never change. Why compile them every time, just to find out their addresses so that the rest of the program can tell where they reside?

There's an "undocumented" feature of the Action! cart you need to know before you can do this. I'll describe it first.

### Compilation offset.

In page 0, $B5-$B6 is used by the compiler as a compilation offset value. The three **HomePak** programs reside at $3400, which is well above the $2404 address that the cart tells me is my LOMEM value. The manual tells you that you can do the following:

```
SET $E = $3400
SET $491 = $3400
```

to set the base address to $3400, but this throws away a good 4K(!) of memory I need to compile to. A better way of handling it is to compile the program to the LOMEM address, but specify an offset to the compiler. That way, when the program gets written out to disk, it loads at the proper address. You can do this by putting a value in $B5-$B6 (using the set command), which is *your* base address minus the LOMEM address found at $491. Thus, if your LOMEM value is $2404, and you want your program to load at $4000, you'd put:

```
SET $B5=$1BFC ;(which is $4000-$2404)
```

at the very beginning of your program. The program, when compiled, would reside in memory during compilation at the $2404 LOMEM address, but when written to disk, will appear to load at $4000.

In order for this to work properly, check the value at $491 *while the edit buffer is empty.* Since any program in memory pushes up the LOMEM value, you'll have to do your compiling from disk, rather than from memory. It's either that, or check the value every time you want to compile, and alter the program accordingly.

Note: There are a couple of bugs in the current version of the cart that effect the offset value. Negative offsets don't work, so you can't use this trick to compile *below* the LOMEM address. Also, there is a subtle bug involving type definitions. If you use the $B5-$B6 offset, and your program uses the type construct, you must set the offset to 0 before any type definition—and set it back to its original value afterwards. Example:

```
MODULE  ;Example 1
SET $B5 = $1BFC
  ;(compile to $4000,
  ;from LOMEM of $2404)

BYTE
  i, j, k  ;some variable definitions

SET $B5 = 0
SET $B6 = 0 ;account for bug
            ;involving TYPE statements
TYPE DISK = [ CARD sector BYTE pos ]
SET $B5 = $1BFC ;return offset to what
                ;it used to be
...
```

Notice that I had to do *two* set statements, because the Action! compiler will always try to make a set value a byte, if it can. We need to set the card at $B5, so we need to set each byte of the card value.

### Getting down to it.

Now we know how to tell Action! where we want our modules to reside. I generally have a file named GLOBALS.H, which is my header file with seldom-changed global variables. I compile this separately, to the desired base address of my whole program.

Once the compilation is finished and I've written the program to a disk file, I use the debugging portion of the monitor to find the end addresses of those variables. (Once a program is compiled—and before any system errors occur—use the program variables in the monitor as you would constants.)

Let's take an example. Type this in and save it to disk as EXAMPLE2.ACT:

```
MODULE ; Example 2
; This is my global variable file

SET $B5 = $1BFC
; so program compiles to $4000 from
; $2404 LOMEM. Note: your system
; probably has a different address
; for LOMEM than mine.  The value for
; LOMEM will differ depending on what
; DOS you're using, how many drives
; and file buffers you have allocated,
; etc.  Do a  ?$491  at the monitor
; with an empty edit buffer to find
; your LOMEM, and subtract it from
; $4000 to get the proper SET value
; for your computer.

BYTE
  two = [2], three = [3], four = [4]
```

Okay, okay, it's short. But, then, this is just an example, right?

After you've written the file to disk, be sure to clear the source from memory, so your LOMEM value is correct. Compile the module using the command *C D:EXAMPLE2.ACT*. Once it's compiled, type in *W EXAMPLE2.OBJ* at the monitor, to write your object file to disk. Now, type this in:

```
?two
?three
?four
```

This tells us the addresses of our byte variables, two, three and four. (You should get the values $4000, $4001 and $4002, respectively.) The last step is to type in *?$E* to get the address of the end of the program, which should return the value $2407 (or whatever your LOMEM value is, plus 3).

Some of you are ahead of me, I can tell—the value returned is the proper value, all right, but relative to the object file *as it currently exists in memory.* You have to add your set value to it to get the final address, so *$2407 + $1BFC (or whatever your values are) = $4003* —which is what we expect it to be.

Now we can start with our second module. Type this in:

```
MODULE  ; Example 3
SET $B5 = $1BFF

; Note that this value is $4003 (the
; address of the byte following the
; first module) minus $2404, my LOMEM
; address.  Again, as in Example 2,
; adjust your values accordingly.

; First off, we have to tell this
; module where our globals are:

BYTE
  two = $4000, three = $4001,
  four = $4002

; Now, for this module's code:

PROC Main()
BYTE
  i, j, k

  i = two + three
  j = three + four
  k = two + three + four
```

```
  PrintF("i=%U, j=%U, k=%U%E",
         i, j, k)
RETURN
```

Save this source file to disk as EXAMPLE3.ACT. Clear the source code from memory, then go to the monitor and type *C EXAMPLE3.ACT* to compile it. Type *W EXAMPLE3.OBJ* to write the object code to disk.

We now have two object files on disk. Exit Action! to DOS and type in the following at the DUP.SYS menu:

```
C [RETURN]
EXAMPLE3.OBJ, EXAMPLE2.OBJ/A [RETURN]
```

This appends the second module onto the first. You can now run EXAMPLE2.OBJ, and the result:

```
i=5, j=7, k=9
```

should be printed to your screen.

Using variations of this procedure, you can create programs that are much larger than can be physically compiled. You'll save time, since you won't have to recompile *everything*, every time.

## ON X GOSUB/GOTO.

There's a C language construct whereby you can pass the address of a function to a function. (For those of you who don't know C, you might want to skip over this section; I'm using C here because the examples will serve as a basis for its emulation in Action!) Here's a short example:

```
/* Example 4 */

static void PrtNum(num)
unsigned char num;
{
  printf("We want to print ");
  printf("the number %u here", num);
}

static void PrintANumber(routine, num)
void (*routine)();
unsigned char num;
{
  (*routine)(num);
}

void main()
{
  PrintANumber(PrtNum, 5);
}
```

*PrintANumber* in the above example takes the address of a function as its argument, and executes it directly. Since the PrtNum routine (actually, the *address* of Prt Num) is passed, it is executed at the PrintANumber call in the main function.

We can carry this concept a little further—by using arrays of addresses to functions. This gives us the tools we need to do our emulation of BASIC's ONxGOSUB function:

```
/* Example 5 */

/* Global declarations */

/*
 FUNCPTR is typed as a pointer to a
 function returning void (no value)
*/
typedef void (*FUNCPTR)();

/*
 Here, we have to tell the compiler
 ahead of time what we're up to:
 we're using these names as functions
 returning void
*/
void Print1(), Print2(), Print3();

/*
 routines is an array of pointers
 to functions returning void
 (n'est-ce pas?)
*/
FUNCPTR routines[] =
  { Print1, Print2, Print3 };

static void Print1()
{
  puts("Subroutine number 1\n");
}

static void Print2()
{
  puts("Subroutine number 2\n");
}

static void Print3()
{
  puts("Subroutine number 3\n");
}

void main()
{
  unsigned char i;

  for (i = 0; i <= 2; ++i)
    (*routines[i])();
}
```

This little program does a lot. First, it executes a "for" loop for the values between 0 and 2. The "pointer" to the desired function is fetched *(routines[i])*, which is then executed directly. *Routines[]* is an "array of pointers" to functions, with three elements (numbered 0 to 2).

This example has the same function as BASIC's ONxGOSUB. The equivalent BASIC would be:

```
0 REM BASIC version of C code
10 FOR X=1 TO 3
20 ON X GOSUB 100,200,300
30 NEXT X
40 END
100 PRINT "Subroutine #1":RETURN
200 PRINT "Subroutine #2":RETURN
300 PRINT "Subroutine #3":RETURN
```

## Translating to Action!

We can carry these same basic concepts over to Action! There's an eccentricity of the compiler that we need to know first. We can't declare an array of *procs* or *funcs*, because such a declaration requires a constant at compile time.

We *can*, however, declare a code block that includes *proc* and *func* addresses, and point an array name to it. For example, to emulate the C example above in Action!, we'd do the following:

```
MODULE  ; Action! version of Example 5

; First, let's define the PROC's
; to be called:

PROC Print1=*()
  PrintE("Number 1")
RETURN

PROC Print2=*()
  PrintE("Number 2")
RETURN

PROC Print3=*()
  PrintE("Number 3")
RETURN

; Next, we define a dummy PROC which
; holds the addresses of the PROC's
; we want to execute:
;
; (We can't define these in a
; CARD ARRAY because they're NOT
; constants and Action! would choke
; on them.)

PROC dummy=*() [
  Print1 Print2 Print3 ]


; Now, a MODULE statement because
; we have to declare a variable:

MODULE  ; for CARD ARRAY declaration

; This declares a CARD ARRAY that
; points (suprize!) to "dummy"

CARD ARRAY
  ptrary = dummy


; This routine does a JMP indirect
;to the address passed to it:

PROC Indirect=*(CARD address) [

  ; ("address" is passed in the A and
  ; X registers)

  $85 $AE       ;STA $AE save low byte
  $86 $AF       ;STX $AF save high byte

; NOTE! To change this to emulate ON x
 GOTO rather than
;    ON x GOSUB, add this line here:
; $68 $68       ;PLA/PLA pull off
                ;        return address

  $6C $AE $00 ] ;JMP ($AE)
; jump indirect to routine, which
; RTS's itself to the calling PROC


; Now, our version of the
; C "main" function:

PROC main()
BYTE i

  FOR i = 0 TO 2 DO
    ; Fetch address of routine to
    ; call ( ptrary(i) ) and execute
    ; it (via "Indirect" PROC)
    Indirect(ptrary(i))
  OD
RETURN
```

Notice the indirect procedure. We have to do this, because there we have to jump "indirectly" to the routine address. Another way of handling this would be to jump indirect directly into the card array, but this would require self-modifying code (which is a no-no).

To convert the above to emulate BASIC's ONxGOTO, we just insert two PLAs in the indirect procedure, to pull the return address off the stack.

### Arrays of arrays.

The last foray we're going to make right now into extending Action!'s functionality is the concept of "arrays of arrays." Action! arrays want to be only one-dimensional, which is prohibitive in a lot of real world programming needs.

Let's take a simple two-dimension byte array. An array of arrays can basically be considered to be an array of pointers to arrays. Since pointers are actually cards in disguise, it follows that, to create an array of arrays, we need to do the following: (1) declare the individual byte arrays; and (2) declare a card array of the addresses of the individual arrays.

We have the same problem we had before—we can't declare an array using values which aren't constants. But we know how to get around that now, right? Here's an example:

```
MODULE  ; Example 6

; Declare our individual arrays:

BYTE ARRAY
  one()   = [ 1, 2, 3 ],
  two()   = [ 4, 5, 6 ],
  three() = [ 7, 8, 9 ]

; Declare a dummy PROC with the
; addresses of the BYTE ARRAYs:

PROC dummy=*() [ one two three ]

; MODULE statement because we're
; declaring a variable:

CARD ARRAY
  ary_of_arys = dummy

; Now, our main procedure, which
; illustrates how to access our
; doubly subscripted arrays:

PROC main()
BYTE i, j
BYTE ARRAY bary

  ; loop for first subscript:
  FOR i = 0 TO 2 DO

    ; fetch address of array:
    bary = ary_of_arys(i)

    ; loop for second subscript:
    FOR j = 0 TO 2 DO
      PrintF("Array(%U)(%U) = %U%E",
             i, j, bary(j))
    OD
    PutE()
  OD
RETURN
```

You should get the following output when you run this example:

```
Array(0)(0) = 1
Array(0)(1) = 2
Array(0)(2) = 3

Array(1)(0) = 4
Array(1)(1) = 5
Array(1)(2) = 6

Array(2)(0) = 7
Array(2)(1) = 8
Array(2)(2) = 9
```

You can, of course, carry this out *ad infinitum*—as many layers as you like—by declaring card arrays for each layer of arrays.

Another typical use of arrays of arrays in programming is "string arrays," where strings are considered to be arrays of characters (as in C and Action!). I'll give a more useful example here:

```
MODULE  ; Example 7

; This subroutine prints out an
; English explanation for the user
; when a system error occurs (only
; errors 128 through 144 are given
; for space reasons)

DEFINE LASTERR = "144"

CHAR ARRAY
  s128() = "BREAK key abort",
  s129() = "IOCB already open",
  s130() = "Nonexistent device",
  s131() = "IOCB Write only",
  s132() = "Illegal handler command",
  s133() = "IOCB not Open",
  s134() = "Illegal IOCB number",
  s135() = "IOCB Read only",
  s136() = "End of file",
  s137() = "Truncated record",
  s138() = "Device timeout",
  s139() = "Device NAK",
  s140() = "Serial frame error",
  s141() = "Cursor out of range",
  s142() = "Serial bus overrun",
  s143() = "Checksum error",
  s144() = "Device done error",
  generic() = "Error %U!%E"

PROC dummy=*() [
  s128 s129 s130 s131 s132 s133 s134
  s135 s136 s137 s138 s139 s140 s141
  s142 s143 s144 ]

MODULE  ; for variable declaration

CARD ARRAY
  errstrs = dummy

PROC PrintError(BYTE errnum)
  IF errnum > 128 THEN
    IF errnum > LASTERR THEN
      PrintF(generic, errnum)
    ELSE
      PrintE(errstrs(errnum - 128))
    FI
  FI
RETURN
```

I'll leave it as an exercise to you, to figure out how this last example works. It's much like the preceding example, if that's any help.

That's it for this journey into esoterica. The Action! language has many capabilities that most people will never see or use. I hope I've at least sparked some of you to do more investigative work.

Next month is letters/feedback time. I've gotten a *lot* of response to my articles on piracy—some pro and a surprisingly high number on the con side. I'll share some of the more representative ones with you next month. □

---

*Russ Wetmore has been involved in the computer industry for over six years. He's probably best known for his game* ***Preppie!*** *and is president of Star Systems Software, Inc., a research and development firm specializing in entertainment and home productivity programs.*

---

```
vs_color(handle, index, rgb_in);

/* set color 8 to white */

rgb_in[0] = 1000;
rgb_in[1] = 1000;
rgb_in[2] = 1000;
vs_color(handle, 8, rgb_in);

/* draw background grid */

color_index = 8;
set_color = vsl_color(handle, color_index);
pxyarray[0] = 0;
pxyarray[1] = 0;
pxyarray[2] = 319;
pxyarray[3] = 0;
v_pline(handle, 2, pxyarray);
for (y=9; y<200; y=y+10)
  {
  pxyarray[1] = y;
  pxyarray[3] = y;
  v_pline(handle, 2, pxyarray);
  }
pxyarray[0] = 0;
pxyarray[1] = 0;
pxyarray[2] = 0;
pxyarray[3] = 199;
v_pline(handle, 2, pxyarray);
for(x=9; x<320; x=x+10)
  {
  pxyarray[0] = 0;
  pxyarray[1] = 0;
  pxyarray[2] = 319;
  pxyarray[3] = 0;
  v_pline(handle, 2, pxyarray);
  for (y=9; y<200; y=y+10)
    {
    pxyarray[1] = y;
    pxyarray[3] = y;
    v_pline(handle, 2, pxyarray);
    }
  pxyarray[0] = 0;
  pxyarray[1] = 0;
  pxyarray[2] = 0;
  pxyarray[3] = 199;
  v_pline(handle, 2, pxyarray);
  for(x=9; x<320; x=x+10)
    {
    pxyarray[0] = x;
    pxyarray[2] = x;
    v_pline(handle, 2, pxyarray);
    }

  /* draw w/color 1 (gray) */

  color_index = 1;
  set_color = vsf_color(handle, color_index);

  /* draw main pie shadow */

  x = 140;
  y = 140;
  begang = 300;
  endang = 3200;
  xradius = 120;
  yradius = 40;
  v_ellpie(handle, x, y, xradius, yradius, begang, endang);

  /* draw pulled-out shadow */
```

```
x = 178;
begang = 3200;
endang = 300;
xradius = 120;
yradius = 40;
v_ellpie(handle, x, y, xradius, yradius, begang, endang);

/* draw pulled-out segment */

color_index = 12;
set_color = vsf_color(handle, color_index);
y = 135;
v_ellpie(handle, x, y, xradius, yradius, begang, endang);

/* draw other segments */

color_index = 3;
set_color = vsf_color(handle, color_index);
x = 140;
begang = 300;
endang = 1400;
v_ellpie(handle, x, y, xradius, yradius, begang, endang);

color_index = 2;
set_color = vsf_color(handle, color_index);
begang = 1400;
endang = 1750;
v_ellpie(handle, x, y, xradius, yradius, begang, endang);

color_index = 6;
set_color = vsf_color(handle, color_index);
begang = 1750;
endang = 3200;
v_ellpie(handle, x, y, xradius, yradius, begang, endang);

/* label the chart */

set_color = vst_color(handle, 5);
set_effect = vst_effects(handle, 1);
v_justified(handle, 30, 17, title, 290, 1, 1);
set_color = vst_color(handle,3);
v_gtext(handle, 20, 47, "Business");
v_gtext(handle, 100,47, "30.55%");
set_color = vst_color(handle,2);
v_gtext(handle, 20, 57, "CAD");
v_gtext(handle, 108,57, "9.72%");
set_color = vst_color(handle,6);
v_gtext(handle, 20, 67, "General");
v_gtext(handle, 100,67, "40.28%");
set_color = vst_color(handle,12);
v_gtext(handle, 20, 77, "Education");
v_gtext(handle, 100, 77, "19.45%");

/* wait for key */

vsin_mode(handle, 4, 1);
vrq_string(handle, 1, 0, dum1, &dum2);

/* reset backgnd color to white */

rgb_in[0] = 1000;
rgb_in[1] = 1000;
rgb_in[2] = 1000;
index = 0;
vs_color(handle, index, rgb_in);

/* reset color 1 to black */

rgb_in[0] = 0;
rgb_in[1] = 0;
rgb_in[2] = 0;
index = 1;
vs_color(handle, index, rgb_in);

/* close workstation */

v_clsvwk(handle);
appl_exit();
_exit(0);

}

/* end main */
```

# INDEX TO ADVERTISERS

| READER SERVICE # | ADVERTISER | PAGE # |
|---|---|---|
| 140 | Abby's Discount | 90, 91, 92 |
| 132 | Allen Macroware | 65 |
| 141 | Alpha Systems | 93 |
| 136 | American TV | 76 |
| — | ANALOG Publishing | IFC, 2 |
| 109 | Astra Systems | 20 |
| 103 | Atari Corp. | 8, 9, 54, 55, 56, 57 |
| — | Batteries Included | IBC |
| 123 | CAL COM | 48 |
| 133 | C.A.P. Software | 68 |
| 139 | Centurian Enterprises | 86 |
| 137 | C.O.M.B. | 77 |
| 118 | Compu-Club | 34 |
| 108 | Computability | 15 |
| 131 | Computer Creations | 60 |
| 146 | Computer Games Plus | 104 |
| 129 | Computer Mail Order | 52 |
| 138 | Computer Palace/Royal Software | 80 |
| 119 | Data Arts | 34 |
| 106 | D.M.I. Services | 14 |
| 104 | Draper Software | 12 |
| 107 | Electronic One | 14 |
| 102 | Games Computers Play | 7 |
| 105 | Gizzmoz | 12 |
| 144 | G.T. Enterprises | 104 |
| 116 | Happy Computers/B&C | 31 |
| 113 | HSU Software | 22 |
| 147 | ICD/Spartan | IBC |
| 121 | Infocom | 36, 37 |
| 126 | Integrated Computer Equipment | 50 |
| 112 | Intra-Tech | 22 |
| — | Jesse Jones | 16 |
| 111 | Lone Star Computer | 21 |
| 125 | Lyco Computers | 49 |
| 120 | Microprose | 35 |
| 124 | Mirage Concepts | 48 |
| 145 | Misty Mountain Software | 104 |
| 134 | MTS Software | 70 |
| 101 | New Horizons Software | 6 |
| 122 | Protecto | 42, 43, 44, 45 |
| 143 | RAK | 103 |
| 127 | Rocky Mountain Atari Service | 50 |
| — | Senecom | 76 |
| 115 | Software Discounters | 28, 29 |
| 110 | Southern Software | 21 |
| 114 | TNT Computing | 22 |
| 130 | Unlimited Software | 6 |
| 117 | Wedgwood Rentals | 101 |
| 128 | White House Computers | 51 |
| 142 | Xlent Software | 87 |

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