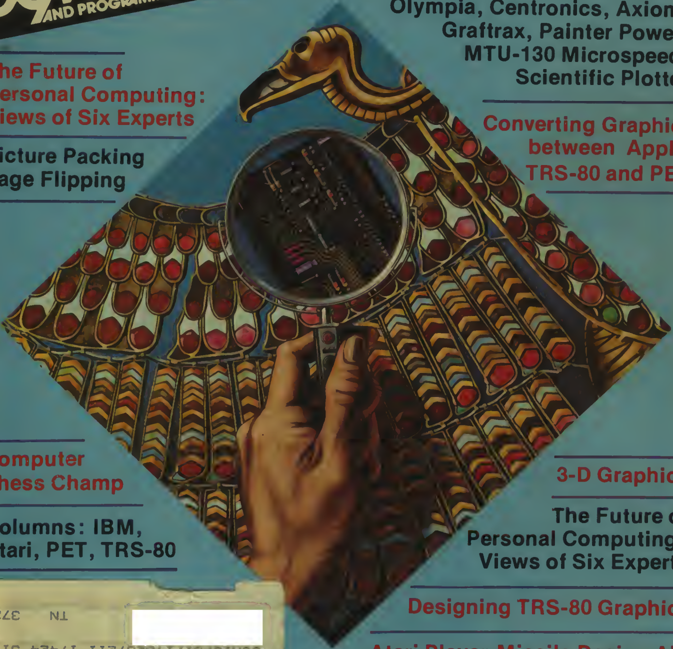
creative computing®

February 1982
vol 8, no 2
$2.95

the #1 magazine of … uter applications and software

Great Graphics For Your Computer

COMPUTERS AND PROGRAMMING



Printer & Graphics Evaluations: Olympia, Centronics, Axiom, Graftrax, Painter Power, MTU-130 Microspeed, Scientific Plotter

The Future of Personal Computing: Views of Six Experts

Converting Graphics between Apple, TRS-80 and PET

Picture Packing Page Flipping

Computer Chess Champ

3-D Graphics

Columns: IBM, Atari, PET, TRS-80

The Future of Personal Computing: Views of Six Experts

Designing TRS-80 Graphics

Atari Player-Missile Design Aid


The Galaxy Invaders Have Returned in This Newest Game of Skill and Excitement.
DEFENSE COMMAND
BIG FIVE
SOFTWARE
P.O. Box 9078-185 · Van Nuys, CA 91409 · (213) 782-6861
Prices per Game: TRS-80 16K Lev2 Mod1/Mod3 Cassette- $15.95
TRS-80 32K Lev2 Mod1/Mod3 Diskette- $19.95
Optional Joystick for Model 1- $39.95
10% discount for 2 items, 15% for 3 or more.
Please add $1.75 per order for postage & handling, Calif residents add 6% sales tax.
Outside USA (except Canada) please add $3.00 per order for postage & handling.
All Games 1980, 1981 by Bill Hogue & Jeff Konyu.
Programs are written in machine language for high quality graphics & sound effects.
Voice & other sound effects are playable through the cassette AUX plug.
High scores are automatically saved after each game on disk versions.
Call or write for our complete catalog.
CIRCLE 164 ON READER SERVICE CARD

in this issue...

evaluations & profiles

articles

applications & software

departments

MEMBER MITA

February 1982
Volume 8, Number 2

Creative Computing (ISSN 0097-8140) is published monthly by Creative Computing, P O Box 789-M, Morristown, NJ 07960 Second Class postage paid at Lincoln, NE 68501
Editorial offices located at 39 East Hanover Ave Morris Plains, NJ 07950 Phone (201) 540-0445
Domestic Subscriptions 12 issues $20, 24 issues $37, 36 issues $53 Send subscription orders or change of address (P O Form 3575) to Creative Computing, P O Box 789-M, Morristown, NJ 07960 Call 800-631-8112 toll-free (in New Jersey call 201-540-0445) to order a subscription (to be charged only to a bank card)

Creative Computing is printed by Mid-America Webpress, Lincoln, NE 68501.

staff

Publisher/Editor-in-Chief	David H. Ahl
Editorial Director	George Blank
Editor	Elizabeth Staples
Associate Editor	David Lubar
Managing Editor	Peter Fee
Contributing Editors	Dale Archibald
	Charles Carpenter
	Thomas W. Dwyer
	Will Fastie
	Stephen B. Gray
	Glenn Hart
	Stephen Kimmel
	Ted Nelson
	Harold Novick
	Peter Payack
	Alvin Toffler
	C. Barry Townsend
	Gregory Yob
	Karl Zinn
Editorial Assistant	Andrew Brill
Secretary	Elizabeth Magin
Production Manager	Laura MacKenzie
Art Director	Sue Gendzwil
Assistant Art Director	Chris DeMilia
Artists	Diana Negri
	Candace Figueroa
	Carol Ann Henderson
	Eugene Bicknell
Typesetters	Jean Ann Vokoun
	Maureen Welsh
Advertising Sales	Renee Fox Christman
	Jeff Horchler
	Renee Cole
Marketing	Laura Conboy
Creative Computing Press Managing Editor	Edward Stone
Software Development	William Kubeck
	Kerry Shetline
	Eric Wolcott
	Neil Radick
	Mike Favor
Software Production	Bill Rogalsky
	Owen Linzmayer
	Bill Thomas
Operations Manager	William L. Baumann
Personnel & Finance	Patricia Kennelly
Bookkeeping	Ethel Fisher
Retail Marketing	Jennifer Burr
	Laura Gibbons
	Roxanne Memmolo
Circulation	Frances Miskovich
	Moira Fenton
	Carol Vita
	Elsie Graff
	Brian Chamberlain
	Regina Jones
	Pat Champion
Office Assistants	Rosemary Bender
	Linda McCatharn
	Diane Feller
	Mary McNeice
	Barbara Werry
Order Processing	Jim Zecchin
	Ralph Loveys
	Gail Harris
	Linda Blank
	Mark Smith
	Karen Brown
	Susan DeMark
Shipping & Receiving	Ronald Antonaccio
	Scott McLeod
	Nick Ninni
	Mark Archambault
	Mike Gribbon

advertising sales

Advertising Coordinator
Renee Christman
Creative Computing
P.O. Box 769-M
Morristown, NJ 07960
(201) 540-0445

Western States
Jules E. Thompson, Inc.
1290 Howard Ave., Suite 303
Burlingame, CA 94010
(415) 348-8222
In Texas call (713) 731-2605

Southern California
Jules E. Thompson, Inc.
2560 Via Tejon
Palos Verdes Estates, CA 90274
(213) 378-8361

Mid-Atlantic, Northeast
CEL Associates, Inc.
27 Adams Street
Braintree, MA 02184
(617) 848-9306

Midwest
Ted Rickard
435 Locust Rd.
Wilmette, IL 60091
(312) 251-2541

New York Metropolitan Area
Nelson & Miller Associates, Inc.
55 Scenic Dr
Hastings-on-Hudson, NY 10706
(914) 478-0491

Southeast
Paul McGinnis Co.
60 East 42nd St.
New York, NY 10017
(212) 490-1021

attention authors

Creative Computing will not be responsible for the return of unsolicited manuscripts, cassettes, floppy disks, program listings, etc. not submitted with a self-addressed, stamped envelope.

OK to reprint

Material in Creative Computing may be reprinted without permission by school and college publications, personal computing club newsletters, and nonprofit publications Only original material may be reprinted, that is, you may not reprint a reprint. Also, each reprint must carry the following notice on the first page of the reprint in 7-point or larger type (you may cut out and use this notice if you wish):

Copyright © 1981 by Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07950. Sample issue $2.50, 12-issue subscription $20.

Please send us two copies of any publication that carries reprinted material. Send to attention: David Ahl.

microform

Creative Computing is available on permanent record microfilm. For complete information contact University microfilms International, Dept. F.A , 300 North Zeeb Road, Ann Arbor, MI 48106 or 18 Bedford Road, London WC1R 4EJ, England.

foreign customers

Foreign subscribers in countries listed below may elect to subscribe with our local agents using local currency. Of course, subscriptions may also be entered directly to Creative Computing (USA) in U S dollars (bank draft or credit card) All foreign subscriptions must be prepaid.

Many foreign agents stock Creative Computing magazines, books, and software However, please inquire directly to the agent before placing an order Again, all Creative Computing products may be ordered direct from the USA—be sure to allow for foreign shipping and handling

CANADA	Surface	Air
1-year	C $29	n/a
2-year	55	n/a
3-year	80	n/a

AUSTRALIA	$A	$A
1-year	28	52
2-year	54	101
3-year	78	150

ELECTRONIC CONCEPTS PTY LTD
Attn Rudi Hoess
Ground Floor 55 Clarence St
Sydney, NSW 2000, Australia

ENGLAND	£	£
1-year	15 00	30 00
2-year	30 00	54 00
3-year	45 00	80 00

CREATIVE COMPUTING
Attn Hazel Gordon
27 Andrew Close
Stoke Golding, Nuneaton CV12 6EL

GERMANY	dm	dm
1-year	52	d6
2-year	98	188
3-year	141	250

HOFACKER-VERLAG
Ing W Hofacker
8 Munchen 75
Postfach 437, West Germany

HOLLAND, BELGIUM		f
1-year		119
2-year		231
3-year		332

2XF COMPUTERCOLLECTIEF
Attn F de Vreeze
Amstel 312A
1017 AP AMSTERDAM Holland

ITALY	IL	IL
1-year	34.000	52.000
2-year	53.000	72.000
3-year	72.000	87 500

ADVEICO S R L
Via Emilia Ovest, 129
43018 San Pancrazio (Parma) Italy
Attn Giulio Bertellini

JAPAN	Y	Y
1-year	8 900	11.800
2-year	13 300	23 100
3-year	19 300	34 400

ASCII PUBLISHING
Aoyama Building 5F
5-16-1 Minami Aoyama Mineto-Ku
Tokyo 107, Japan

PHILIPPINES	P	P
1-year	214	363
2-year	413	718
3-year	596	1059

INTEGRATED COMPUTER SYSTEMS, INC
Suite 205, Limkelkai Bldg Ortigas Ave
Greenhills P O Box 483, San Juan
Metro Manila 3113, Philippines

SWEDEN	Kr	Kr
1-year	123	206
2-year	236	405
3-year	340	803

HOBBY DATA
Attn Jan Nilsson
Fack
S-200 12 Malmo 2, Sweden

OTHER COUNTRIES	US$	US$
1-year	29	50
2-year	55	97
3-year	88	143

CREATIVE COMPUTING
P O Box 789-M
Morristown, NJ 07960 USA

ANNOUNCING A REVOLUTION IN THE COST OF PROFESSIONAL SOFTWARE

VISACCOUNT is a fully integrated business and accounting system designed for use in small businesses. VISACCOUNT is extremely comprehensive and professional, yet it is very easy to use. The system is controlled from a series of interconnected menus permitting user-friendly operation. Everything you need to set-up and operate the system is provided with the VISACCOUNT package. Experts have estimated the development costs for a fully integrated software system ranges between $7,200 and $22,000.† When you buy software the developer has to recapture this expense. Computer Services Corporation of America is selling its software with a view that volume sales can almost negate this development cost.

OUR GUARANTEE — Buy both our software and that of our competitors (who will no doubt charge several times our price because they need to recapture their development cost). Compare the two systems and we know you'll return theirs (make sure they'll let you return their software). If you decide not to keep our system, then return it within 45 days for a full refund. Once you've used our system we're confident you'll be delighted.

†

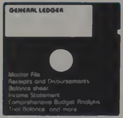
VISACCOUNT

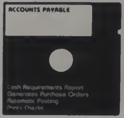
What You Receive

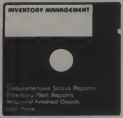
- Nine 5¼" double density disks (or six 8" single density disks)
- Easy-to-use operator's manual (over 200 pages)
- Self-study guide on bookkeeping and accounting (over 180 pages)
- Cassette based instruction program on set-up and operation

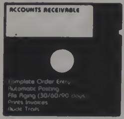
Available for Apple*, TRS-80, and most others

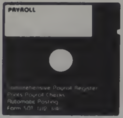
*The Apple version requires the Microsoft Z80 softcard.
CSCA has CBASIC2, CP/M and Microsoft Z80 softcard in stock.

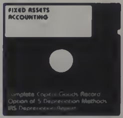












EXTRA: MAILING LIST PROGRAM

Features

Menu Driven: The entire system runs from a single master menu which accesses numerous subsidiary menus, when needed, to perform the full spectrum of business and accounting functions.

Self-Documenting: All the information needed to use the sytem is provided in an easy to self-study format.

Requirements: 48K CBASIC2
2 DISK DRIVES CP/M

Send $159 for the VISACCOUNT system

COMPUTER SERVICES CORPORATION of AMERICA
332 East 30th Street New York, New York 10016
Order Toll Free 1-800-221-2486
Technical Number 1-212-685-0090

Name ______________________

Address ______________________

City/State/Zip ______________________

☐ Master Charge ☐ Visa ☐ American Express

No. ______________ Expires ______________

Your System ______________________

Disk Size ☐ 5¼" double density ☐ 8" single density

CIRCLE 127 ON READER SERVICE CARD

input/output...input/output

Hotline Hangup

Dear Editor:

I recently discovered what I think is *bad news* for Apple owners, present and future.

In a field where hardware/software is constantly changing and being updated, one of the best things about Apple was that an owner used to be able to call a hotline number where technical problems could be tackled directly and immediately.

If an individual owner calls one of these numbers today, he gets a recording! He is told to see his dealer, and if it is really an emergency, Apple people will try to return his call within three working days. (Know of any important applications that can wait around for three days?)

The company seems to feel that dealers can henceforth handle service problems, and that this will force us to buy from good dealers.

There are serious flaws in this thinking. No one should be forced to shop around outside of his local area to find a dealer who is technically competent. Further, even if he is technically oriented, how can one dealer be expected to be experienced in all the likely (let alone possible) problems?

And why should a user be forced to fight another layer of people/travel/communications interfacing for service problems? One central service department (or a few regional ones) can always handle servicing better.

As an example, when I bought my first Apple, there was a problem that required an alteration to the mother board—try dropping something like that on your local dealer—the (then) Southern California regional distributor's service department diagnosed the problem over the phone. I took it in and was home again and operating in an afternoon.

"Woe is us" when we have technical problems in the future. Maybe the price tag on the new brands will start looking more attractive—real soon!

Paul Sharp
27173 Sena Ct.
Valencia, CA 91355

Inka-dinka-doo

Dear Editor:

A year ago I bought a Centronics 730 printer, and a generous supply of paper. After a bit of use, it dawned on me that to get legible copies, ribbons were going to cost me more than the paper! This especially irked me, because it seemed that a "worn out" ribbon was in excellent physical shape—just a little short of ink. So I started experimenting with ways of getting the ribbon re-inked.

After some rather messy results, I seem to have hit upon a satisfactory procedure, which I would like to share with your readers. This letter is being printed with a ribbon that has done about 2000 pages already; I leave it to you to advise readers whether it is satisfactorily dark.

The procedure I used should work on all printers physically resembling the Centronics 730, e.g. the 737 and 739, and the Radio Shack printers of same type. Readers may find that a similar approach will work on other printers; however, my technique takes advantage of the fact that the 730 uses a continuous-loop ribbon.

On the left side of the printer (as you face the switches), the ribbon travels down a narrow passage in which its half-twist is supposed to be located. At the front end of this passage it turns very sharply around a post, and quickly reaches the pinch-rollers that pull it along. This latter section of ribbon cuts off a small triangular corner of the chamber.

My approach was to put something in this corner, to re-ink the ribbon as it passes by. What seems to work is a small piece cut out of a regular stamp pad and wrapped in a bit of the cloth that covers the pad. This piece should be big enough to cover the full height of the ribbon, and to press the ribbon slightly out of a straight line path.

It should wedge fairly firmly into the corner, but not press so hard on the ribbon as to seriously impede movement; and it should not be so big that loose ends could protrude into the rollers.

I use regular stamp pad ink; an ounce (for about $1.00) seems enough for several thousand pages. Before any long printout, I usually put a few drops on top of my re-inking pad; this can be repeated in the middle of a very long printout. For satisfactory results you do have to remember to do this regularly, keeping the ribbon well inked.

If you mostly do short printouts, you should ink every few times, and when you finish printing pull the ribbon so it no longer touches the pad. This prevents parts of the ribbon from getting over-inked. With some practice and care, you can get a steady stream of nice dark printouts.

Robin Ault
Concolor Allied Technical Services
45 Dexter Road
Newtonville, MA 02160

Note: The print quality of the letter was excellent—would that all of our submissions looked as good!—EBS

Precisely the Problem

Dear Editor:

I am writing concerning the puzzle page in the August 1981 issue of *Creative Computing*. While this page may be of less importance compared to others, the significance of my revelation seems to be of the utmost importance.

I am concerned specifically with "The Sesquicentennial Puzzle" in which the objective was to find four digit numbers in which the square of the sum of the two digit pairs is equal to the original number.

I followed the puzzle instructions, and attempted to figure it out with my Apple II computer. Well, I think I have found a computer to actually be *wrong*. Of course, I am probably the one who is mistaken, but let me show you my data.

I have included the program I used. Originally, lines 10 and 80 were a for-next loop. However, the computer printed out


Star Warrior:
Slay the Dictator
and Save the
Civilized People
STAR WARRIOR
Star Warrior. Another bug-free, fantastic game from EPYX. With the unique EPYX life-time warranty: If anything happens to your cassette or disk at any time and for any reason, send it back with just $5.00 for shipping and handling and we will send you a brand new one
course there is also our 30-day unconditional guarantee: if your EPYX game has any
whatsoever within 30 days of purchase
return it to us or your dealer and we will
it free No questions asked.)
it your dealer now and pick up Star Warrior
good looking, protective box with one of
instruction books you ever read. Now
for the Apple II (48K RAM
and Radio Shack's TRS-80
the TRS-80
(32K RAM). And
16K and the Atari (32K). Only
$39.95 on disk or cassette.
tock and you can't wait
from Automated Simulations
$39.95 plus $2.00 for shipping and handling
tax if you are in California).
you will be delighted with Star
Warrior.
not exactly what you w
full refund Again no qu
(800)
824-7888; In California
(800) 852-7777; In Hawaii and Alaska
(800) 824-7919.
Order today. You and your computer deserve the fun.
AUTOMATED SIMULATIONS INC
COMPUTER GAMES THINKERS PLAY
EPYX
CIRCLE 110 ON READER SERVICE CARD

absolutely no answers. So, I attempted to discover the problem. I used only the number 3025, the number used in the puzzle example.

My program does execute the problem correctly as evidenced by the variables' matching numeric values. Both the original number (X) and the resulting square (P) are the same value. However, the computer refuses to admit it. P does equal X, but the computer neither prints X or answers in the affirmative (1) the question whether P=X (i.e.–print P=X).

Furthermore the computer falsely contends that P is actually greater than X. But if P and X both have the value of 3025, how can they not equal each other?

I have only taken a beginning course in basic programming, but I do wish to know the answer to this question.

Thank you for your time, knowledge and cooperation.

Robert Lehrburger
80a Greenacres Ave.
Scarsdale, NY 10583

```
10 X = 3025
20 A = ( INT (X / 1000))
25 B = X - (1000 * A)
30 C = ( INT (B / 100))
35 D = B - (100 * C)
40 E = ( INT (D / 10))
50 F = D - (10 * E)
60 W = (10 * A) + C
62 Z = (10 * E) + F
65 Q = W + Z
67 P = Q ↑ 2
70  IF P = X THEN  PRINT X
80  END
```

```
]RUN
(No answer)

]PRINT A
3

]PRINT B
25

]PRINT C
0

]PRINT D
25
```

```
]PRINT E
2

]PRINT F
5

]PRINT W
30

]PRINT Z
25

]PRINT Q
55

]PRINT P
3025
```

```
]PRINT X
3025

]PRINT P+X
6050

]PRINT P=X
0

]PRINT P<>X
1

]PRINT P<X
0

]PRINT P>X
```

A common problem — when testing a floating point number for equality it is often necessary to test for a narrow range of answers, such as this:

IF A < B+.0001 and A > B-.0001 THEN GOTO 100. This is due to round-off and computation errors and the fact that computers store numbers with more precision then they report them. While the computer would print 3025 for both 3024.99999 and 3025.00001, it would not consider them equal. — GB

We Read You Loud and Clear

Dear Editor:

Does FIS interface with GF? Is DS a peripheral of HPC? When a vehicle is half submerged in salt water does the R in RV refer to "recreational"? Does TriT have something to do with steak, or is it sometimes equipped with BW?

To answer in the cult cant of computer language: no FIS (French interrupted screw) isn't aboard the same vessel with a GF (gallows frame). Nor is a DS (dolphin striker) a peripheral of a HPC (high pressure cylinder). And RV has nothing to do with recreational vehicle. It means, in a submarine, ride the vents. And TriT (triatic stay) is sometimes wrapped with BW (bally wrinkle).

How many thousands of people who would like to have a home computer don't buy one because they're discouraged (and insulted) by the snobbishness of the few experts, each trying to top the other with more unintelligible gibberish?

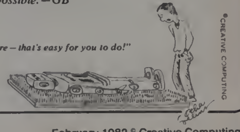
And how many thousands of other prospective customers are dissuaded from buying by folks like me who *did* buy ($5000 worth of Apple) and now tell everybody who'll listen not to spend a dime on computers until the experts learn how to write plain and simple English?

May I suggest that *Creative Computing* begin by:
(1) Writing with words, not symbols?
(2) Devoting a page of each issue to an explanation of the most used-and necessary-symbols?

I'm sure such a method would increase sales to people who now won't buy, and mollify my temper as soon as I get past SYNTAX ERROR.

Robb White
1780 Glen Oaks Drive
Santa Barbara, CA 93108

We agree that technical jargon and symbols limit the readership of articles, and we try to avoid them. Recently my fellow editors demanded that I rewrite my article, "So You Want to Buy a Monitor," (1981 Buyer's Guide*) in order to take the technical discussion out of the article and put it in a sidebar. (A sidebar is a separate comment that runs alongside an article.) I still left an unexplained "NTSC" in the article. I am afraid that dedicating one page to a glossary would not be practical, but we do ask authors to define terms the first time they use them, and avoid abbreviations, symbols, and technical terms whenever possible. — GB*



"—Oh, sure — that's easy for you to do!"

Give your system some NEC, and watch its performance soar.

NEC's crisp, clear, high-performance JC1202 RGB color monitor, an industry standard. Also available the JC1201 composite video version

NEC's classic green monitor, (JB1201), one of microcomputing's performance legends. Easy on the eye and the checkbook.

The impressive new NEC dot matrix printer. Parallel interface. 100 cps. 2K buffer. pin or friction feed. Stunning performance and versatility in the hottest new peripheral of the year.

You don't need an all-NEC system to benefit from NEC components.

Owners of Apple®, Radio Shack®, Atari®, IBM®, and many other microcomputers will find their equipment to be perfectly compatible* with NEC's famous monitors, as well as our highly-featured new PC-8023A dot matrix printer.

Ask your dealer for a demonstration.

Productivity at your fingertips

NEC

NEC Home Electronics USA
Personal Computer Division
1401 Estes Avenue
Elk Grove Village IL 60007

CIRCLE 203 ON READER SERVICE CARD

Microcomputer Week '82

David H. Ahl, publisher of *Creative Computing*, will speak on "The State of the Art in Educational Software" and present a workshop on "Stimulating Simulations" during Microcomputer Week '82, The Third Annual Conference co-sponsored by Catalyst. The conference will be held March 3-7 at Jersey City State College in Jersey City, New Jersey.

The focus of the five-day event centers upon microcomputers in education at elementary, secondary, and college levels. An additional focus this year will be on acquiring in-depth knowledge and experience at three levels: novice (zero level beginner), advanced (three or more years experience with microcomputers), and intermediate—in more than 20 subject areas.

For more information about the conference call (201) 434-2154 or 547-3094, or write Catalyst Conference, H 112, Jersey City State College, 2039 Kennedy Boulevard, Jersey City, NJ 07305.

Microcomputer Directory

Gutman Library at the Harvard University Graduate School of Education is seeking program descriptions for inclusion in its forthcoming second edition of *Microcomputer Directory: Applications in Educational Settings*, which will be published in the spring of 1982. If you are involved in, or know about a project that utilizes microcomputers for instructional and/or administrative purposes, write to: Microcomputer Directory 2, Gutman Library, Harvard Unversity, Graduate School of Education, Appian Way, Cambridge, MA 02138.

The Library will then send you a standard reporting form.

Corrections

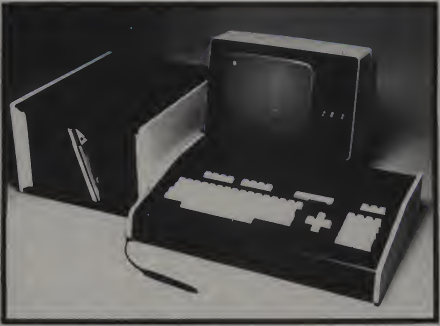
"Boxes, A Structured Spatial Language," which appeared in the November 1981 issue of *Creative Computing*, was co-authored by Bruce Luttrell, 485 Cheney Ave., #6, Oakland, CA 94610. Mr. Luttrell and co-author George Miller are employed by the Bank of America in San Francisco.

In our December 1981 New Products section we mistakenly listed the price of Lifeboat Associates' new accounting system, **The Boss**, at $24.95. The correct price is $2495.

creative computing equipment evaluation

Graphics, Music and More

Carl Strobel



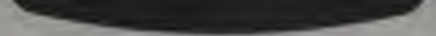
The MTU-130.

Photography by David Hornick.

When computer professionals get more excited over a new computer than the kids next door, you know the machine has to be impressive.

The computer that is receiving this kind of attention at my house could easily be the most powerful and versatile microcomputer yet offered for personal, professional and small business use. It is the MTU-130, a superb new computer just introduced by Micro Technology Unlimited, a small Raleigh, North Carolina company that up to now has specialized in developing advanced hardware and software enhancements for computers produced by other people.

If the phrase "most powerful and versatile" sound a bit extravagant, add the words "advanced design" and "expansion capacity" and a few other adjectives and take a look at what the MTU-130 offers. It will be a long look because there is a lot to see—memory capacity, quality sound and music, high resolution graphics, a disk operating system that puts many of the bigger systems to shame, Basic and assembly language programming capabilities acclaimed by my professional programmer friends.



Two shades of gray, in addition to black and white, can be created in the medium resolution mode. In this mode, the computer provides a 240 x 256 dot matrix for graphics creation.

The computer comes with 80K of system and user RAM and is easily expandable to a directly addressable 256K. If you need more memory, virtually unlimited expansion is possible through a memory bank switching capability.

High resolution graphics has been one of MTU's specialties. The MTU-130 has two graphics levels in addition to its standard 80-column, 25-line alphanumeric display. One level offers the ability to create objects on a 240 x 256 dot matrix in black, white and two shades of gray. The second level provides double that resolution through the addressing of individual pixels on a 480 x 256 pixel screen. The results, as shown in the accompanying photographs, are impressive, indeed.

A high definition light pen feature is standard and provides an easy means of creating graphics on the screen as well as

Carl Strobel, 1716 Tarleton Way, Crofton, MD 21114.

CRYSTALWARE

ATARI 48K — w/ disk

TRS-80 48 — w/ disk

APPLE 48K — w/ disk

THE FINEST IN FANTASY GAME SOFTWARE

"Having previewed over fifty of your competitors' games, I can assure you that your use of scrolling far exceeds anything I've seen for the Atari and, of course, for the Apple. I'm very impressed by the dedication and quality that your company exhibits by virtue of this demo." **David Sosna** — Associate Producer Universal Pictures

Crystal has done its best to become the Porsche of the computer game industry. New scrolling techniques, video disk games, a real-life fantasyland — our mad programmers toil onward with little food or sleep to produce some incredible firsts in the microcomputer world. If you are an unappreciated genius and want to join our staff to help create the world of tomorrow today give me a call. Our magazine *Crystal Vison* will within the next month have a circulation of 80,000 and we look forward very soon to producing our first full length motion picture. I'd like to thank my friends at Votrax and Axlon for giving us the tools (128K RAM for Atari and a vocal text synthesizer) to truly produce some programming miracles.

★ ★ ★ NEW RELEASES ★ ★ ★

THE CRYPT — One evening you awake at sunset to find yourself in what appears to be an endless cemetery. Although defenseless, you must somehow find your way out or perish from the hideous assaults of flesh-eating zombies, rats, vampires, werewolves, and other repulsive monstrosities. To escape you may have to descend into the catacombs beneath the cemetery. This game is a little different from the others of our series because we use a lot of static graphics to set the mood. It is similar in some respects (without any copying intended) to those of our friends at On-Line who produce excellent static graphic adventures. You must use all your common sense and a great deal of courage to escape from this perilous adventure alive. We have made it so nearly impossible that the first player to do it successfully will receive a $200.00 prize. **$49.95 2 disks**

QUEST FOR POWER by Mark Benioff — An extraordinary game with the adventure and magic of Arthurian legend. Join Galahad as he leaves Camelot in search of the Scroll of Truth. Explore the treacherous depths of the Caves of Somerset, visit the medieval city of Essex. Along the way you will meet powerful wizards and great prophets. The villages of Sunderland and Leeds dot your path. Somewhere in an evil castle called Skenfirth, lurks the devil himself, while the Evil Giant Gogmogo, hungry for human prey, roams the forests. In Fantasyland tradition we include 64 full screens of hires scrolling and some sensational graphic and animation sequences. Well worth the **$39.95 1 disk**, enjoyable to all ages.

★ ★ ★ GALACTIC EXPEDITION ★ ★ ★

The year is 3021, almost 100 years since the expedition to the Sands of Mars has returned. The Starship Herman now rests quietly in the Zikon Museum in New Brisbane. It's nearly 80 years since World War III, the Ames Research Center celebrates its 150th anniversary, and you stand at the unveiling of a truly technological wonder — the first ion-propelled vessel, saucer-shaped Lady Joanne, its viewport of pure diamond, its hull of synthetic emeralds. The Martian glyphs of the Meshim and those of Lemuria have now been deciphered and it appears that a much greater mystery is about to unravel. 7 planes and 7 doors — 7 guardians and 7 candles. 7 strange new worlds await the ultimate adventurer to unlock a timeless secret. The starship may seem strange and unfamiliar to our veteran adventurers, faced with its marvelous new technology, this craft must be flown by constant monitoring of ion stabilizers. During your galactic expedition you are surrounded by the flickering heavens, beset by meteor showers and time-warps. Each unique world holds one of the 7 keys to unlock the Great Mystery. The games all run off the Main Module which also is a game unto itself.

From Earth to Moon — On the Moon's dark side lie entrances to caverns extending to the moon's hollow core which contains a timeless secret. Here live a race of burrowing creatures, who have built vast earthen cities with storehouses full of precious stones. Gravity is extremely critical and you must use all your skills to manually land your craft. This first Master Disk contains the dos needed to run additional scenarios. Its price is **$39.95** and includes 64 screens of Hires graphics.

Mists of Venus — On Venus' ever hot surface are endless jungles and swamps. The air is unbreathable and spacesuits and oxygen must be carried. This world is especially treacherous with all sorts of loathsome creatures and hardly any place dry enough to land your ship. Beneath the green seas our adventurer may find the second key to solving the Mystery. **$29.95** (must have Master Disk to run)

Planet Herman — It is hard to tell where Herman's atmosphere ends and the surface begins. Much of this adventure will have the feeling of a starship submarine. Navigating around Herman is very dangerous but with a computer on board Lady Joanne it may be just possible. This senario costs **$29.95** and needs the Master to run.

The Asteroid Belt — Every play something oids. A combination of the best machine language sub-routines of our new Crystaloids with a fast moving adventure game. Penal colonies, lurking pirates, and some unusual forms of scavenger life exist here. It's difficult to travel in the Asteroid Belt without getting blown up. Perhaps you should find some expert help by rescuing a pilot, who is also a sentenced thief or murderer, from one of the penal colonies. There are places for trading and you may wish to indulge yourself with a visit to the sensual Pleasure Planet. **$29.95** (needs Master Disk)

Uranus - World of Ice — A freezing place with nights of −200° F. Bring along Thermasuits, as well as some Laars with which to battle the Grungik, a 12 foot tall relative of Big Foot, fond of human flesh. Uranus also has a secret inner labyrinth with tropical flora and fauna. However, the King of the Ice Planet, Norion may have his own idea about your trespassing. Without proper clothing, weapons and supplies, your stay here may be very exciting and very short. **$29.95** (needs Master Disk to run)

Jupiter - World of Dwarfs — How would it feel to weigh 300 or so lbs.? A trip to Jupiter should fill you in fast. There is a particularly interesting red spot on Jupiter and a curious set of moons. Picking up some antigravs will help. Landing should really tax your energies. In the Jupiterian atmosphere, you fall fast! Be prepared to use 10 times the normal amount of fuel. Better find the 6th key quickly before your fuel and food are exhausted. **$29.95** (needs Master Disk)

The Crystal Planet - You will have to embark on this final portion of your expedition ignorant of what you may encounter here on this mysterious planet, excepting that the 7th world holds the ultimate key to winning the contest. **$29.95** (needs Master Disk)

The Contest — To the Winner with the highest score, who solves the mystery by November of 1982 will go $5000.00 in cash. Good Luck!

★ ★ ★ ★ ★ ★

GLAMIS CASTLE — According to ancient legend and records this castle is one of the most haunted sites in Great Britain. One Lady Glamis, known to be in league with the devil, liked to send out a destructive demon to harrass the townspeople. She finally was burnt at the stake on Castle Hill, cursing as she died all future generations of the Lyon family. Her demon still seems to haunt that spot, murdering the curious who stray up to Castle Hill after dark. The curse stipulated that each succeeding generation would have at least one child, often female, who would be a vampire. When an heir comes of age, there is a secret ceremony in which the heir, his father, and the steward take crowbars and chip away plaster concealing a hidden chamber, known only to them, that Earl Patie used when he gambled with the devil. Another tradition says that a creature, half-man, half-beast stalks the passages in the walls of Glamis to insure the fulfilling of the curse. The mystery, of course, is to determine the location of this secret chamber. Our game, occupying 2 disks, will have as exact a replica of the castle as possible. It's definitely one of a kind! And we will be offering a $500 prize to the first person daring enough to solve the centuries-old mystery of Glamis Castle. **$49.95 2 disks.**

Crystal has many other fine fantasy and space games. For a copy of CRYSTAL VISION which includes a complete catalog please send $3.00 to the address below.

Our order lines are open 24 hrs. a day 7 days a week.

(408) 778-2966 **CRYSTAL COMPUTER** 17120 Monterey Rd., Morgan Hill, CA 95037

VISA

CIRCLE 165 ON READER SERVICE CARD

allowing direct user response for such things as menu selection. Programming the light pen is as simple as any other Basic programming, thanks to special commands in the extended Microsoft Basic.

Hal Chamberlin, one of the pioneers in microcomputer music, is vice president for research and development of MTU, so you could expect emphasis on a sophisticated music capability.

The MTU-130 has an 8-bit digital-to-analog converter that not only provides exceptional quality four-voice music but also allows implementation of very lifelike human voice and other complex sounds in user programs. This music capability, incidentally, has been used since last fall by Ohio State University in teaching music courses. The computer music has an eight-octave range and programmable envelopes, and each of the four voices has 16 harmonics which are programmable.

The computer music has an eight-octave range and programmable envelopes.

CODOS 2.0

The computer offers what is probably the most advanced disk operating system available for microcomputers. It is superior even to a well-known minicomputer system I've used. Called CODOS 2.0, or Channel-Oriented Disk Operating System, it is a more advanced version of a DOS offered by MTU for the past several years and was written by MTU's software manager, Bruce Carbrey.

CODOS merits a lengthy discussion by itself, and I shall expand on its power and subtleties more fully later. Just a quick word here to note that it offers true I/O device independence and provides a programming flexibility that has to be used to be believed. CODOS also dynamically allocates file space on disk; no need to declare to your DOS in advance how big your files are going to be—even if you know.

CODOS supports up to four double density 8" disk drives, either single or double sided or any mixture of the two types. Disk capacity is 500K bytes for single sided and 1 megabyte for double sided disks. My entire collection of game programs on cassette now resides on one side of one disk with room to spare.

Not insignificantly, the sustained data transfer rate under CODOS is 19.7K bytes per second. MTU claims, and my experience supports it, that CODOS will locate, load and begin execution of a 32K file in three seconds.

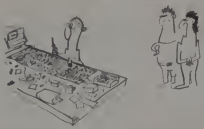
The beginning of a game of pool on the MTU-130 which combines high-resolution graphics with sound effects. The two lines which cross at the upper left pocket form the graphics cursor used in this game to specify the point at which the cue ball is aimed.

The MTU-130 is clearly designed for floppy disk operations to take advantage of the speed and power of the system. But an audio cassette port is there for those who want to use tape for input and output. With appropriate software, being developed by MTU, nearly all audio cassette formats in use by microcomputers today can be read and written through the port, making possible tape exchange between the MTU-130 and other computers.

Other I/O ports include an 8-bit parallel and an RS-232 serial port. The RS-232 port has software selectable data transfer rates from 50 to 19,200 baud with programmable data format. It offers another handy way to transfer programs or data from one machine to another, using the Download and Upload utilities in CODOS.

Local netting of the computers, which has significant educational and business applications, is also possible through an internal I/O port. Software, in conjunction with a Network Transceiver Board, will allow data communications at 50K baud.

Finally, for music enthusiasts who want greater sound fidelity than is available from the standard 3" x 5" speaker (which actually provides good quality sound), there is an output for connection to a high fidelity system.



"Yesterday I bought a chip that does all that for 50¢."

Those ubiquitous folks at Microsoft have written a powerful, extended Basic for the machine. The interpreter is loaded from disk rather than residing in ROM which is the way the minis and mainframes work. It simplifies upgrades and the introduction of more features later on at a cost of about one second's delay while the interpreter loads. Those of us who have lived through Commodore's frequent changes to the PET ROMs can appreciate MTU's good intentions.

The concept of disk-based operating software also makes it easier to implement other languages on the MTU-130.

The Computer

The computer itself is in a nicely styled brown and tan case 22" wide by 14" deep. A 96-key keyboard makes the case wider than that of an Apple, but it is not as high or deep. Upper and lower case letters, numbers and standard symbols are provided, along with special function and control keys. Eight user-definable function keys are at the top of the keyboard where they can easily be correlated to eight "legend" boxes on the monitor—of which more in a moment.

The MTU-130 is a 6502-based machine.

Press a key and you get an audible click through the on-board speaker; "auditory feedback" is probably the elegant name for the feature. As you might have anticipated by now, MTU has made the tone, duration and volume of the click adjustable. Simple modifications to the I/O driver software allow the user a choice—or no click at all. Admittedly, the ability to make keys click to your preference is not a key criterion in judging a computer. But to me it illustrates the thought that went into the design of the MTU-130.

A 12" green-phosphor high resolution monitor sits atop the computer case while the disk drives go on the side of the computer where they are out of the way. Both the monitor and disk drive power supply can be plugged into AC receptacles on the back of the computer case, allowing the MTU-130 power switch to control everything.

The heart of the computer is what MTU has called the Monomeg processor board. It contains the 48K of user RAM, 16K of two-port RAM for the bit-mapped video display which is the basis of the high resolution graphics capability, the I/O and sound generation logic and associated hardware, and a 6502 microprocessor with a 1 Mhz clock rate.


APPLE PANIC
SPACE★QUARKS
APPLE PANIC
Brøderbund Software PRESENTS
SPACE★QUARKS
Ladders take you from level to level in
The deadly, intricate dances of the space
BRØDERBUND SOFTWARE
GENETIC DRIFT
TRACK ATTACK
This finger-pounding arcade game requires
Fast cars and fast trains make this gold
ASK YOUR DEALER OR SEND CHECK OR MONEY ORDER TO
Brøderbund Software • 2 VISTA WOOD WAY, SAN RAFAEL, CA 94901 • (415) 456-6424
CIRCLE 117 ON READER SERVICE CARD

Yes, the MTU-130 is a 6502-based machine. The company was adamant that this computer, with its highly efficient instruction set and flexible addressing codes, have the speed and power to meet personal computing needs for some time to come. MTU also points to the availability of 6502 machine language programs and programmer expertise in support of their decision.

For those who need some number crunching capability, MTU has a 68000 board in production that will share tasks with the MTU-130. Full handshaking and bidirectional interrupts allow the two processors to communicate. Initially the 68000 will be on a 128K RAM board; this will be upgraded to 512K using 256K RAM chips with the 68000 having straight addressing to all 512K. Up to three boards can be mounted inside the MTU-130.

Memory

The MTU-130 uses dynamic RAM for memory, but the display section keeps on-board RAM refreshed without introducing wait states or other types of system delays.

The exceptional quality of the high-resolution display is achieved by having each pixel addressable in bit-mapped memory. Setting the bit causes the corresponding pixel on the screen to light. The mathematics required to draw objects in high resolution gets a bit complex, but MTU's machine language software routines called by Basic commands make the process rapid and painless for the user.

In the gray scale graphics mode, shades are created combining two horizontally adjacent pixels into a single wider dot. The brighter gray scale dot is set at the same intensity as the white dot in the other mode, creating a relatively dimmer gray and a brighter white.

An 18-bit address bus on the Monomeg board supports the direct addressing of up to 256K of memory. Because the addressing techniques use the address modes of the 6502, in practice the memory is divided into 64K for programs and 64K for data. Further expansion, as mentioned earlier, is possible through use of bank selection registers.

An expansion bus, with sufficient electrical power already available on the MTU-130 as delivered, makes memory expansion a simple matter of inserting memory boards into the existing card files in the case.

Mounted above the Monomeg board is the CODOS disk controller board with 16K of read/write memory, a 256-byte bootstrap loader PROM and the disk controller circuitry.

CODOS is loaded automatically from disk into the memory on the board by the bootstrap PROM in about one second. The critical top 8K of RAM is then write-protected to prevent inadvertent crashing of the system by a user program.

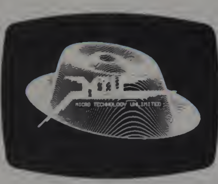
CODOS loads automatically.

Don't judge the power of CODOS by the memory space it occupies. It acts like a much bigger DOS, partly because it is. It is written with 15 overlays which are moved into memory only when needed with no delays in response apparent. The other part of the power story is the fact that CODOS is written in optimized machine language.

CODOS loads automatically. Put a disk in drive 0 or power up with a disk already in the drive and the loading begins.

Once loaded the CODOS monitor assumes control and a series of commands from a job file designated "Startup" are read and executed. The Startup file initially provided with the system does the basic housekeeping needed to get the system running and concludes by asking, in a pleasantly modulated voice (there's that sound capability again) for the date. However, Startup can easily be modified by a user to perform any desired action—such as loading and executing a specific program on disk without involving the user. Totally customized operation is possible.

The automatic booting of CODOS and the possibilities of the Startup file seemed a nice convenience until I talked to Susan Semancik of the Delmarva Computer Club, which has been breaking new ground with its work in computer support for the handicapped. The club was initially interested in the MTU-130 because its fine graphics and animation capabilities lend themselves to work on sign language for the deaf. But Susan saw the automatic loading and customized operation of Startup as a boon for the severely handicapped, such as quadriplegics. A simple device to turn the MTU-130 on, such as a mouth switch, would unlock the full power of the machine.



The MTU-130 displays the company's symbol in high-resolution graphics mode, which allows individual addressing of the 122,880 pixels on the screen.

CODOS Commands

Back to the power of CODOS. It provides for several different types of facilities: there are 35 free format built-in commands, all of which are oriented to system operations, opening and closing drives for example, and manipulation and execution of machine language programs.

The ASSIGN command is at the heart of the channel-oriented DOS and the I/O device independence. What it means is that any file on disk or any I/O device can be simply assigned a channel number and then data can be moved to or from it over that channel. CODOS keeps track of the mundane details.

The system is so simple and flexible that it was actually hard for me to accept at first.

For example, under Basic program control, data can be read in from channel 5, which might be assigned to a data file on disk, and read out to channel 6, assigned to a printer. Reassign channel 6 to a modem, either through the Basic program or by a direct command, rerun the output part of the program and the same data is sent over the phone lines. Once they realize the power this capability provides, newcomers to CODOS are totally converted.

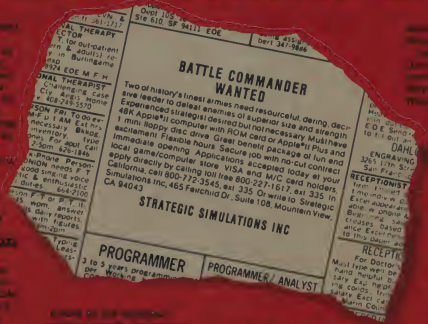
Easy manipulation of machine language files is possible through such commands as GETLOC, display load addresses of files; DUMP, display the contents of memory in both Hex and ASCII; HUNT, search for a string of bytes in memory; and TYPE, display contents of a file.

The convenience and versatility of CODOS is underlined by the way in which the TYPE command can be applied, not only for machine language programs but for a file of any type—Basic program, data or whatever.

The command TYPE XFILE will display the contents of XFILE on the monitor. TYPE XFILE P will send the contents to a line printer. TYPE XFILE YFILE:1 will write a duplicate copy of the file, renamed YFILE, on the disk in drive 1. Another example TYPE 5 ZFILE, will cause input from the device or file assigned to channel 5 to be written on disk as a file named ZFILE.

The system is so simple and flexible that it was actually hard for me to accept at first. I thought I had to be overlooking something.

HELP WANTED


BATTLE COMMANDER WANTED

Two of history's finest armies need resourceful, daring, decisive leader to defeat enemies of superior size and strength. Experienced strategist desired but not necessary. Must have 48K Apple®II computer with ROM card or Apple®II Plus and 1 mini floppy disc drive. Great benefit package of fun and excitement. Flexible hours. Secure job with no-cut contract. Immediate opening. Applications accepted today at your local game/computer store. VISA and M/C card holders, apply directly by calling toll free 800-227-1617, ext. 335. In California, call 800-772-3545, ext. 335. Or write to Strategic Simulations Inc, 465 Fairchild Dr., Suite 108, Mountain View, CA 94043

STRATEGIC SIMULATIONS INC

PROGRAMMER

PROGRAMMER/ANALYST

SOUTHERN COMMAND™
Job Description

NAPOLEON'S CAMPAIGNS: 1813 & 1815™
Job Description

Software protection against inadvertent deletion of files is provided by LOCK, with UNLOCK making them vulnerable again. RESAVE allows an updated file to replace an older version on the disk. The dynamic file space management of CODOS even allows new files to be larger than the originals; CODOS allocates the additional space as needed. Incidentally, the only maximum limit to file size is that of the disk capacity—500K bytes for single sided and 1 megabyte for double sided.

One feature that long-time disk users have liked is the fact that files do not have to be OPENed or CLOSEd. Only the disk drives need that care.

If the user can't find a CODOS command to his liking, he can create his own. Simply SAVE a machine language program that performs whatever function is needed and the name of the program becomes the CODOS user-defined command. The flexibility of the system is evident everywhere.

CODOS also includes utilities which allow for formatting new disks, copying all or specified files and deleting files. BACKUP is a particularly handy method for duplicating all files on a given disk at high speed.

Two utilities allow users to identify permanently to CODOS the specific configurations of their systems. SYSGENDISK is used to define number of disks, disk drive track-to-track step time and head load time if they are changed from the as-shipped version. SYSGENDEVICE probably gets greater use; with it up to six I/O devices can be added as standard system components, and devices can be deleted or their characteristics modified.

Machine language programmers on the MTU-130 can get mainframe-style support with Supervisor Call instructions, a powerful tool found on many large computers. The SVCs allow programmers to call 30 different subroutines.They are far easier to use and more powerful than a Call Subroutine (JSR in 6502 mnemonics) for several reasons.

The SVCs are address independent, and preserve the value of the machine registers (no saving and then restoring the values when going to a subroutine through an SVC). They are a tremendous aid to program debugging. An error which occurs during the processing of an SVC automatically aborts the program, generates an error message explaining the problem, displays the address of the SVC and records the value of all registers.

Reliability

A few words about the reliability of disk operations with CODOS. Long after many of my friends were boasting of loading speeds with their floppy disk drives I was still wedded to cassette tapes. Their complaints about disk crashes and loss of data, combined with my own experiences on a minicomputer system, led me to choose the slow but reliable magnetic tape.

I am still waiting to report my first crash.

After more than a month of intensive use of CODOS and the Shugart SA801 drives that came with the system, I am still waiting to report my first crash. I have been reasonable, but not fanatic, about environmental controls. The MTU-130 sits in an otherwise unused bedroom where no smoking is allowed and which I dust and vacuum on occasion. But a constant stream of visitors, including my short-haired cat who has penetrated my defenses on at least two occasions and left behind an ample supply of hair, has made the environment less than pristine.

I can't give any data on mean time between crashes or data errors per 1000 disk accesses simply because there haven't been any.

For those who use the MTU-130 in an even less controlled environment than mine, it's worth noting that both the computer case and the disk drive case have positive pressure ventilation—the internal fans suck air in from the outside—which makes filtering a simple task.

Another CODOS feature that supports data recording reliability is an option under the FORMAT command used to write timing information on new blank disks. CODOS will check the disk for bad sections and automatically bypass them in allocating file space.

Extended Basic

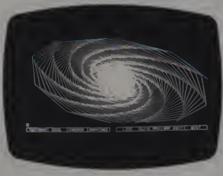
I have already mentioned the extended Basic that is standard with the MTU-130. It has several extra commands designed specifically for the computer.

It bears a close resemblance to Commodore Basic, even to the use of the "?" symbol as a shorthand for the PRINT command. It includes PEEK and POKE, and the handy Microsoft string function commands LEFT$, RIGHT$, MID$, CHR$, ASC, VAL, and LEN. The standard arithmetic and trig functions are also included.

Expanded commands include BYE, to exit Basic and reenter the CODOS monitor and TONE, which allows Basic program control over the pitch, waveform and volume of sound generated by the CB2 signal on the parallel output port.

ENTER loads a Basic program in ASCII from a file or device which can then be SAVEd in tokenized MTU Basic. LIST outputs in ASCII format from the machine to a file. These commands make programs more transportable between the MTU and other computers.

OUTCHAN provides I/O independence in Basic by directing output to any previously designated channel as in the CODOS discussion above.



A sample of MTU-130 high-resolution graphics. The boxes, or "legends," at the bottom of the screen give the names of routines which can be called by pressing the corresponding user-defined function key.

The name of a popular computer magazine is written on the screen using the light pen capability. The screen was first made all white and the light pen used to turn off pixels, creating a pattern in black. Reversing the video produced the image shown here.

I mentioned the eight function keys at the top of the MTU-130 keyboard and their relation to the "legend" boxes on the monitor screen. These boxes can display menu information or any other data that a user might have to choose among for input.

One simple example of their utility and the Basic commands that support them was in a simple program using the light pen in creating logic circuits. The LEGEND command, followed by the appropriate labels, printed the names of the logic gates in the "legend" boxes on the screen. By pressing the function key under the appropriate box, I selected the gate to display on the screen where the light pen was pointed.

KEY is used in an ON KEY GOTO ... or ON KEY GOSUB ... command where the KEY value ranges from 1 to 8.

The LIB command adds additional power to the Basic by linking in a designated library of additional specialized Basic

INTRODUCING MTU-BASIC

MICROSOFT BASIC + USER ORIENTED ENHANCEMENTS = MTU-BASIC

CAN YOU

- Save and load BASIC programs in either memory image or ASCII format?
- Input COMMANDS and data to BASIC from a disk file as well as from the keyboard, i.e. drive BASIC from an ASCII "job" file on disk?
- Execute ANY Disk Operating System command from a BASIC program?
- Redefine the effect of keyboard function keys and display legends on the CRT to indicate their present function?
- Use a lightpen to input actual X, Y coordinates on a 480 x 256 pixel array in 1/60 second?
- Obtain very precise coordinate input using a moveable crosshair positioned by the cursor keys?
- Plot high resolution images using screen coordinates or floating point coordinates with the necessary transformations and image clipping accomplished automatically?
- Easily extend BASIC's command set with your own application oriented machine language routine library (up to 8 at once)?

MTU-BASIC CAN DO all of the above yet is based on the industry standard, Microsoft BASIC. If you are missing even one of the above functions, you should find out how an MTU-130 computer can make your association with BASIC a lot more pleasant and better suited to your special needs.

The MTU-130 also comes with other standard features that most computers offer only as options at extra cost — such things as 19.6K Bytes/sec sustained disk data transfer rate, digitized speech playback, 4 voice music synthesis, 480 x 256 bit mapped CRT screen display, fiber optic lightpen, RS-232 port, two parallel ports, hardware for cassette input and output, interface for local network, 80K RAM, 18 bit address bus, 8 bit audio DAC with 1 watt amplifier and a 3" x 5" speaker.

Shouldn't you be using MTU-BASIC on an MTU-130 Computer?

EXAMPLES FROM MTU-BASIC

ENTER "TRANSFER3"
  Reads in an ASCII text file as program statements.

SYSTEM "ASSIGN 1 BASICIN"
  Redirects input from keyboard to disk file named BASICIN.

LEGEND 1, "First," "Second"
  Relegends function keys 1 and 2 to read "First" and "Second".

LTPEN F, X, Y
  Sets F = 1 and X, Y to coordinates when lightpen picks a point.

GRIN NW$, X, Y
  Displays crosshair and inputs X, Y location of its final position; NW$ contains the exit key.

DRAW .0645, 3*Y
  Draw a vector from current location of graphic cursor to specified coordinates.

LIB "VGL," "IGL"
  Select library extensions to be linked to BASIC.

The base MTU-130-1S system comes with one single-sided double-density 8" floppy disk, a 12" green phosphor CRT, and MTU-BASIC for $3995. Three other models priced up to $4995 contain 1 or 2 single or double sided drives for up to 2 Megabytes of storage. 4 Megabyte systems available on request.

We obviously cannot describe fully all of the details of the MTU-130 here. If you wish to know more about this complete desktop computer, call or write for our comprehensive 15 page descriptive literature. International requests include $5.00 U.S.

COME TO MTU — for excellence in microcomputing systems.

MTU
Micro Technology Unlimited
P O Box 12106
2806 Hillsborough St
Raleigh NC USA 27605
(919) 833 1458

CIRCLE 224 ON READER SERVICE CARD

A digitized photograph often demonstrated on the Apple. Shown here in close up, the picture occupies less than half the MTU-130 screen while providing the same detail as the full-screen Apple presentation.

commands. Three such libraries come with the system, the IGL (Integer Graphics Library), VGL (Virtual Graphics Library) and CIL (CODOS Interface Library). Asked why these powerful extensions to MTU Basic weren't included in the Basic itself, MTU had a reasonable answer. Since they are for specialized applications, the decision was made to free up memory space for general use by allowing them to be linked in only if needed.

IGL supports simple graphics by allowing a user to draw lines (solid or dashed according to your specifications) and make use of the light pen.

The light pen command, SLTPEN, is simple to use. It recovers the x and y coordinates of the position of the pen on the screen and sets a flag when this is accomplished. The command checks for the light for 1/60th of a second so a simple loop keeps the pen checking until it sees the light and sets the flag. Use the TONE command and you get an audible signal when the action is completed.

IGL provides the ability to LABEL drawings with textual information. A visible graphics cursor can be moved around the screen to aid in drawing by determining the x and y coordinates of a given point.

VGL is a more powerful library that includes the IGL commands and adds a few of its own. Most notable is the ability to define a WINDOW and a VIEWPORT. The WINDOW allows graphics display of data using any reference system for measuring x and y coordinates by setting their range. Scaling, in effect, can be done by the program. Any values beyond the range are clipped, as though the lines were actually being viewed through a physical window. VIEWPORT establishes that physical part of the screen where the window will exist.

The third library supplied with the computer, CIL, provides a set of CODOS disk operating commands callable from the Basic program. If the one required isn't there, SYSTEM followed by the CODOS command will make it part of the program.

For ease in machine language programming, MTU-supplied software also includes a two-pass resident assembler which accepts assembly language source programs and outputs source code and listings with error messages and a symbol table and cross reference map. It is a fast and elegant operation according to an experienced programmer who has experimented with it.

A simple repetitive pattern shows the capability of the MTU-130 for advanced graphics. This is from the demonstration program provided with the computer.

MTU-130 Technical Specifications

CPU	MOS 6502, 1 MHz
Memory	80K dynamic RAM (48K user, 16K display, 16K DOS), expandable to 256K direct addressable
Keyboard	96 keys including alphanumeric, calculator display, cursor controls, 8 user-defined keys, Interrupt/Reset
Screen	12" high-resolution green phosphor
Graphics	80-column, 25-line alphanumeric, gray scale graphics on 240 x 256 dot matrix, black and white graphics on 480 x 256 matrix
I/O	Two 8-bit parallel ports, 6522 chip (one internal port); RS-232 serial; cassette interface; video out; audio out
Sound	8-bit analog-to-digital converter, 1 watt amplifier, 3" x 5" speaker, volume control
Light Pen	Plus or minus two pixel resolution, 1/60 second digitizing speed
Language	Extended Basic interpreter loaded from disk, three libraries
DOS	Channel-Oriented Disk Operating System (CODOS 2.0)
Assembler	Two-pass assembler

Summary

One thing rare for a new machine is the total lack of critical comment I have received from other users. Pressed to say something less than laudatory, I could only come up with the complaint that on-screen editing of programs, prior to their storage on disk, is not as good as that of the PET. But few computers are. Lines in programs, for example, cannot be changed by typing over errors and hitting Return. Programs retrieved from memory, as well as text and other files, can be edited very efficiently with a resident Editor program.

In summary, the MTU-130 is a powerful machine. The cost, which no doubt puts it out of reach of the casual or first time buyer is a bargain considering the capabilities of the machine. Prices for the system, which includes the computer, monitor, CODOS, Basic and the libraries, are $3995 with one single sided disk drive, $4195 for a double sided drive, $4495 for two single sided drives, and $4995 for two double sided drives.

No matter how well designed or powerful a computer is, however, there are two key questions which must be considered when evaluating it.

Are there any bugs lurking in the machine that would make the glowing technical specifications meaningless? How much software will there be to support the computer?

Anticipating the first question MTU has carried out a testing program that may well be unique for personal computers. A group of experienced microcomputer owners across the country and in Canada, with backgrounds in such key areas as 6502 assembly language programming, graphics and computer music tested the machine for several months. They provided weekly feedback to MTU engineers. Apart from a few minor or improbable problems (simultaneously pressing the Mod, Reset and Interrupt keys would cause the system to crash) the computer received outstanding marks.

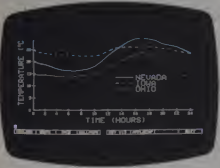
Software

Software development always presents a chicken-and-egg question. No one wants to spend time writing first rate programs unless a large market exists, but the market won't develop unless there is software support for the computer.

Some impressive software, music composition and graphics packages, for example, are already available from MTU's earlier projects. Software development houses are also working on supporting programs, according to David Cox, president of MTU. Among the projects is a compiler for COMAL, a structured programming language that has gained popularity in Europe for business applications.

Another project is rumored to be a Visicalc-like program with expanded applications and more flexible formats.

One feature of the MTU-130 should attract software vendors—a unique software protection feature that allows authorized users to make copies but helps protect software from piracy. MTU would program a unique user number into systems needed for a user, such as high school or university, who planned to purchase software on a use license basis. Only those systems with the proper user number would be able to use the software.



A simple graph drawn with the MTU-130 graphics software enhancement to Basic.

Similarly, a unique vendor number can be assigned to companies buying directly from MTU and selling a customized system to a specific market.

Two user groups have already been formed for the MTU-130, one by MTU itself which plans a quarterly newsletter, which will be free to MTU owners for the first year. The other group is an independent one formed by Jack Brown of Saturn Software Ltd., Delta, BC V4C 5Y9 Canada. Jack is also developing a version of Forth for the machine.

The MTU-130 is an exciting machine which has an exciting future. □

Inexpensive Backup for TRS-80 Disks

David A. Hinton

creative computing
SOFTWARE PROFILE

Name: Dumpload
Type: Disk-to-tape backup utility
System: Model I TRS-80 Disk drive
Format: Disk or Tape
Summary: Valuable tool for backing up disk libraries.
Price: $16.95 on tape, $19.95 on disk
Manufacturer:
Complete Computer Services
8188 Heather Dr
Newburgh IN 47630

Many utility programs have been written and sold for the Model I TRS-80. Most of these are well-thought-out pieces of software that fill the programmer's needs, and a few of them can even be classified as excellent. Dumpload, created for users of disk-based Model I systems, is one of the newest entries into the utility software marketplace and it, too, deserves to be called "excellent."

Any experienced programmer knows the importance of making backups of the frequently used and valuable disks in his library. Some people, myself included, don't feel safe unless they have backups of their entire library. As the program library grows, having a duplicate set of disks soon becomes a very expensive practice. Some programmers resort to using less costly cassettes to make backup copies of seldom used programs, but this is usually a tedious process and does not work well for all types of software.

Any experienced programmer knows the importance of making backups.

Getting Started

Dumpload allows you to make cassette backups of your disk library—but without the usual hassle. It can copy anything and everything (e.g., DOS, data, word processor files, Basic, Fortran, Pascal, assembly code, object code, etc.). The command options allow the user to copy only a certain track, a group of selected tracks or the entire floppy. When making a complete disk backup to cassette, the process is fully automatic even for one-drive users. No more swapping disks in and out of the drive. Just load the desired floppy, load a blank tape, initialize Dumpload and walk away.

This utility can be purchased on cassette or disk. I ordered the cassette version and received it in about 10 days. The instructions which accompany Dumpload cover the use of both the tape and disk versions. Procedures are included to place the tape version on a disk for easier access or copy the disk version to another disk. Dumpload will work with TRSDOS 2.3 or NEWDOS80 without modification.

A Choice of Speeds

When Dumpload is loaded, it begins by asking if you want to use the standard 500 baud tape speed. What's this, a choice? That's right, the program is capable of backing up a disk to tape at the standard Radio Shack cassette speed of 500 baud or at an optional high speed of about 1800 baud. At 1800 baud, a 40-track disk can be saved on less than 10 minutes of tape.

The written instructions point out that you will have to run at 500 baud if your keyboard contains the Radio Shack XRS-2 cassette modification. If you have this modification, indicated by a keyboard serial number ending with a dash one (-1), don't give up on using the high speed. Another set of instructions included in the Dumpload package gives all the information needed to install a bypass switch which will allow you to enable and disable the XRS-2 modification at will. (This is the same modification required to use B17 sold by ABS Suppliers).

David A. Hinton, R.R. 3, Box 44B, Rockport, IN 47635

Bright New Stars From Sirius Software

DARK FOREST: The age was dark, the forest was dark and the Gruds were everywhere Three of your kingdom's most valued treasures are missing and you must comb the countryside to recover them. An adventurous game of strategy and conquest for up to six players.

BEER RUN: Is a light-headed game of suspense. Can you catch the Artesians before the Guzzlers and Bouncers catch you? Enter the Sirius Building and find out!!

COMPUTER FOOSBALL. A fast action electronic version of this favorite table game. You and up to three friends can play this hires game using the new JOYPORT.

Coming Attractions . . .

AUDEX: Create sounds, shape them, edit them and play them back in your own programs. The only tools required are your Apple II keyboard, screen and an optional tape player.

BORG: Can you out run and out shoot the dragon's henchmen? Watch out for the wrath of Borg if you do!

LeGREEDY: So you always wanted to play the real estate game but couldn't afford to Find out how much of LeGreedy is in you.

JOYPORT: Expand the Apple II game paddle port to handle up to four Apple type game paddles and two Atari joysticks. Four Apple game paddles can be read sequentially under software control. Comes in attractive impact resistant case.

HADRON: You are a fighter patrol in space. You are trying to follow an enemy drone ship back to its home base. To get there you must successfully negotiate a dense meteor field and duck fire from the base. Exciting 3-D play.

OUTPOST: Alone in a space outpost you've been attacked from all sides by enemy fighters. You must use your propulsion units and shields to ward off the attackers. A fast reflex action game.

Sirius Software, Inc.

10364 Rockingham Drive Sacramento, California 95827

All products are designed for use with Apple II computers.

CIRCLE 238 ON READER SERVICE CARD

If you prefer not to mount a switch in your keyboard case or you don't have a switch immediately available, the instructions also describe how to disable the XRS-2 circuit temporarily. Neither of these modifications requires any circuit board traces be cut.

Easy to Use

After the tape baud rate question is answered, an introductory message and a menu of three options are displayed on the screen.

Option 1 dumps the disk, which must be in drive 0, to tape. All you have to do is load a blank cassette, set the recorder for record mode and answer the questions displayed on the screen. You are first asked the starting track number.

You may start with any track you desire. Pressing "enter" without giving a value defaults to an answer of 0.

You are then asked, "How many tracks on this diskette?" Pressing "enter" gives a default answer of 35. If your disk contains more than 35 tracks, or you only want to dump a few tracks, you can indicate this by typing "40" or the number of the last track you want to dump.

My article was recovered safe and sound in about one minute, thanks to Dumpload.

Option 2 will restore the Dumpload tape to a disk. All you need to do is load the recorded tape in the cassette recorder, set it for play mode and load any formatted disk in drive 0. The tape contents will then be placed on the disk with each track being restored to its original position without any further action from you. If a checksum error is encountered, the recorder will stop. You can then choose to rewind the tape to the blank area preceding that particular track record and try Option 2 again, restore the track to disk with the checksum error or discontinue the restore attempt.

Option 3 permits you to verify that you have made a good tape. It will read the tape records, looking for checksum errors, but will not write to the disk.

Options 4 and 5, which allow you to exit Dumpload, are mentioned in the written instructions but are not displayed on the screen. Option 4 will return you to DOS Ready, and Option 5 will reboot the system.

How It Works

Dumpload creates a record or series of records on the cassette tape with each record constituting one disk track. The records are separated from each other by a blank area of tape which enables you to position the cassette at the beginning of any desired track record manually. A checksum value is computed for each disk track as it is processed before it is sent to the recorder. This checksum value and the track number become part of the actual record stored on the tape. Therefore, when a track record is being restored from tape, the computer can verify that the tape record is good and where that particular track record is to go on the diskette.

A Personal Experience

I wrote this article using my TRS-80 as a word processor. The article was about half finished, when the power company provided me with a two-second interruption in service.

My first thought was to congratulate myself for having just saved a current copy of my file to floppy. I then rebooted my disk. The drive motor clicked into action but nothing happened. The motor timed-out and stopped. I tried again and got the same results.

That's when I had my second thought: "Oh no, it's gone!" I inserted a different disk, booted, and everything worked perfectly. "Well, that's it. I have lost my article and all the other files on that disk, I thought. But wait, it acts like track zero is glitched and that might be the only problem." Since Dumpload can copy and restore a single track, I figured I might as well give it a try.

I loaded Dumpload, inserted a good disk into the drive, and a blank cassette into the recorder and dumped track 0 to tape. I rewound the tape, inserted the glitched disk into the drive, and loaded track 0 on the disk. I then booted the disk and was back in business again. My article, along with all my other files, was recovered safe and sound in about one minute, thanks to Dumpload.

Conclusion

Dumpload is highly interactive, and, therefore, is easy to use, even for the beginner. Once an option to save or restore a disk is chosen, it is as fully automatic and convenient as making a backup using two floppy drives. I have found it to be a very simple, inexpensive way to protect my large library of disks.

Dumpload is available from Complete Computer Services, 8188 Heather Dr., Newburgh, IN 47630. It is sold on cassette for $16.95 or on disk for $19.95. If you send them a disk containing TRSDOS 2.3 or NEWDOS80, they will install Dumpload on your disk, return it and charge you only $15.95. □

Develop Your Own Computer Curriculum With Radio Shack's TRS-80® Authoring Systems

Radio Shack makes it easy to custom-design your own computer assisted instruction materials using our TRS-80 authoring systems!

You Don't Need Programming Experience! The new TRS-80 AUTHOR I represents a unique "screen-oriented" approach to courseware design. Using your own teaching materials as a guide, you create one screen display at a time— complete with subject explanations, study hints, graphics, and questions for students to answer. And AUTHOR I even keeps track of each response. TRS-80 AUTHOR I is the ideal way to begin creating CAI materials. Available January, 1982 for only $149.95.

Write Your Own Sophisticated Courseware! Using Radio Shack's TRS-80 PILOT Plus, you tell the computer exactly what text and graphics to display and when to wait for a student's response. A comprehensive set of simple commands make TRS-80 PILOT Plus a very flexible authoring system. Now available for just $79.95.

Test Your Students by Computer, Too! Radio Shack's QUICK QUIZ lets you create multiple-choice tests of up to 40 questions with four answer choices per question. You can test up to fifty students and store their scores for later review. Available now for only $29.95.

All It Takes Is a TRS-80! These Radio Shack courseware authoring systems require a 32K TRS-80 Model I or Model III disk system

Need More Information? Visit your nearest Radio Shack store, dealer, or Computer Center — or mail the coupon today!

Radio Shack®

The biggest name in little computers™

A DIVISION OF TANDY CORPORATION

6100 Stores and Dealers and
185 Computer Centers Nationwide

Retail prices may vary at individual stores and dealers.

Send me your free TRS-80 Computer Catalog.

NAME ____________

SCHOOL ____________

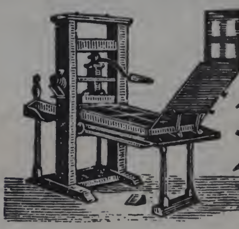
ADDRESS ____________

CITY ____________ STATE ______ ZIP ______

Radio Shack Education Division, Dept. 82-A-334
1300 One Tandy Center, Fort Worth, Texas 76102

CIRCLE 208 ON READER SERVICE CARD

creative computing equipment evaluation



Re: Print

David Lubar

Printers. They haunt me at night, chasing me on tractor rollers, trying to snare me with lassos of ribbon, shouting "Review me!" There are so many new ones. But it isn't all a horror show. A good printer is a thing of beauty, worth using, worth reviewing. Two front runners caught up with me this month. Their stories follow.

Cost Effective

The Olympia 100KRO is a printer to ponder. Doubling as an office typewriter, producing letter-quality printout with a daisy wheel, it costs an unbelievably low $1690. The only tradeoff is speed. At a top speed of 300 baud, with some data required for signals and other information, the printer can do about 16 characters per second at top speed. Add to this the unidirectional nature of the printing and you don't exactly get a racing model. But at that price, who is going to complain?

While someone went on quest for a serial interface card for the Apple, I tried the Olympia as a typewriter. In some subjective way that can't be explained on paper, it just felt right. It is a large unit, with scads of extra features. One that immediately won my heart was an eight-character memory that works with the correction key. With each stroke of this key, an errant letter is removed. Great. A smart repeat key repeats whatever character was last typed. Index and reverse index keys repeat automatically when held, advancing or retreating the paper. The wide carriage with friction feed takes anything fed to it, and a control switch allows for carbon copies. Margins, once set, are remembered for up to 90 hours with the power off. Any changes in settings are reinforced with a beep, letting you know the Olympia has heard you. Taking the Olympia beyond the smart-typewriter class, a serial port in the rear of the machine allows communication with any computer capable of serial communication.

Once an interface card appeared, the real test began. First, the Olympia produced a mixed-case file from Apple Writer. The next test was short program listing. Everything seemed fine until I took a close look at the listing. The greater-than and less-than signs had been replaced with other symbols. An examination of the type wheel confirmed the absence of these characters. Fortunately, a call to Olympia produced the hoped-for answer. An ASCII wheel is available, but it was currently on back order. Although this prevented a test of the ASCII wheel for now, Olympia seems determined to grab a share of the computer market, and the scarcity should be short lived. Beyond this small problem, all was fine (see Figure 1 for print samples). With a California Computer Systems serial interface, the user just plugs in both ends of a serial cable (not supplied), and the printer is ready to run. Some interfaces require a special wiring jumper. Again, Olympia provided the required information, showing evidence of good customer support.

The printer is accompanied by a manual that covers the typewriter aspect, and a few spec sheets on the interface which might bring joy to the hearts of engineers but did little for me. Fortunately, the specs aren't needed unless one wishes to create some sort of special interface or other bizarre project.

Ribbons come in cartridge form, with carbon and fabric being available, and they just snap right in. A separate spool holds the correction ribbon. Type wheels snap in using a special holder. If you need letter-quality printout and can live with a slow print speed, the Olympia 100KRO is definitely worth checking out.

Olympia is backed by a large dealer network, and many stationery stores carry Olympia supplies. Since it existed as a typewriter before the introduction of the interface, the scarcity of supplies that plagues many printers shouldn't be a problem. If you plan to use it for program listings, make sure an ASCII wheel is available from your dealer. If your main application is word processing, it's ready to go as is. Just add a serial cable and an interface if your computer doesn't have one, then let the beauty loose.

The Olympia 100KRO lists for $1690. Their address is Olympia USA, Inc., Box 22, Somerville, NJ 08876.

CIRCLE 252 ON READER SERVICE CARD

```
The Olympia produces letter-quality printout.  It also
functions as a typewriter.  This example was done with
a carbon ribbon and the standard typewheel.
```

Figure 1. A sample of what the Olympia has to offer.

Connect the Dots

Rising from the ashes of the 737, the Centronics 739-1 is a dot matrix printer with some nice features. It takes fanfold, roll, or single sheet paper, prints at up to 100 characters per second, uses a parallel interface, and has switch-selectable character sets for six languages. The baud rate is also switch selectable, and can range from 50 to 19200. We tested it on a TRS-80, but it should work on any system capable of parallel communication.

Let's get the few negative aspects out of the way first. The design of the paper feed is such that fanfold paper, if left unattended, will curl back to the rear as it emerges and re-enter the feed area. This can cause a rather severe jam.

Paper loading requires removal of the top. While this just lifts off, it can be a bit of a nuisance. Also, some desirable printing combinations are not supported. For instance, Centronics does not recommend switching from normal monospaced characters to other characters in the middle of a line. This precludes such possibilities as printing a condensed superscript. Finally, while the printer produces up to 100 characters per second, it prints unidirectionally, thus losing time while the printhead returns to the left margin.

The above complaints are all minor, and are compensated for by nice print quality with descenders, a selection of print sizes, and graphics capability. Basically, three types of print are available: normal (ten characters per inch), condensed (16.7 cpi), and proportional. Vertical spacing is six lines per inch. Each of the three can also be printed in elongated form. Samples of these can be found in Figure 2. The 739 powers up with the normal characters. Other styles are selected through escape codes. A new code is required for each line of elongated characters. Other user controls include underlined text and half line feeds in forward and reverse directions.

```
Normal printout at 10 characters per inch
Proportional normal characters
Elongated normal (monospaced)
These characters are condensed
This is condensed elongated
Here is condensed proportional
```

Figure 2. A selection from the Centronics cast of characters.

While right justification is possible using proportional spacing, it requires some complex programming on the part of the user. From one to six dot spaces can be sent using an escape sequence, but the spacing algorithm must be programmed by the user.

Graphics are produced using codes that control six vertical pins. Once the graphics escape sequence is sent, any command to print CHR$(N), where N is in the range from 32 to 95, will produce one of 64 different vertical dot patterns. Graphics printing, with support of such codes as line feed and carriage return, continues until a new escape sequence is sent. Each line can contain up to 594 dots, producing a maximum row length of eight inches. Through user programming, a good graphics dump can be produced. Even systems without screen graphics can produce paper graphics, though the method is up to the user. With the right software driver, it would even be possible to use the graphics for special character sets. In essence, this would be a software character generator that intercepted each letter and sent the proper series of graphics commands.

In general, it seems that while the Centronics functions perfectly well without any user effort, it should be possible, with a bit of work, to get many extras from the printer. For instance, superscripts could be printed by issuing a half reverse line feed (though, as mentioned above, a condensed superscript cannot be used in a line of normal characters).

All things considered, the Centronics 739 is a worthy printer for graphics, listings, in-house letters, and any other applications that don't require fully formed characters. The printer is priced at $995. Centronics Data Computer Corporation is located in Hudson, NH 03051. □

CIRCLE 253 ON READER SERVICE CARD

Centronics: A Look At the Future

Interview with President John Tincler

David Ahl and Betsy Staples

We know that our readers are interested in printers. In fact, in response to our last reader survey, 59% said that a printer was the next peripheral on their shopping list.

Centronics Data Computer Corp. is one of the largest and most visible manufacturers of printers, selling not only under its own brand name, but also supplying larger computer manufacturers such as Radio Shack and Atari.

Yet, in recent months, the media have carried tales of slipping profits, and last summer, *Creative Computing* received letters from several readers who were disgruntled enough to write us recounting tales of woefully inadequate service on their Centronics printers. We were curious, so we called then newly-installed president John Tincler for some answers.

The Mistakes

Mr. Tincler, formerly executive vice president of operations for Centronics, was named to the presidency of the company in May of 1981. When asked to what he attributed the reported financial losses, he cited "an accumulation of things that have occurred over a period of years, specifically some inventory problems."

Among steps being taken to correct the problem, he named "the recognition that we should have completely phased out the 100, 300 and 500 series printers," and that Centronics's initial offering in the small printer market, the 730, "was being replaced by the 737 and 739."

He hastened to add, however, that reserves have been established to allow the company to continue to supply parts for the discontinued model.

Another area in which Centronics had been losing money was its sales to foreign markets. Because of the sudden increase in the strength of the dollar overseas, many companies in similar positions have experienced losses in translating prices from one currency to another.

"We hope that the inventory problem is behind us and we look to the future. As far as translation losses are concerned, we are in a position to adjust our prices, and we are taking steps to prevent this from continuing," said Mr. Tincler.

The Market

Is the 730 series of printers being received by the market as well as he expected?

Mr. Tincler believes that "Centronics built the market, and has certainly gained a tremendous share of it. There is opportunity there and good market acceptance of the product.

"Unfortunately, the Japanese came in very strongly, and are intent on capturing a large part of the market. They have already made inroads."

How does he see the continuing impact of such Japanese printers as Epson and Oki?

"From all reports, the Japanese product is reliable, and certainly cost-effective. As a company, we are not in a position to compete on price. If the price level in that market is driven down, which seems to be what is happening, we will have to find a more sophisticated user, one who is interested in the functional capacity of the product as well as the price and our ability to support it.

"I think our edge—being able to provide features which we think are important to users over the long haul and at the same time having the total support capabilities to support these products—is much better than the Japanese can ever expect to have."

Support and Service

Since he mentioned support, we asked Mr. Tincler about the service Centronics offers: Is the company prepared to supply the service that an end user requires, or do they expect dealers to provide it?

In response, he cited the company's new Dealer Support Program, designed to enable dealers of Centronics products to provide repair services for the 737 and 739 at their own facilities.

> ***"Centronics built the market."***

Under this plan, a dealer may choose either of two options to become an "Authorized Sales and Service Center." Option I allows the dealer to service the printers himself and to perform module assembly exchange by purchasing a complete package which includes all the necessary materials to repair the machines. Centronics then repairs the modules at a fixed rate. The dealer must be certified to participate in this part of the program.

A dealer taking advantage of Option II collects printers from his customers and then contacts Centronics to make the necessary repairs.

Since the announcement of this program, *Creative Computing* has not received any more complaints about Centronics service, so it may be working.

Speaking, again, of support, what about mail order? What does Mr. Tincler recommend for the computer owner in Indiana who buys a printer from a mail order vendor in California and then finds it needs service?

"I think he has several options. He obviously gets a warranty to start with, no matter where he bought the product. Beyond that, since it is a low-priced item, he is obviously not going to expect a service man to come and service the thing. He has a choice of taking it to the nearest Centronics walk-in service location or sending it to that location for repair."

The Future

We asked about the QuietWriter which Centronics had announced earlier and then "let slip."

" 'Slip' may be the wrong word," he replied. "I think we are going to be more conservative in our approach to pre-announcing things in the future, because it is simply not to our advantage to do it.

As for the QuietWriter, "there was interest being generated in the product as far back as two years ago, but the product is still in development—and coming along quite well," he added.

"The machine will employ a whole new technology for putting marks on the paper; it will not be a dot matrix device. It will provide fully formed characters and will still be extremely quiet. We think it is going to have multiple capabilities, being able to work in the word processing enviroment, function as a communications device, and, in time, to be an intelligent workstation."

What about pricing? Will it be in the same range as a Diablo, Qume or Spin-Writer, or lower? Mr. Tincler thinks "the pricing will be dictated by the market and the applications with which we go."

He thinks that the lower end printers, like the 739, have a future as the answer to the desire of many users to upgrade their hardware. "People will buy an entry level product that may have few capabilities. They buy it to become acclimated, as a tool to help them become familiar with the type of product while they look around for the additional capabilities and features they want.

"Once they understand the product, they know its value and may be willing to pay more for it. That's where we come in."

When asked for a long-range forecast for Centronics, Mr. Tincler said that "in the long run, it is still a strong, healthy company with many assets. It is still the leading supplier of printers, and with the new products that are on the horizon, the company will take off and grow again very soon." □

THE BACKBONE OF YOUR SYSTEM

The Heath/Zenith 19 Smart Video Terminal gives you all the important professional features, all for under $700.* You get the flexibility you need for high-speed data entry, editing, inquiry and transaction processing. It's designed to be the backbone of your system with heavy-duty features that withstand the rigors of daily use.

Standard RS-232C interfacing makes the 19 compatible with DEC VT-52 and most computer systems. And with the 19, you get the friendly advice and expert service that makes Heath/Zenith a strong partner for you.

Pick the store nearest you from the list at left. And stop in today for a demonstration of the Heath/Zenith 19 Smart Video Terminal. If you can't get to a store, send $1.00 for the latest Heathkit® Catalog and the new Zenith Data Systems Catalog of assembled commercial computers. Write Heath Co., Dept. 035-864, Benton Harbor, MI 49022.

HEATH/ZENITH

Your strong partner

*In kit form, F.O.B. Benton Harbor, MI. Also available completely assembled at $995. Prices and specifications are subject to change without notice.

CP-202A

Project Nebula

STAR RAIDERS for the Color Computer

Owen Linzmayer

creative computing
SOFTWARE PROFILE

Name: Project Nebula
Type: Strategy/Arcade game
System: TRS-80 Color Computer, joysticks, 4K RAM
Format: Program Rom-Pak
Language: Machine
Summary: Fair Color Computer version of Star Raiders
Price: $39.95 catalog # 26-3063
Manufacturer:
Radio Shack
1300 One Tandy Center
Fort Worth, TX 76102

Project Nebula is a Color Computer version of Atari Star Raiders, a game in which the player controls a lone fighter in space, searching and destroying alien ships in real time.

The object of the game is to defend earth from the evil forces of Zykon. If you are successful in your mission to rid the galaxy of enemy ships, planet Earth is saved. If not, Earth is doomed to become a slave-planet of Lord Scylla.

After inserting the Rom-Pak, you choose among the four game modes. These are Target Shoot, Target Shoot with speed, Star Commander and Advanced Star Commander.

The first two modes are exactly what their names imply: target shoots. They are helpful for practice, to become familiar with your ship's controls and how the enemy fighters act.

Star Commander mode offers a complex mission in which you are aided with a long-range sensor and hyperspace engines to propel your ship into other sectors. The long-range sensor displays the 45 sectors of your galaxy in a lo-res 9 x 5 matrix.

Each sector may contain either a friendly space station, used for refueling and repairing damage, or up to four enemy ships. The only difference between the two Star Commander modes is that in the Advanced one your ship may be damaged. There are ten difficulty levels for each game mode.

The game screen is divided into two displays. The upper portion is a hi-res yellow-on-red graphics display of a cockpit view. It is through this window that you see the stars drift by and enemy fighters swoop in for the kill.

The lower third of the screen is your instrument panel. Located on this control console are two short-range sensors; one frontal, the other rear. These two grids help in determining the location of other objects in the sector relative to your ship. Your fuel gauge is located between the two sensors. Being shot, entering hyperspace and firing your lasers all use up fuel and when the gas is gone, you lose. Directly above the fuel gauge is some sort of scanning device which does nothing but slow down the computer clock speed.

You control your fighters by steering with the right joystick. The ship responds to the joystick like an old plane with a control stick. You can shoot by pressing either joystick button. If you have chosen a mode in which you can control speed, the left joystick acts as a throttle. This is confusing as well as awkward, and play would be much easier if speed were controlled on the keyboard.

Project Nebula has strong points as well as weak areas. On the positive side are the life-like actions of the enemy ships. As the distance between you and the enemy rapidly decreases they become larger and more detailed. Unlike other space games, the attackers move around, trying to evade your shots while attempting to cripple your ship with devastating rocket blasts. Another plus for this program are the variations of game modes and skill levels which make it a hard game to master.

Among the flaws which detract from the general appeal of the game are the obnoxious "sound effects." The static that crackles from the TV speaker is annoying and distracting. Fortunately this problem is easily remedied by turning down the volume control on the set.

The only other major complaint concerns the documentation, which leaves something to be desired. The instructions are extremely brief, and so vague are the docking instructions that I have yet to do so successfully.

On the whole, Project Nebula is an adequate program. The game is good—not great—and has a reasonable amount of entertainment value. Before plunking down the money for the Rom-Pak, ask your Radio Shack dealer for a demonstration to see if the game is right for you. □

The Axiom EX-850 Video Printer

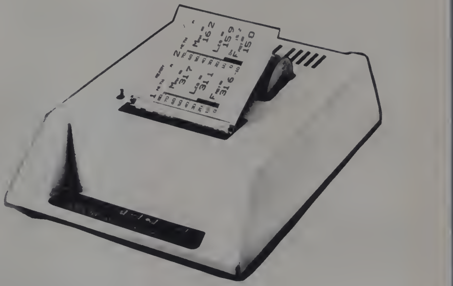
creative computing equipment evaluation

Silk Screen

David Lubar

In the last few months, many articles in *Creative* have been graced with an abundance of computer screen pictures. While we've always used screen illustrations when appropriate, the number has increased in the last several issues. Is it a change in format? Is it an urge for art? None of the above. The truth must finally come out. We've got a new toy and we can't stop playing with it. The Axiom EX-850 Video-Printer is an answer to many prayers.

If you've ever waited for a dot-matrix screen dump, or tried to get a good reproduction of a text page, you know what I mean. In contrast, the Axiom produces an image from the video signal generated by a computer. The magic of this is that whatever goes to the screen can be put on paper, as long as the image can be frozen for a few seconds. Any text face, any graphics, any image whatsoever can be put on paper. The only limitation is that the image will be in black and white. This can cause a slight problem when reproducing color graphics since certain background colors that look fine on a monitor may appear grainy when the pixel configuration is reduced to black and white.



The Axiom EX-850 VideoPrinter.

Double-width picture of the Apple Hi-res screen.

To interface with computers, the Axiom contains two input ports. There is a BNC connector for composite video (most home computers produce this sort of signal), and a DIN socket for separate video and sync signals. You first have to make or buy a cable to match the signal and connectors of your computer. In the case of the BNC composite video connection, making a cable is fairly simple. If you need the DIN interface, the wiring is more complex, though it is thoroughly explained in the manual. (Axiom currently sells cables for the Apple, PET and TRS-80.)

Since computers tend to vary in the quality of the signals they send, a series of adjustments is necessary to get the ideal image. This is accomplished with a combination of dip switches and trimmers. The dip switches allow for a selection of the number of raster scan lines. This can range from 508 to 988, making the Axiom fluent in both American and European systems. Other dip switches allow the user to select a starting point for the printout, thus blanking out raster lines above a certain point. The factory settings on the Axiom worked well on the computers we used.

The three trimmers control horizontal hold, slice level, and video gain. These will have to be adjusted for any specific system. Fortunately, the trimmers can be adjusted while a printout is being produced, thus allowing a real-time check for the correct setting.

Once the settings have been selected, the Axiom is ready to go. It takes aluminized roll paper, available from Axiom and also from a variety of supply distributors. For some reason, the process of printing on this paper produces an odor of chlorine, reminiscent of the YMCA the day after they fill the pool, but you get used to it.

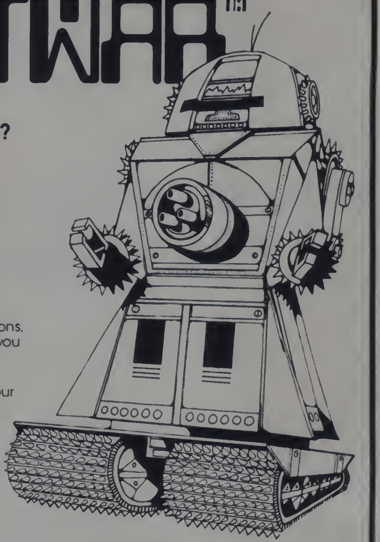
The front panel has four switches. The print switch, as the name suggests, starts the printout process. A paper feed steps the paper forward a line at a time. The reverse switch produces a negative of the screen image. This is useful since a set pixel is white on a monitor, but black when printed out (while this may seem strange, it does make sense: a monitor displays a set pixel by turning on a white dot on a black screen; a printer displays the same pixel by making a black mark on white paper). The fourth switch selects normal or double resolution. In double resolution, twice the number of horizontal points are printed, doubling the width of the printout. A normal printout takes just over thirteen seconds, a double-width picture takes 27 seconds.

So far, we've used the Axiom with the Apple and Atari. It worked well in both cases, though some background colors did produce the patterned effect mentioned above. If you need screen images with any regularity, and have no qualms about aluminized paper, the Axiom EX-850 VideoPrinter might be the answer.

The EX-850 VideoPrinter costs $1595. Axiom is located at 1014 Griswold Ave., San Fernando, CA 91340.

CIRCLE 254 ON READER SERVICE CARD

ROBOTWAR™



Do you like thinking games?
Do you like fast-action spectator sports?
Want to have fun learning more about computers and programming?
Think you can program better than your friends?

If you answered YES to any of these questions, RobotWar is for you. A game of the future you can play today . . .

Create a robot by writing a special Battle Language program. This program gives your robot its unique fighting personality.

Debug your robot on the Test Bench, a cybernetic window into your Robot's mind. Is it really checking its damage level to consider evasive action? Does it increment its radar and lasar cannon aim while searching for enemies? If all checks out, it's on to . . .

The Battlefield . . . Challenge up to four competitors from the Robot Ready Room on your disk. Your robot will meet them in the arena where you have a bird's eye view of the mechanical carnage. Robots scurry about, radars flash, lasar shots fly and explode . . . and only one survives. You're the witness to a futuristic Gladiator spectacle.

Available on disk for the Apple computer with 48K and Applesoft ROM, at computer stores everywhere.

from the leader in quality software

MUSE SOFTWARE™

347 N. CHARLES STREET
BALTIMORE, MD 21201
(301) 659-7212

Call or write for information and the name of your nearest **MUSE** dealer

CIRCLE 223 ON READER SERVICE CARD

New Graphics Horizons for the PET

Carl Strobel

Each time I tell myself that I've tried everything my computer has to offer—games, data processing applications, machine language programming, word processing—another door opens and I get a glimpse of a totally new horizon.

The latest world to conquer, and the most fascinating by far, is that of high resolution graphics. The possibilities seem almost as limitless as those which opened up when I first sat down with my brand new personal computer.

I've created a three-dimensional representation of my house and viewed it from any number of positions (including an underground worm's eye view), tracked satellites across a map of the world, designed a kitchen by moving cabinets and appliances around a three-dimensional room layout, created computer art and written in Japanese, and still I've just scratched the surface. There is a myriad of other uses, educational, business, personal and just plain fun (how about a cockpit view of landing a jet aboard an aircraft carrier, or a periscope attack on a merchant convoy).

The key to providing my PET with a relatively low cost, yet versatile high resolution graphics capability was the superbly conceived and engineered Visible Memory produced by Micro Technology Unlimited, 2806 Hillsboro St., Raleigh, NC 27605.

Carl Strobel, 1716 Tarleton Way, Crofton, MD 21114.

How It Works

The Visible Memory is based on a beautifully simple concept. To best understand how it works, let's take a quick look at the way graphics are created on the PET screen (the same principles generally apply to other microcomputers).

There are two methods commonly used to generate graphics on a computer screen. In vector graphics, found in more expensive computers, the desired shape is drawn on the face of the CRT. To make a 2" line slanting at a 17-degree angle, the electron beam is turned on at the starting point of the line and makes a trace two inches across the face of the CRT at a 17-degree angle.

Raster graphics, used in most personal computers, is a little less direct. The electron beam moves in horizontal sweeps across the screen and is turned on and off in pulses, effectively making individual dots of light on the screen. The letter "T," for example is formed by turning the beam on for several consecutive pulses to form the crossbar, then adding the necessary dot in each of the next few horizontal sweeps to form the stem of the letter.

The raster method, while it does have some advantages, obviously produces a coarser picture. In practice, it also means the user is generally limited to those graphics symbols designed into the computer.

The PET screen is divided into 1000 blocks, 25 rows of 40 blocks each, in which a letter, number or graphics symbol can be displayed. Each block is composed

Figure 1. The Japanese character "Nihongo," meaning "Japanese language," as drawn by the Visible Memory. Any non-Roman alphabet can be produced.

Figure 2. A simple perspective drawing of a pyramid.

Figure 3. A perspective view (with hidden lines removed) of the author's house, as viewed from below—a worm's eye view.

of 64 potential dots of light called pixels, arranged in an 8 x 8 square. The pixels within a block are lit up in various combinations by the raster method described above to form any of the predefined symbols chosen by the user or designated by his program. In practice, the lefthand column and bottom row of pixels in each block are kept dark when forming alphanumeric characters in order to provide spacing between characters and between lines. But these pixels are available to form other symbols.

The graphic set of the PET is impressive, but it is also limited. In perspective drawings, for example, you can only create lines that are horizontal, vertical or at a 45-degree angle. Some clever art work has been accomplished using the graphics set (for example, the baseball players in Karl Savon's Batter Up! and the animated cartoons in *Cursor* magazine), but realistic or detailed drawings are not possible.

Consider, however, what would happen if you could light up any pixel you wished. You could not only draw lines at various angles to display objects in realistic perspective, but you could create any shape on the screen that you wanted—a map of Australia or the Chinese characters for "martini."

Enter the Visible Memory. Each bit in its 8K bytes of memory controls one pixel on the screen. Store a value of 1 in the bit and the pixel is turned on; a value of 0 keeps the pixel dark. The VM thus gives the PET owner 64,000 possible points of light with which to draw. They are arranged in 200 rows of 320 points each. The VM also includes several other very clever features which I will discuss later.

The key to the operation of the VM is an on-board graphic video generator which uses two of the inputs from the PET video display logic and adds a signal of its own. The PET generates vertical and horizontal drive signals used by the sweep circuitry

Figure 4. Flying a PET onto a carrier deck. The view is from a point 200' aft and about 50' above the flight deck.

in the monitor to control the movement of the electron beam across the face of the CRT. The PET also generates a display signal which turns the beam on and off to create graphics characters in the manner described above.

The VM video generator synchronizes itself with the two drive signals from the PET and creates its own video display signal which turns the beam on and off as directed by the graphics software, giving the user the ability to light individual pixels. Moreover, through a simple POKE command the user can select either PET video or VM video or overlay the two.

Visible Memory, continued...

Figure 5. A closeup of the VM board and interface.

The overlay capability has been added to the latest version of the VM and gives the user added flexibility by allowing the PET alphanumerics set to be used with VM graphics. One practical application is to display place names on a VM-generated map at the user's request. A handy feature for teaching geography.

Another POKE command blanks the screen without affecting the PET or VM graphics in memory. This makes possible animation and other striking visual effects.

Additional Features

As mentioned earlier, the VM offers several other highly useful features not directly related to graphics. The board has five ROM sockets accessible by software command to allow use of the growing number of ROM programs, such as the Programmer's Toolkit and the Commodore Word Processor. The board also contains a light pen register (you supply the IC's) for additional flexibility in expanding your system. The comprehensive VM manual tells all you need to know to hook up the light pen and write the software necessary for its operation.

The ROMs, the visible memory and a KIM bus are all accessed through an enable control register using a POKE command. By setting the appropriate bit in the register, any of the devices may be made available as needed. It all sounds much more complicated than it really is; a chart in the VM manual explains what decimal value to POKE into the address in order to turn on the various devices. Jumpers are also supplied to allow the user to enable some of the devices at power-up.

The KIM bus, incidentally, allows the addition of other Micro Technology products such as memory expansion and a disk controller. Another Visible Memory can be added to provide gray scale graphics on an external monitor, using the bus.

But the one capability which made the VM cost effective for me was the ability to use its 8K of memory as additional RAM when not in the graphics mode.

This feature also gave me the only problem I have had with the VM. Initially I couldn't get my PET to recognize the existence of the additional 8K of RAM even though the VM worked perfectly in generating graphics. A little reflection and study of the VM manual showed that the unit as shipped had three ROM sockets enabled when the PET's power was turned on. The visible memory was then enabled by a POKE command to the enable control register. A quick change of jumpers to enable the memory at power-up solved the problem.

Installation

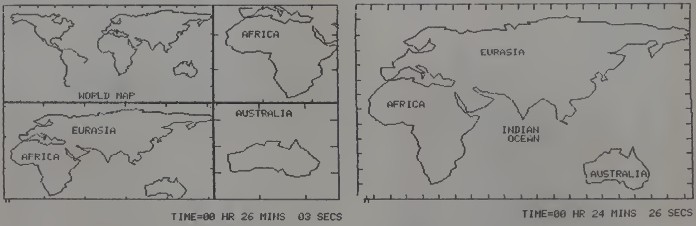
Installation of the VM is simple—and I speak as one who panics at the mere thought of opening the PET cabinet, much less touching anything inside.

The unit has two major components, the visible memory board itself and a connector board, along with the necessary cables. Two different types of connector boards are available to accomodate the varieties of PETs which have been produced.

The clear, step-by-step instructions provided in the manual give confidence to a non-hardware type such as myself. The connector board is plugged into the PET memory expansion connectors, three wires from the connector board are soldered to the large power diodes on the main logic board of the PET, the visible memory board is attached by cable to the connector board, another cable is plugged into the monitor circuitry of the PET, and the system is ready. The whole operation, including triple checking each step (I said I was cowardly about the inside of the PET), took 10 minutes. Brackets are available for mounting the VM inside the computer cabinet or the unit can be put in an external case.

Figure 6. The VM attached to the author's PET. The board can be mounted inside the computer chassis or protected in an external cabinet.

CIRCLE 285 ON READER SERVICE CARD



Figures 7 and 8. High resolution graphics printouts produced by a Commodore printer using a screen dump routine. The times show the amount of time required to print the contents of the screen—slow but effective.

The manual explains how to check each step of the installation, and a diagnostic program is included to verify proper operation of the memory when installation is finished.

Documentation

Technical documentation is excellent. There is a full description of the principles of operation, with schematics and pinout data included.

The manual contains a demonstration program in Basic for plotting a sine wave. The subroutines for converting X and Y coordinates into POKE addresses and values are easily adapted to a program of your own. The manual also explains the principles for programming the VM in Basic, along with the algorithms for calculating the byte address and bit number of any pixel.

Software

The easy way to program is to use the software package that Micro Technology offers separately. It contains a demonstration program that displays the impressive high resolution graphics capability of the system and has other programs which provide the ability to draw and write text. But most important, it contains machine language subroutines and a Basic interface routine which speed up the creation of graphics a hundredfold.

My three-dimensional graphics software uses those machine language subroutines to draw the figure. After calculating the coordinates of the two-dimensional projection of a given object, the Basic program calls the machine language routines to connect the vertices. It is much faster and less complicated than trying to draw directly with the Basic program.

For objects with many curved lines, such as maps, or with many short lines, such as Chinese characters, it is convenient to store the coordinates of the points as data statements and have a routine which reads them out and converts them to the byte addresses and bit values of the pixels.

In another language application, the PET keyboard can be converted to Hebrew. Each key represents a specific Hebrew letter. When a key is pressed the program draws the appropriate letter on the screen, writing from top to bottom and right to left.

The PET keyboard can be converted to Hebrew.

Micro Technology's graphics subroutines occupy about 1K in RAM, which leaves enough memory for any of the main programs which I've tried so far. Even the satellite tracking program with its world map, written by my friend Bill Crowell, just fits into the remaining 7K. However, a complex program, such as a game involving flying air strikes against moving targets over a realistic terrain, would probably require more than the minimum 8K on my PET. Additional memory is easily accommodated by the VM—just remember the address jumpers.

So far, the discussion has been about generating graphics on the monitor screen. A high resolution printout would be valuable for computer art or in computer-assisted design. Bill Crowell has written a machine language program which allows such a printout on a standard Commodore printer and is adaptable to any other printer which offers a user-defined character. Printing is slow, but the results shown in Figures 5 and 6, are effective.

In a future article, Bill and I will talk more about the high resolution printout routine, the programming of three-dimensional graphics, the satellite tracking software, and other graphics programs.

Price

The price of the memory board is $359, with the VM manual available separately for $10. The connector board for the PET 2001 is $35; the board for the 16/32K or CBM PET is $65. Internal mounting brackets, if desired, are $15 for the 2001 or $10 for other PETs.

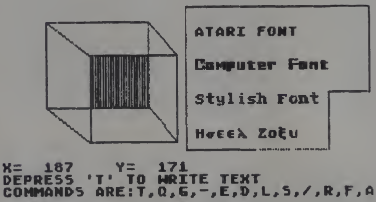
A newly designed VM unit for the 80-column PET, which includes memory board, connector board and internal mounting brackets, is available for $495.

MTU also produces graphics software packages. The basic package containing machine language subroutines for rapid plotting is the one described here. It requires 2K of PET memory and costs $25. A more advanced graphics software package which adds more than 45 graphic commands to the PET Basic and provides a high level of sophisticated graphics programming costs $49. It requires 7.5K of PET memory and is available for all PET ROMs and the 80-column PET.

As I said in the beginning, it's an exciting new world. □

The Atari Graphics Composer

David Lubar



Cube was done using the draw-to and fill routines of the hi-res mode. Lettering was added in the text mode.

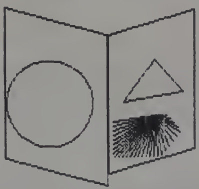
creative computing
SOFTWARE PROFILE

Name: Atari Graphics Composer
Type: Graphics utility
System: Atari 400 or 800, 32K RAM, Basic Cartridge, paddles or joystick
Format: Disk or Tape
Language: Basic and Machine Language
Summary: Versatile system for graphic creation
Price: $39.95 on disk or tape
Manufacturer:
Versa Computing, Inc
3541 Old Conejo Rd. Suite 104
Newbury Park, CA 91320

Everyone who has come within thirty feet of an Atari knows that the machine is capable of great graphics. Everyone who has come closer than that knows how tough it is to get those great graphics. By producing the *Atari Graphics Composer*, Versa Computing has taken care of the hard work, leaving the user free for creativity and experimentation. This set of utilities performs five main functions; hi-res drawing, medium-res drawing, text writing, geometric figure creation, and player creation. The combination is powerful enough to allow a wide range of graphics.

The high-res mode allows drawing with paddles or joystick on a four-color screen with a resolution of 320 by 160. There is one background color, which can be changed at any time, and three foreground colors. While the luminance of the foreground colors can be changed, the color value is predetermined by the background. In this mode, the user can either draw freestyle, or draw lines between any two points. Other options include fill and brush routines. There are two types of brushes; normal brushes fill an area with a solid pattern, the air brush puts a pattern of dots over an area. Combining these, one can color in a picture, then add shading. The fill routine, written in Basic, is not fast, but it is very thorough, filling in most irregular patterns without missing any spots.

Another nice feature is the accelerating crosshair. When the joystick is moved to a new position, the crosshair moves slowly at first, then speeds up. This allows for fine control over a small area and less waiting time when crossing the screen. While the quality of any graphics done in this mode depends, obviously, on the user's artistic ability, the capability is there to produce detailed pictures.



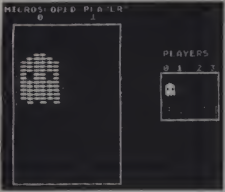
Figures and Moiré pattern made with the geo-maker.

The medium-res mode provides a screen with 160 by 80 resolution, with one background and three foreground colors. These colors can be changed at any time. (For those unfamiliar with the Atari, a change in color actually changes a color register, thus not only do future lines appear in that new color, but lines drawn previously with that color also change to the new color.) As with the hi-res mode, medium-res also provides a fill routine and a selection of brushes.

The text mode places characters from any of four fonts on the hi-res screen. In the disk version of this package, users can switch between any of the modes using hi-res without losing the picture on the screen. Thus a scene can be drawn using the drawing mode, then labeled in the text mode. Along with upper and lower case, all special Atari symbols are supported. Also, the program will accept any user-generated fonts, though the documentation doesn't cover the process of font creation.

To write on the screen, the user first positions the cursor at the desired starting point, using joystick or paddles, then types "T" for text. From that point until the escape key is pressed, all typed characters will be displayed on the screen. Editing keys such as delete still perform their usual function. If the user has switched to lower case, the program won't recognize any commands, but it will prompt the user to press the SHIFT and ALL CAPS keys.

The geo-maker mode allows the creation of a variety of geometric figures, from circles and arcs to triangles and parallelograms. Figures are defined by specifying points. A circle, for example, is defined by its center and any edge point. Triangles and parallelograms require three points. The circle and arc take the longest creation time, while other figures appear rapidly. The geo-maker includes a routine for Moire patterns. The user specifies the step value and, if desired, a window area, then uses the joystick or paddles to fill an area with the pattern.



Player creation is now a simple and dynamic process.

One of the most attractive features of the Atari is the ability to use players in animation. These shapes are usually coded by hand. The *Graphics Composer* has automated the process. Player creation is potentially the most valuable utility on the disk. It presents the user with a grid for designing players. Each large dot turned on in the grid is also displayed in true size on the screen. Once a player is created, it can be saved, and the decimal values representing the player can be displayed, allowing the user to put that player in his own programs.

Beyond explaining all the functions of the programs, the documentation also describes how to use the picture loading routine in other programs, thus making pictures created on this system retrievable by other software.

Anyone doing, or planning to do, graphics work on the Atari should seriously consider the *Atari Graphics Composer*. □

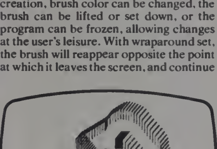
Painter Power

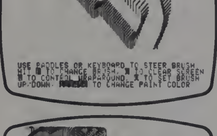
David Lubar

> **creative computing**
> **SOFTWARE PROFILE:**
>
> **Name:** Painter Power
>
> **Type:** Abstract painting system.
>
> **System:** 48K Apple, Applesoft, Disk Drive
>
> **Format:** Disk
>
> **Language:** Basic and Machine Language
>
> **Summary:** Fascinating and Fun
>
> **Price:** $29.95
>
> **Manufacturer:**
> Micro Lab
> 2310 Skokie Valley Rd.
> Highland Park, IL 60035

Eric Podietz held an audience enthralled with a dynamic creation of abstract art. The demonstration of his real-time graphics system was one of the highlights of the 1980 Personal Computer Arts Festival in Philadelphia. Using angled lines and shapes for brushes, Mr. Podietz put patterns on the screen, creating images reminiscent of weavings, abstract landscapes, and Escher stairways. He used an S-100 system and worked in black and white. But that was last year. During that time, he was not idle. He was busy creating an Apple version, adding extensions that make full use of color graphics and other Apple features. The result is *Painter Power*, a software package unlike anything else on the market. Two versions come with the disk; beginner and advanced. The beginner version gets the user going right away. The advanced version adds more power and a bit more complexity.

To use the beginner version, the painter selects a background color and a speed and gets down to creating. Using keys or paddles, the direction of the moving brush is controlled, putting marvelous images on the screen. If the brush is not to the user's liking, it can be changed easily. During creation, brush color can be changed, the brush can be lifted or set down, or the program can be frozen, allowing changes at the user's leisure. With wraparound set, the brush will reappear opposite the point at which it leaves the screen, and continue





Simple examples of designs created with Painter Power. The first uses the pre-defined brush from the beginner mode, the second was done with a user-defined brush in the shape of a question mark.

painting. With wraparound off, an image of the brush reappears, allowing the user to keep track of its relative location, but will not paint until it is returned to the actual screen. In essence, the painter (player?) has a neat little imagination box that seems to offer an infinite variety of images. Finished scenes can be created and saved to disk, or users can follow in the footsteps of Mr. Podietz and give real-time performances (with an appropriate musical accompaniment). Those who tested the program enjoyed it immensely, even in the beginner version.

Advanced *Painter Power* adds all the extras that users of the beginner version might begin to wish for. While this version takes a bit more effort on the part of the user, the return is well worth the time spent learning the system. Not only can brushes be created, they can also be saved to disk. There is even the capability to create a special "Quickstroke" where a brush traces a predetermined pattern. And for those with a mathematical bent, a special routine allows the creation of brushes based on math functions. The location of the brush is displayed numerically at the bottom of the screen, aiding the user in keeping track of the brush when wraparound is turned off. There are many more features in the advanced system, and it would take days to explore all of them.

How does *Painter Power* differ from other painting programs? While you can probably reproduce its results with other systems, the fluidity and symmetry obtained by the moving brush make it the easiest system available for abstract designs. The strength of the program is its dedication to a specific area of graphics, and the ease with which it implements that approach.

While *Painter Power* deals with the abstract and is obviously not for everyone, it will delight anyone who is interested in creating patterns and designs, or just finding another way to have fun with the Apple.

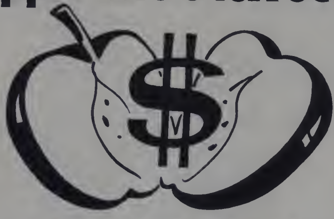
Other Graphics

Several other Apple graphics programs arrived here too late to be covered in this issue. Notable among them is a graphics editor from SubLogic, that works in conjunction with their 3-D packages. The A2-GE includes a motion programmer. It will be reviewed here in the near future. Also, several vendors have new packages for shape table creation, animation, and other areas of graphics. These, too, will be explored in detail in upcoming issues. ☐

micro lab presents a

TAXSAVER

Buy the TAX·MANAGER and turn your apple into a tax deduction.



Let the Tax Laws work for you – buy the TAX·MANAGER in December and deduct the Apple and the Program THIS YEAR!

Use The Tax-Manager to help you prepare your taxes. Then include the cost of this program and part of the cost of your computer as a deduction.

You don't have to be an accountant to understand it. Simply enter your tax information into this easy-to-use program. Then sit back and relax while it quickly computes the information and prints most of your federal income tax schedules. Get The Tax-Manager now and start the New Year with your taxes under control.

When tax laws change, don't be concerned. The Tax-Manager will never be outdated. With Micro Lab's Extended Warranty Plan ($30 a year) you can update to the current version at no additional cost. You will not have to reinvest more money in a new program. The Tax-Manager, which is the first of the Micro Lab Tax Saver group, will keep you current.

THE TAX-MANAGER IS NOW AVAILABLE AT THE INTRODUCTORY PRICE OF $150.

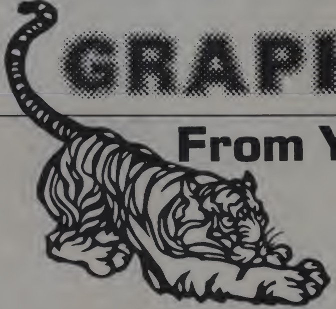
micro lab

systems that work

2310 Skokie Valley Road
Highland Park, IL 60035 • 312-433-7550

CIRCLE 186 ON READER SERVICE CARD

GRAPHS From Your Apple II



Robert Plamondon

The high resolution graphics capability of the Apple II is a versatile feature, indeed. Graphics are used for such varied purposes as space games, custom character sets, and, or course, graphs.

In the past the use of Apple-generated graphs was limited by the scarcity of programs to generate them, and the means to make permanent copies. Most printers lacked the ability to print graphs, and those that did required machine-language driver programs. Thus, graphic output from the Apple was used only by those who had both a suitable printer and a good deal of programming experience.

Fortunately, those days are now gone. Several popular printers, such as the Paper Tiger, Epson MX-70, and some daisy-wheel printers have graphics capability, either as a standard feature or as an inexpensive option. In addition, several software houses have released programs which allow you to create and print your own graphs.

Scientific Plotter

Scientific Plotter from Interactive Microware and Creative Computing Software is available on diskette for 48K Apples with ROM Applesoft, and comes with about 30 pages of mildly confusing documentation.

This package is designed specifically for lab scientists who want to be able to make neat graphs of experimental data. The only kind of graph it makes is the x-y plot; if you want bar graphs or pie charts, this is not the program for you.

creative computing

SOFTWARE PROFILE

Name: Scientific Plotter

Type: 48K Apple, Applesoft, Disk drive

Format: Disk

Language: Applesoft

Summary: Quality graphing program

Price: $24.95

Manufacturer:

Interactive Microware, Inc.
P.O. Box 771
State College, PA 16801
or
Creative Computing Software
39 E. Hanover Ave.
Morris Plains, NJ 07950

Scientific Plotter produces a graph of your data points, with each point represented by a circle, square, cross, or star. Each of these symbols is available in four sizes. You can add error bars if you like, and the points can be connected by straight lines, or not, at your option.

The great advantage of the program is that it lets you play with the format of your graph, and scale it exactly to your needs. When drawing graphs by hand, your choices of format and scale are limited by the types of graph paper you have at your disposal. Drawing graphs by hand is also tedious and error-prone – just the kind of thing you'd like to fob off onto a computer.

Scientific Plotter has an impressive array of options. You can type in data points by hand, calculate them in subroutines, or pull them off a disk file. You have full control of the size of the graph, the location of the axes, the scale, and the color of the data points. The format of the graph, the data, and the graph itself can be saved and retrieved from the data. Labels can be placed anywhere on the graph in any of four orientations and in any hi-res color. And there are many other useful features; too many to cover in a review.

Drawing graphs by hand is also tedious and error-prone — just the kind of thing you'd like to fob off onto a computer.

The program works by asking you a series of questions. It starts by printing:

NAME OF FORMAT FILE ()? <NONE>

Format files hold all the information on scaling, labels, and whatnot that the program needs to make a graph. The two parentheses generally hold the range of

Robert Plamondon, 667 SW 15th Street, Corvallis, OR 97330.

THE DATA FACTORY™

MAJOR OVERHAUL.

Come in and test drive our new, more powerful 1981 model

Our data base has been out-performing its competition for over two years. This fifth edition offers such quick performance and amazing control that it's difficult to imagine what else you'd want in a data base. The 5.0 version of The Data Factory includes a personal input routine that allows you to completely customize your inputs; a new output routine brings pin point control to your printouts; a new sort feature works with amazing speed (1000 names in under six seconds); multi-data disks on-line; and other new features never before offered on micro computers. Micro Lab leads the way.

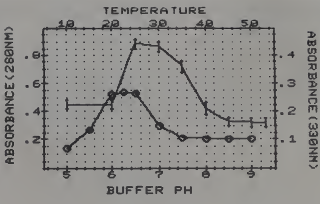
With our Extended Warranty for $30 annually, a previous owner may trade-in an earlier version. The 5.0 edition includes the first years Extended Warranty at no additional cost. Call us or see the new Data Factory at your dealer for $300.

micro lab

systems that work

2310 Skokie Valley Road
Highland Park, IL 60035 • 312-433-7550

CIRCLE 188 ON READER SERVICE CARD



A sample graph mode by Scientific Plotter. Printed in normal plot mode by Paper Tiger Graphics.

values an answer can take; in this case, your response can be anything you want, so there are no limits shown. The "NONE" indicates that if you hit return without typing anything, the program assumes you don't want to load a format file. "NONE" is the default answer.

There are quite a few questions, and answering all of them (if only by the default value) can take a long time, especially when you make mistakes. Fortunately, the default value is equal to the last value you have entered, so you type only the corrections, and hit return on all the other questions. If you read in a format file at the beginning of the cycle, the values in the file become defaults. This can also save time, since most graphs have many parameters in common.

As a final time-saver, Control-A causes the program to step through the questions automatically, assigning the default value to each quantity. This can be stopped by hitting any key. This feature lets you flash past the routine questions and stop only where changes must be made.

As the questions are answered, the program gets the information it needs to start the graph. As soon as you input the position of the x-axis, the program displays the hi-res graphics page, draws the x-axis, and returns to text mode. This sequence of input, plotting, and return to text mode occurs every time the program puts something on the graph, and lets you see what you are building.

The labeling feature is very flexible.

Unfortunately, there is no way to back up to fix a mistake on the previous question. Instead, you must start over. This is the worst flaw in the program.

The labeling feature is very flexible; labels can be placed in any of four orientations, anywhere on the screen. A ridiculously large number of labels can be placed on a graph.

One method of placing labels and axes on the graph is the Cursor command which places a small cross on the hi-res display. This cross can be moved by game paddles or a joystick, and is used to designate the starting position of a label or a coordinate axis without guessing x and y values.

My initial reaction to this program was massive frustration at the difficulty of correcting errors, followed by great satisfaction at the quality of my graphs. Once I had a few format files on disk, I found that I could make graphs with a few non-default values, and everything moved very quickly.

I have found Scientific Plotter to be a very useful program, and a genuine bargain at $25.

Paper Tiger Graphics

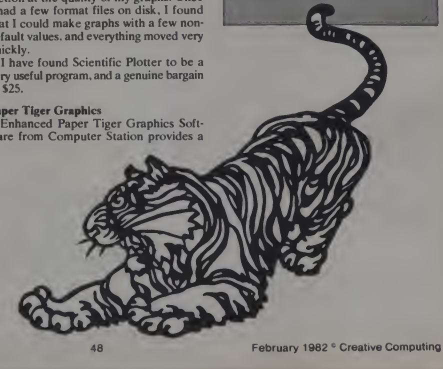
Enhanced Paper Tiger Graphics Software from Computer Station provides a way to transfer the contents of the hi-res graphics screen to your printer, assuming that you have a Paper Tiger 440 or 445 with graphics, as I do. Computer Station also sells graphic dump programs for the Paper Tiger 460G, Anadex 9501 and the NEC Spinwriter, which I assume are similar to the one for the Paper Tiger 440G.

Computer Station takes the problem of putting the contents of the screen onto a piece of paper, solves it elegantly, and wraps a truly foolproof control section around it. The program gives you a printout very quickly; its speed is limited mostly by the speed of the printer interface card. The program is menu-driven, and the menu is the best I have ever seen. The whole program is a joy to use.

The only fly in the ointment is that you have to tell it what kind of interface card you have, and in which slot it is located. If you have trouble remembering the card you have, and where you put it, this can slow you down.

creative computing
SOFTWARE PROFILE

Name: Enhanced Papter Tiger Graphics
Type: Hi-res screen dump
System: 48K Apple, Disk drive IDS 440G 445G
Format: Disk
Language: Machine language
Summary: Quick and elegant
Price: $44.95
Manufacturer:
Computer Station
12 Crossroads Plaza
Granite City, IL 62040



A reproduction of the famous self-portrait of Leonardo da Vinci, done in expanded plot mode, by Paper Tiger Graphics.

Graphs, continued...

The program lets you print either of the hi-res pages, in either normal (4 3/8" x 2 3/4") or expanded (6 1/2" x 5 3/8") modes. The larger size makes pictures large enough to hang on a wall. You can print either a positive or a negative image (i.e., either a white or a black background); justify the output to the left, center, or right of the page; display the graph before printing it; and load pictures from disk without stopping the program. All in all, the package is very well done.

The software comes with adequate documentation, and a large number of sample graphs and pictures.

Enhanced Paper Tiger Graphics Software runs on the Apple II and Apple II Plus, and costs $44.95. □

creative computing equipment evaluation

TEXT & GRAPHICS
Options for Apple and Epson

Alan Tobey

Two new options for owners of the Apple II computer and the Epson MX-80 printer can greatly extend the abilities and the ease of use of this popular combination. For little additional cost, these products give the user 24 different print modes with the MX-80, sophisticated graphics routines, and very simple firmware control of many of the printer's text and format features.

The full range of these features is available only to those who have both an Apple and an Epson, but users of Apples who have other graphics printers—or MX-80 owners with other computers—can take advantage of at least one part of this powerful pair.

The Grappler Interface

The Grappler Interface, from Orange Micro, is a parallel interface card for the Apple. Its on-board ROM is provided in a specific version for each compatible printer—currently all Anadex and Epson printers, IDS Paper Tigers with graphics, and the Centronics 739. The Epson MX-80 requires Graftrax-80, described below. Future graphics printers will also be accommodated.

The Grappler Interface gives the user simple control of several useful text and graphics routines. The Grappler's functions are invoked by simple commands either from the keyboard or from within a program. All commands begin with "Control-I" from Basic or "Control-Y" from Pascal or CP/M, and usually require entering just a single additional character to set each feature.

Text Features

The most important text function of the Grappler is a text screen dump routine. With only a Ctrl-I "S" command, whatever is on the Apple CRT text screen will be printed out automatically, with a 20-character left margin that centers the text on the printout page. (One inconvenient limitation: only the standard 40-character Apple display can be dumped; 80-column boards are not supported.) With similar commands, the Grappler can set or change left and right margins, line length and page length (with an automatic six-line skip-over-perforation feature).

The Grappler Interface gives the user simple control of several useful text and graphics routines.

The screen dump routine is a very handy feature for printing out the results of programmed calculations when the printout routines have not been included in the program, or for printing partial listings of program sections you may want to think about before editing.

The text screen can be dumped any time the cursor is active (blinking), so you can, for example, print out the text screen when the program is halted for a keyboard input without disrupting further program execution. The cursor disappears while the screen is being printed, and then returns, ready for your input as if nothing had happened.

A minor annoyance is the inability of the Grappler to initiate horizontal tabs beyond the 40th column in the normal way; instead a single POKE command is required. This isn't a limitation—just a quirk the user must remember.

Graphics Features

The Grappler treats the Apple graphics in a manner similar to the way it treats the text screen. Short commands allow the Apple to send the stored contents of either hi-res graphics page one or page two to the printer, where it can be printed normally (black-on-white), inverse (white-on-black), double-size, and/or rotated 90°. In the rotated mode the printer can emulate a chart recorder by printing a series of rotated page images in sequence.

Since until now the only way to dump the Apple graphics pages to a printer has been to load (or type in) a fairly elaborate software routine, the Grappler offers tremendous advantages in convenience and savings in programming time. With the Grappler, a few keystrokes get you a graphics printout, from inside a program or as a direct command. It's so easy to do that it encourages frequent and almost whimsical use, just to have a copy of what is stored in the graphics pages. My kids love drawing pictures on the CRT with the joystick and then getting a hard-copy printout to tear off and color.

In addition to graphics dumps, the Grappler can supply the MX-80 (and "some" other printers which the manual doesn't identify) with the missing eighth bit required for TRS-80 block graphics. (The Apple II outputs only seven bits.) That is a delightful feature; one of the few advantages the TRS-80 has had to make Apple owners jealous is neatly eliminated—on paper, at least.

Orange Micro has recently revised and expanded the Grappler documentation from an early primitive version. (I originally received four pages of instructions and one page of corrections.) The current 18-page manual is written in real English—clear and unambiguous—and seems quite complete. An insert even provides a program to modify Visiplot for use with the Grappler.

The Grappler Interface should be useful to every Apple user who owns—or plans to buy—a graphics printer. With a list price of $165 ($15 less than the list for Apple's own parallel printer interface card) it's even a bargain.

Orange Micro Inc., 3150 E. La Palma, Suite G, Anaheim, CA 92806. (714) 630-3322.

Alan Tobey, 1228 Peralta Ave., Berkeley, CA 94706.

THEY SAY THE JAPANESE ARE COMING AND WILL DOMINATE MICROCOMPUTING. THE INNOVATORS SAY WELCOME!

In 1978 Exidy introduced the Sorcerer® Microcomputer to the personal computer marketplace.

It was clearly ahead of its time and the competition in price and performance. The graphics were superior, upper/lower case characters were standard and numeric keyboard was included. Printer, communication and dual cassette electronics were built-in, not options. Twice as much information was displayed on the screen. **The competition created their next generation to catch up.**

In 1980 Exidy introduced their integrated desktop Computer System 80 for the very small business. It was an extension of the Sorcerer® computer . not obsoleting it but expanding its capacity from the home to the office. Its price/performance outstripped the competition in desktop computers. Dual disk drives with 1.2 million words of information, letter quality printer and office automation software . **a complete business computer breaking a new price barrier.**

In 1981 Exidy Systems introduced Multi-Net 80, the first

multi-processor, multi-user, multi-tasking computer system with MP/M™, CP/NET™ and CP/NOS™ for the serious small business. Once again the Multi-Net is an extension of the same Sorcerer® Computer purchased in 1978 or 1980. Your 'getting started' computer becomes your 'getting serious' computer in a multi-user, multi-task environment. **Networking becomes a reality with Exidy Systems, with our competition it's a twinkle in their eye.**

By adding Multi-Net 80 capacity to your stand alone computer system you add a minimum of 35 megabytes of Winchester storage and true 16 user capability because each user has their very own CP/M compatible Z80 microcomputer. That's true upward compatibility in both hardware and software from the company that delivers Innovation in Microcomputing™

EXIDY SYSTEMS

1234 Elko Drive
Sunnyvale, California 94086
(408) 734-9831

What do we say about competition? We welcome it!!!

INNOVATION IN MICROCOMPUTING™

CIRCLE 177 ON READER SERVICE CARD

Graftrax-80

Graftrax-80 is a kit that gives the Epson MX-80 printer bit-graphics capability. It does not require an Apple but will work with any computer that will drive the regular MX-80. (One exception: it will not work with the Epson 8141 serial interface.) Installing it requires pulling one IC and plugging three others into sockets provided in the MX-80, cutting one jumper wire on the circuit board of the printer, and resetting several DIP switches. Directions for doing this are very clear, and an unusually good line drawing (for once no murky photograph) makes the chance of an error virtually nil. Even a full-fledged fumblefingers should not feel intimidated.

Although Graftrax-80 is advertised as a graphics add-on, one of its most useful features is a text printout enhancement. The kit adds an italics print mode to the options already provided by the standard MX-80. This doubles (to a total of 24) the number of different print modes the MX-80 can print.

All of the regular variations and combinations of type style—using normal, emphasized, double-width, compressed and double-strike print—can also be printed in italics. This gives tremendous versatility to an already excellent printer and provides a variety of type styles for almost every conceivable purpose, from extra-bold headings to normal 80 cps print.

Graftrax-80 is a kit that gives the Epson MX-80 printer bit-graphics capability.

EPSON MX-80 PRINT MODES WITH GRAFTRAX

1. THIS IS NORMAL PRINT.
2. *THIS IS NORMAL ITALIC PRINT.*
3. **THIS IS NORMAL EMPHASIZED PRINT.**
4. ***THIS IS NORMAL EMPHASIZED ITALIC PRINT.***
5. THIS IS NORMAL DOUBLE-STRIKE PRINT.
6. *THIS IS NORMAL DOUBLE-STRIKE ITALIC PRINT.*
7. **THIS IS NORMAL EMPHASIZED DOUBLE-STRIKE PRINT.**
8. ***THIS IS NORMAL EMPHASIZED DOUBLE-STRIKE ITALIC PRINT.***
9. THIS IS COMPRESSED PRINT.
10. *THIS IS COMPRESSED ITALIC PRINT.*
11. THIS IS COMPRESSED DOUBLE-STRIKE PRINT.
12. *THIS IS COMPRESSED DOUBLE-STRIKE ITALIC PRINT.*
13. THIS IS DOUBLE-WIDTH PRINT.
14. *THIS IS DOUBLE-WIDTH ITALIC PRINT.*
15. **THIS IS DOUBLE-WIDTH EMPHASIZED PRINT.**
16. ***THIS IS DOUBLE-WIDTH EMPHASIZED ITALIC PRINT.***
17. THIS IS DOUBLE-WIDTH/DOUBLE STRIKE PRINT.
18. *THIS IS DOUBLE-WIDTH/DOUBLE STRIKE ITALIC PRINT.*
19. **THIS IS DOUBLE-WIDTH/DOUBLE STRIKE EMPHASIZED PRINT.**
20. ***THIS IS DOUBLE-WIDTH/DOUBLE STRIKE EMPHASIZED ITALIC PRINT.***
21. THIS IS DOUBLE-WIDTH COMPRESSED PRINT.
22. *THIS IS DOUBLE-WIDTH COMPRESSED ITALIC PRINT.*
23. THIS IS DOUBLE-WIDTH COMPRESSED DOUBLE STRIKE PRINT.
24. *THIS IS DOUBLE-WIDTH COMPRESSED DOUBLE STRIKE ITALIC PRINT.*

Each print mode variation is established using simple escape codes, and with Graftrax-80 all can be turned on and off even in the middle of programmed print lines (not true with the standard MX-80). This makes sophisticated control of the printout quite simple. One example: I've set up an MX-80 to print product labels at my business. I wrote a short utility program in Applesoft that uses string concatenation to condense all the possible combinations of printer function codes into string variables. For instance, once I've set up DI$=CHR$(27)+CHR$(83)+CHR$(27)+CHR$(52)—equivalent to "ESC S ESC 4"—I can shift to double-width italic printing at any point in a printout routine with just a "PRINT DI$" statement. I load a complete routine as the beginning of a label-printing program, and then programming printout type style becomes almost as fast and as automatic as shifting to upper case.

Graftrax-80, however, is mainly a graphics enabler. Its major function is to add to the MX-80 the bit-graphics capabilities that the Epson MX-70 and MX-100 already have. In bit-graphics mode, any of the top eight printhead needles can be fired at any of 480 or 960 horizontal positions per line. This means that almost any point on the paper can be printed black or left white for truly high-resolution graphics. Graftrax-80, then, brings the MX-80 up to par with other graphics printers such as the Anadex series or the IDS Paper Tigers.

Graftrax-80 will also support TRS-80 block graphics for Apple users, independent of the Grappler. Once block graphics mode is entered via an escape code, each block graphic character is specified with a single ASCII code, so many graphics printout effects can be programmed much more quickly than in the laborious bit-plot mode.

There are several quirks of which the user should be aware. The Apple II doesn't pass the Decimal 9 or Decimal 13 character to the MX-80 with Graftrax in a way that the printer can properly interpret. The TRS-80 Model I has the same problem with Decimal 0, 10, 11 and 12. This means that certain tab and paper feed functions can't be specified conveniently; but the Graftrax manual includes reasonably short POKE routines as acceptable fixes.

Any one of its features would make Graftrax-80 well worth its additional $90 (list) cost. Together, they make an already great printer even better and put highly sophisticated printout routines within easy reach of even inexperienced programmers. I wouldn't have an MX-80 without it.

Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505. (213) 539-9140. □

Rocket Raiders

Our High Quality Software Is More Than A Stroke Of Genius... It's A Work Of Art.

☐ **PM EDITOR:** by Dennis Zander (Atari, 16K)
Create your own fast action graphics game for the Atari 400 or 800 using its player missile graphics features. By using player data stored as strings, players can be moved or changed (for animation) at machine language speed. All this is done with string variables (PO$(Y)=SHIP4). This program is designed to permit creation of up to 4 players on the screen, store them as string data and then immediately try them out in the demo game included in the program. Instructions for use in your own game are included. PM EDITOR was used to create the animated characters in **ARTWORX** RINGS OF THE EMPIRE and ENCOUNTER AT QUESTAR IV.
PRICE **$29.95** cassette **$33.95** diskette

☐ **ROCKET RAIDERS** by Richard Petersen (Atari 24K)
Defend your asteroid base against pulsar bombs, rockets, lasers, and the dreaded "stealth saucer" as aliens attempt to penetrate your protective force field. Precise target sighting allows you to fire at the enemy using magnetic impulse missiles to help protect your colony and its vital structures.
PRICE **$19.95** cassette **$23.95** diskette

☐ **INTRUDER ALERT!** by Dennis Zander (Atari, 16K)
This is a fast paced action game in which you must escape from the "Dreadstar" with the secret plans. The droids are after you and you must find and enter your ship in order to escape. It you fail, the rebellion is doomed. **PRICE** **$16.95** cassette **$20.95** diskette

☐ **THE RINGS OF THE EMPIRE:** by Dennis Zander (Atari 16K)
The Empire has developed a series of battle stations protected by one or more rings of energy. You must destroy these weapons by attacking them in your Y wing fighter armed with Zydon torpedoes. Each time you blast through the rings and destroy the station the Empire develops a new station with more protective rings.
PRICE **$16.95** cassette **$20.95** diskette

☐ **FOREST FIRE!:** by Richard Petersen (Atari,24K)
Using excellent color graphics, your Atari is turned in to a fire scanner to help you direct operations to contain a forest fire. You must compensate for changes in wind, weather and terrain. Not protecting valuable property can result in startling penalties. Life like variables make FOREST FIRE a very suspenseful and challenging simulation. **PRICE** **$16.95** cassette **$20.95** diskette

☐ **PILOT:** by Michael Piro (Atari, 16K)
Pilot your small airplane to a successful landing using both joysticks to control throttle and attack angle. PILOT produces a true perspective rendition of the runway, which is constantly changing. Select from two levels of pilot proficiency.
PRICE **$16.95** cassette **$20.95** diskette

☐ **ALPHA FIGHTER:** by Douglas McFarland (Atari, 16K)
Consisting of two different programs, ALPHA FIGHTER requires you to destroy the alien starships. As you become more successful, the games get harder and harder. **PRICE** **$14.95** cassette **$18.95** diskette

☐ **GIANT SLALOM:** by Dennis Zander (Atari, 16K)
Bring the Winter Olympics to your computer anytime of the year! Use the joystick to guide your skier's path down a giant slalom course consisting of open and closed gates. Choose from three levels of difficulty. Take practice runs or compete against from two to eight additional skiers.
PRICE **$15.95** cassette **$19.95** diskette

☐ **HODGE PODGE:** by Marsha Meredith (Apple 48K, Applesoft or Integer BASIC)
This captivating program is a marvelous learning device for children from 18 months to 6 years. HODGE PODGE consists of many cartoons, animations and songs which appear when any key on the computer is depressed. A must for any family containing young children and an Apple.
PRICE **$19.95** diskette

☐ **HEARTS 1.5:** by Arthur Walsh
(Atari 24K, Apple, TRS 80, PET, North Star and CP/M (MBASIC) systems)
You are pitted against two computer opponents in this popular card game. The program employs a hard to beat playing algorithm which creates quite a challenge for even the advanced player.
PRICE **$15.95** cassette **$19.95** diskette

CIRCLE 112 ON READER SERVICE CARD

TYPE-'N-TALK®
ARTWORX is offering the fantastic TYPE-'N-TALK™ from Votrax®. This easy to use unit connects to your computer's serial port. Text is automatically translated into electronic speech enabling the TYPE-'N-TALK™ hobbyist to use and enjoy it immediately.
PRICE **$329.00**

The following **ARTWORX** programs are available for TYPE-'N-TALK

STUD POKER (Atari,24K)	**$16.95** cassette **$20.95** diskette
TEACHER'S PET (Atari,24K, North Star)	**$16.95/ $20.95**
BRIDGE 2.0 (Atari, 24K, North Star)	**$19.95 / $23.95**
NOMINOES JIGSAW (Atari, 24K)	**$17.95 / $21.95**

Please specify "TNT" version when ordering programs

☐ **CRANSTON MANOR ADVENTURE:** by Larry Ledden (Atari, North Star and CP/M)
You must enter mysterious Cranston Manor and attempt to collect its many treasures. This extemely challenging program will provide you with many hours (days?) of adventure. The program may be interrupted at will and your status saved onto the diskette.
PRICE **$21.95** diskette

☐ **STUD POKER:** by Jerry White (Atari, 16K)
This is the classic gambler's card game. You will find the computer to be a worthy opponent who occasionally bluffs but never cheats! STUD POKER employs all of the Atari's sound, color and graphics capabilities.
PRICE **$14.95** Cassette **$18.95** diskette

☐ **TEACHER'S PET:** by Arthur Walsh (Atari, Apple, TRS 80, PET, North Star and CP/M (MBASIC) systems)
This is an introduction to computers as well as a learning tool for the young computerist (ages 3-7). The program provides counting practice, letter word recognition and three levels of math skills.
PRICE **$14.95** cassette **$18.95** diskette

☐ **FORM LETTER SYSTEM:** (Atari, North Star and Apple)
This is the ideal program for creating personalized form letters! FLS employs a simple to use text editor for producing fully justified letters. Addresses are stored in a separate file and are automatically inserted into your form letter along with a personalized salutation. Both letter files and address files are compatible with **ARTWORX** MAIL LIST 3.0 and TEXT EDITOR programs.
PRICE **$39.95** diskette

☐ **TEXT EDITOR:** (Atari and North Star)
This program is very "user friendly" yet employs all essential features needed for serious text editing with minimal memory requirements. Features include common sense operation, two different justification techniques, automatic line centering and straightforward text merging and manipulation. TEXT EDITOR files are compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE **$39.95** diskette

☐ **MAIL LIST 3.0:** (Atari, Apple and North Star)
The very popular MAIL LIST 2.2 has now been upgraded. Version 3.0 offers enhanced editing capabilities to complement the many other features which have made this program so popular. MAIL LIST is unique in its ability to store a maximum number of addresses on one diskette (typically between 1200 and 2500 names!). Entries can be retrieved by name, keyword(s) or by zip codes. They can be written to a printer or to another file for complete file management. The program produces 1, 2 or 3-up address labels and will sort by zip code (5 or 9 digits) or alphabetically (by last name). Files are easily merged and MAIL LIST will even find and delete duplicate entries! The address files created with MAIL LIST are completely compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE **$49.95** diskette

☐ **THE VAULTS OF ZURICH:** by Felix and Ted Herlihy (Atari, 24K, PET)
Zurich is the banking capital of the world. The rich and powerful deposit their wealth in its famed impregnable vaults. But you, as a master thief, have dared to undertake the boldest heist of the century. You will journey down a maze of corridors and vaults, eluding the most sophisticated security system in the world. Your goal is to reach the Chairman's Chamber to steal the most treasured possession of all: THE OPEC OIL DEEDS!
PRICE **$21.95** cassette **$25.95** diskette

☐ **BRIDGE 2.0** by Arthur Walsh (Atari(24K), Apple, TRS-80, PET, North Star and CP/M (MBASIC) systems)
Rated #1 by Creative Computing, BRIDGE 2.0 is the only program that allows you to both bid for the contract and play out the hand (on defense or offense!). Interesting hands may be replayed using the "duplicate" bridge feature. This is certainly an ideal way to finally learn to play bridge or to get into a game when no other (human) players are available.
PRICE **$17.95** cassette **$21.95** diskette

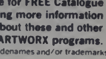
☐ **ENCOUNTER AT QUESTAR IV:** by Douglas McFarland (Atari, 24K)
As helmsman of Rikar starship, you must defend Questar Sector IV from the dreaded Zentarians. Using your plasma beam, hyperspace engines and wits to avoid Zentarian mines and death phasers, you struggle to stay alive. This BASIC/Assembly level program has super sound, full player missile graphics and real time action.
PRICE **$23.95** cassette **$27.95** diskette

☐ **THE NOMINOES JIGSAW PUZZLE:**
by C. Minns/B. Brownlee (Atari, 24K, TRS-80, and Apple)
We quote: "A brainteaser supreme ... the concept of NOMINOES JIGSAW is brilliant ... this video jigsaw game is so clever and completely original that only the most hardhearted puzzle hater could fail to be charmed." —ELECTRONIC GAMES MAGAZINE
PRICE **$17.95** cassette (also available for TRS 80 color computer) **$21.95** diskette

Artworx **Highest Quality Software®, Guaranteed.**
ARTWORX SOFTWARE COMPANY
150 North Main Street Fairport, NY 14450 (716) 425-2833

Call ARTWORX toll-free number to order direct:
800-828-6573 In New York, Alaska, Hawaii call: (716)-425-2833
All orders are processed and shipped within 48 hours.

Shipping and handling charges:
Within North America: Add $2.00
Outside North America: Add 10% (Air Mail)
New York State residents add 7% sales tax.
Quantity Discounts:
Deduct 10% when ordering 3 or more programs
Ask for ARTWORX at your local computer store.



Write for FREE Catalogue listing more information about these and other quality ARTWORX programs.

*ATARI, APPLE, TRS-80, PET, NORTH STAR, CP/M, and TYPE-N-TALK are registed tradenames and/or trademarks

BRING IN THE NEW YEAR!

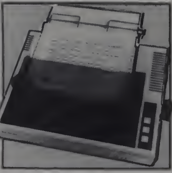
LOOK CLOSELY AT THESE SUPER SAVINGS!!

SAVINGS!

AMAZING SPECIALS!

OMEGA SALES CO.

• We Accept C.O.D.'s • Stock Shipments Same Day or Next • No Surcharge For Credit Cards • All Equipment Factory Fresh w/MFT Warranty • We Carry the Complete Line of Personal Software



EPSON MX-80 $ 469

ATARI 800 16K $ 749

EAST COAST
1-800-556-7586

WEST COAST
1-800-235-3581

PRICES ARE SUBJECT TO CHANGE W/O NOTICE.

NEC Color Monitor
JC 1201 $319

INTERTEC SUPERBRAIN 64K RAM	**$2799**
QD SUPERBRAIN	$2999
NEC 5510 SPINWRITER (7710)	**$2345**
NEC 5520 SPINWRITER (7720)	$2695
NEC 5530 SPINWRITER (7730)	$2345
NEC 12" MONITOR	$ 189
NEC COLOR 12" MONITOR	$ 339
NEC PC 8023 Printer 100 CPS Tractor & Friction	$ 639
OKIDATA MICROLINE-80	**$ 379**
OKIDATA MICROLINE-82A	$ 529
OKIDATA MICROLINE-83A	$ 749
DIABLO 630	$1995
APPLE II PLUS 48K	**$1139**
APPLE DISK w/3.3 DOS Controller	$ 525
APPLE DISK w/o Controller	$ 449
EPSON MX-80	$ 469
Interfaces: IEEE $55, TRS-80 CABLE $35, APPLE INTERFACE & CABLE $90, RS-232 $70	
HAZELTINE 1420	$ 799
NORTHSTAR HORIZON II 32K QD	$2925
ANADEX DP-9500/9501	$1199
TELEVIDEO 912C	**$ 699**
TELEVIDEO 920C	$ 729
TELEVIDEO 950	$ 929

WE CARRY THE COMPLETE LINE OF ATARI SOFTWARE, PERIPHERALS AND ACCESSORIES.

MORE... ON VIC GRAPHICS

Bob Yannes

We recently received the following information concerning the VIC-20 from Bob Yannes, an engineer at Commodore. The article describes some capabilities of the VIC which were not mentioned in my original review in the September Buyer's Guide. *Bob was surprised that I did not mention these features.*

My article was written using only the manuals and other materials furnished to normal, everyday purchasers of the VIC computer. I noted in the article that no programmer's reference guide was available. Apparently it still isn't. I also noted that the one manual furnished had some major shortcomings. It still does. Thus, while we are happy to hear about the additional capabilities of the VIC-20, we are disappointed that purchasers will have to read Creative Computing *or some non-Commodore book or manual to learn how to use these features.*

We feel that the VIC offers excellent price performance. This is enhanced by the fact that Commodore recently entered into a contract with Bally to provide cartridges of all of Bally's coin-op games for the VIC. This could not be done on a computer that did not offer good graphics and animation capabilities. However, at this point, Commodore is not supplying the necessary information to the user so that he can make use of the graphic capabilities. This we view as a serious shortcoming. —DHA

The VIC is capable of a full bit-mapped display in which each of 28160 pixels is individually addressable. The VIC-20 offers three basic display modes. The "standard" text mode consists of the upper/lower case character set and PET graphics characters which are available from the keyboard.

The second display mode allows the user to define his own character set for special symbols, foreign languages and game characters. The user can either define all 256 characters, or define half and use half of the character ROM.

The third display mode is a 176H by 160V bit-map display with each pixel addressable. Within each of these modes there is a sub-mode which reduces horizontal resolution but improves color flexibility.

The multiple display modes allow users to get more out of their VICs as their expertise increases. Beginners can create graphics easily from the keyboard, while more sophisticated users can take advantage of the definable characters and bit-map.

A plain vanilla, unexpanded VIC-20 contains enough RAM for the full bit-map. An unexpanded VIC-20 does not have enough RAM for complicated programs using the bit-map, but plug-in cartridges (such as games) can use the bit-map effectively.

The real power of the bit-map is available to the user when he purchases the Super Expander cartridge which not only provides extra RAM, but also adds a host of graphics and music commands to VIC Basic.

The 22 by 23 character display format was chosen to keep costs down (the fewer characters displayed, the less memory is required to hold them) and to eliminate the complaints normally associated with color video displays. Color televisions were never designed to display small color dots and create many problems for beginners with graphics.

If a dot is too small, the television will only display a smudge or nothing at all. Depending on the rate the dots are shifted out to the TV, the TV may also produce all sorts of undesirable color fringing, even on a black and white image (Apple actually uses this color fringing effect to create their hi-res colors).

The VIC was designed to eliminate these effects by making the dots large enough for the TV to display properly and shifting the dots out at a special rate. It is, therefore, possible to pick any color combination on the VIC without worrying about how to fudge the characters to compensate for the TV problems.

All of this is handled by the Video Interface Chip used in the VIC-20, which not only handles the display but also provides the light pen interface, paddle interfaces and sound generator, making it one of the most flexible display chips around. The high speed of the VIC-20 is a result of the transparent DMA technique used by the video chip which never stops or slows the 6502 processor. □

Bob Yannes, 109 E. 4th St., Media, PA 19063.

Lynn Busby, president of the Computer Station, as seen by the Dithertizer II.

You and your Apple can have a new view of the world.

Dithertizer!

Dithering. Developed at Bell Labs and MIT, dithering was originally an approach to picture transmission. Compared to other methods, dithering is fast and accurate.

The Dithertizer II was designed for the Apple computer by David K. Hudson, a researcher at MIT. Design goals were high accuracy, fast scanning, maximum reliability and an economical price.

High Quality Images

The resolution is of the Dithertizer is the maximum the Apple can handle in the high-resolution mode, i.e., 280 x 192 (53,760) pixels.

To produce an image, a video camera is focused on the subject. Peripherals Plus furnishes a Sanyo VC161OX camera, a laboratory/industrial unit with an f 1.6 lens. This camera has a focus range of 18" (for extreme close ups) to infinity (for distant subjects).

The camera scans an entire frame in 1/60th of a second. Two frames are scanned, of course, in 1/30th of a second. By adjusting the blackness control (with Paddle 0) to any one of 255 levels you can determine the threshold of gray between the two frames.

A 1/30th second, two-frame scan has two levels of gray and produces a high-contrast but quite recognizable image.

Pictures or Contours

Using the "Contour" software routines and contrast control (Paddle 1), it is possible to subtract one image from another. If the blackness thresholds of the two images are close, say 125 and 127, the resulting image will show just the outlines or highlights of an object.

Another possibility is to reduce the contrast to zero which results in a nearly blank screen except for movement in the area scanned. This type of movement detector is much faster (1/30th second) and more precise than other much more expensve systems. It is currently being used to detect and record movement of laboratory animals. It is also used in security installations.

The "Dithering" software routines use the contrast control to divide an image into gray tones. As mentioned above, two levels (usually white and black) result in a high contrast image. Four gray levels provide additional definition while sixteen levels produce a highly detailed image in just over 1/4th of a second. Extremely high detail is possible using the highest 64-gray level setting. At this level, an image is produced in 64/60ths of a second or just over one second. The quality of this image is close to that of a halftone photograph found in a newspaper or magazine.

Using Dithered Images

What can one do with a dithered image? Upon completion it can be stored automatically in either page 1 or 2 of the high-resolution graphics area of the Apple. Hence, it can be printed out on practically any printer. To print it on an Apple Silentype printer or equivalent requires no additional software.

To take advantage of the automatic print routines in the Dithertizer itself does require additional software tailored to a specific printer. Software packages are available at $44.95 each for the following printers: IDS 440, 445, 460, and 560; IP225; Anadex DP9500 and DP9501; Spinwriter 5510 and 5520.

Individual images or series of images may also be incorporated in other programs in the same way that other hi-res graphics are used. Using VersaWriter software, for example, text may be added to images. An image may be shown on the screen while a disk is loading or while the computer is completing a time-consuming calculation in another program.

With the proper software, the Dithertizer can be used to perform image enhancement, to identify features, detect motion, track a moving target or create a detailed picture for display. The possibilities are limited only by your imagination.

Quality Construction

The dithertizer is manufactured to exacting specifications by Computer Station. It consists of the Dithertizer II board which plugs into Slot 7 in the Apple II, a cable which connects between the Dithertizer and motherboard and a 10 foot cable to the camera. The system requires a 48K Apple disk system.

The software package consists of three routines on disk: "Dither" to build a gray scale picture, "Contour" to produce an edge scan using image subtraction, and "Dscan" to store a binary image in either page 1 or 2 of the high-resolution graphics area.

Peripherals Plus also includes a Sanyo VC161OX video camera with external horizontal and vertical sync input.

The components of the packge—hardware, software and camera—are warranteed by the manufacturers against defects in material and workmanship for 90 days. In addition, Peripherals Plus guarantees that if you are not completely satisfied you may return the system for a prompt and courteous refund.

Order Today

The entire Dithertizer system consisting of the Dithertizer board, Sanyo camera, cables and software costs only $650 plus $6 shipping and handling in the continental United States. Customers in other loctions should write for shipping rates. Price for the board and software alone is $300 while the camera alone is $410. To order your system, send payment or Visa, MasterCard or American Express card number and expiration date to the adress below. Credit card customers may also call orders to our toll-free number.

Don't put it off. Remember, your system is backed by both manufacturer warranties and a complete moneyback guarantee of satisfaction from Peripherals Plus.

Give your Apple a new view of the world with a Dithertizer. Order today.

Peripherals Plus

39 East Hanover Avenue
Morris Plains, NJ 07950
Toll-free **800-631-8112**
(In NJ 201-540-0445)

CIRCLE 239 ON READER SERVICE CARD

Stephen B. Gray

Responses to TRS-80 Challenge no. 2 -Star Within a Circle

A long time ago, back in the May 1980 *Creative* (p. 148), the second TRS-80 software challenge was put to you readers. Here's a reprint of that challenge:

Software Challenge #2 — Star Within a Circle

Quite a variety of responses to the first software challenge (September 1979, p 190) was received, and five are described in this issue.

Now it's time for a second challenge: write a program that puts a circle with a diameter of 2 to 5 inches anywhere on the TRS-80 screen, and then puts a five-pointed star within that circle, just touching it.

Just as several astute readers came up with some clever variations on the first challenge, others will see possibilities in the second challenge that lie beyond the single sentence.

Although many solutions were received in response to the first software challenge, several times as many people responded to the second. Over a third consisted only of a listing; I'd neglected to ask for a "short cassette of the program," as I had in the first challenge. The result was hours of typing, which led to several severe attacks of lassitude. Hence the lateness of this report.

Range of Entries

The entries ranged all the way from a Westchester computer consultant who wrote, "I used Applesoft. So sue me!" to many who went far beyond the original bounds of the challenge.

A very few sent in the minimum program. Others exercised vast amounts of imagination, and sent in programs that rotate the star by an input amount, draw the star within a circle or an ellipse, draw a star with as many points as desired, draw the star at the same time as the circle, draw any polygon (or a star) within the circle, draw white on black or vice versa, draw circles around the star points, or add shading to the star.

Nine Runners-Up

Before we get to the top three entries, nine other programs with highly ingenious features deserve mention.

Incidentally, the quality of programs submitted was very high. There was only one program I couldn't make work. Although the listing was beautifully indented, it kept giving errors. A DIM was added here and a GOSUB corrected there, among many other fixes, but the program still had such problems that I put it aside and went on to programs that worked.

One other program had a problem I couldn't fix right away, but all the others either ran perfectly or could be fixed quickly, which means that *Creative* has many fine programmers among its readers.

Ron Casterson

A program that draws stars with 3 to 11 points was sent by Ron Casterson (Livermore, CA). It uses wraparound, so that if you specify 0,0 as the center of the circle, a quarter of the circle will be displayed in each corner of the screen. As Casterson notes, "There is a choice of 3, 5, 7, 9 or 11 points for the star."

Wallace P. Havenhill

The program from Wallace P. Havenhill (Cleveland Heights, OH) isn't interactive; it draws a circle of random diameter at a random location, draws in a five-pointed star, clears the screen, and repeats the process elsewhere on the screen, all automatically.

Vincent M. Hietala

One of the very shortest programs is from Vincent M. Hietala (Embaras, MN), with only 35 active statements. It asks for the length of the horizontal and vertical axes, then gives you the limits of where you can put the center of the circle or ellipse in which the circle will be drawn, such as

```
30 < X < 98, 20 < Y < 28
```

John L. Thomas

The first display in the program from John L. Thomas (Bolingbrook, IL) is a full screen of information telling the user what to do, and describes the use of "skip values," which "determine the linking of

Does your CP/M** or TRS-80* Word Processor need help?

Aspen Software has the finest document proofreading tools available.

GRAMMATIK™

Beyond Spelling Checking

Spelling checkers are useful, but they are not enough! Grammatik can find many errors that a spelling checker can't. It detects many errors commonly found in text entered on computers, such as doubled words ("the the"), inconsistent capitalization ("STicky shift key"), incorrect punctuation, and others. That's not all! Grammatik also checks your document for good writing style using a dictionary of over 500 misused phrases as defined in many writer's style manuals. It marks and classifies the problems it finds in the document file for easy correction with your word processor, and provides suggestions for correcting the problems. The phrase dictionary can be easily extended to include checking for esoteric jargon or your own pet peeves. Grammatik also collects other stylistic information that can be used to revise the document to improve its readability such as average sentence and word length. It can produce a profile with the number of times each unique word in the document was used, helpful for identifying overworked vocabulary. Grammatik is not only a valuable proofreading tool, it is also a useful learning tool. You will notice significant improvements in your own writing style after using Grammatik for only a short time. Grammatik is fast, easy to use, and works with all popular TRS-80 and CP/M word processors. Model I/III version requires a minimum 32K, 1 drive system. Model II TRSDOS* version requires 64K and 1 drive. CP/M version requires CP/M release 2.2 and 48K.

PROOFREADER™

The Aspen Software Company Spelling Checker

Don't buy a spelling checker until you've considered Proofreader. Recently, several ads for other spelling checkers have compared themselves to "others". They weren't comparing themselves to Proofreader! Proofreader has all the features you need for checking your documents for spelling errors and typos. Proofreader looks up every word in its 38,000 word dictionary, and does not increase its "vocabulary" by using less accurate root word analysis like some others do. You won't need to spend as much time adding new words as you would with a smaller dictionary. Proofreader is easy to use -- you can start checking your documents immediately. Proofreader is fast -- it can check even your largest document (20 pages or more) in less than 5 minutes! Unknown words are listed on the screen, and can be saved in a file for later manipulation. The Proof-Edit feature (optional on the Model I/III version, included with Model II and CP/M) allows you to interactively correct the unknown words in context. New words can easily be added to the dictionary, and expansion is limited only by disk capacity. Proofreader works with all TRS-80 operating systems and word processors, so if you change systems, you won't need a new spelling checker. On the TRS-80 Model I/III, only 32K RAM and 1 disk drive are needed. Proofreader also works with all popular CP/M word processors. Add up the facts and the low price, and you will conclude that Proofreader is the best value available in spelling checkers.

Aspen Software programs are professional quality, reliable software tools developed for the TRS-80 and CP/M by a Ph.D. in Computer Science. All software is protected by Aspen Software's low cost upgrade privilege for new versions. Other tools include:

— SOFT-SCREEN™, a powerful, state of the art full screen text editor. Over a year in development, Soft-Screen is compatible with all TRS-80 programming languages, including BASIC, FORTRAN, MACRO, Ratfor, and COBOL. Commands are easy to learn, yet versatile and complete to satisfy the most experienced user. Soft-Screen is also available for P&T Model II CP/M.

— SOFT-TEXT™, Aspen Software's text formatter. When used with Soft-Screen, provides a powerful word processing system. Full featured, including automatic pagination, even and odd page headings, underlining, index generation, footnotes, support for advanced printer capabilities, and much more. Model I/III version supports serial printers at full speed. Soft-Text offers a real alternative for Model II TRSDOS users. Please write or call for more details.

— RATFOR, a structured language preprocessor for Fortran developed at Bell Labs. Aspen Software Ratfor is one of the best versions available, and the only one with a pretty printer option. Totally compatible with Microsoft F80. Includes several extensions, including "case", "string", and conditional compilation. User's manual contains all information needed to learn and write Ratfor programs. Requires FORTRAN.

— PP-RATFOR, a pretty printer. Automatically formats and indents Aspen Software Ratfor source programs. An essential program development tool.

	Model I	Model II (64k,1d)	Model III	CP/M (2.2,48k)	Manual only
Proofreader	$54.00(32k1d)	$119.00	$64.00(32k1d)	$129.00	$8.00
Proof-Edit	$30.00	incl.	$30.00	incl.	incl.
Grammatik	$59.00(32k1d)	$99.00	$59.00(32k1d)	$149.00	$8.00
Soft-Screen	$69.00(48k1d)	$99.00	$75.00(48k1d)	$99.00(P&T)	$15.00
Soft-Text	$69.00(48k1d)	$99.00	$75.00(48k1d)	$99.00	$15.00
both	$129.00	$179.00	$139.00	$179.00	$25.00
Ratfor	$49.00(48k2d)	$99.00	$59.00(48k1d)	$99.00	
PP-Ratfor	$30.00(48k2d)	$49.00	$34.00	$49.00	
both	$74.00(48k2d)	$139.00	$84.00	$139.00	$15.00

IMPORTANT: Specify computer model, operating system, memory size, and number of drives when ordering! For CP/M, currently only 8" single density CP/M versions available. Please inquire about other CP/M disk formats. All TRS-80 versions available. Manual only orders can be applied to final purchase. CP/M prices are introductory.

Orders sent postpaid by first class mail. Terms: Cash, check, money order, VISA, or Master Card. NM residents add 4% tax.

Proofreader, Grammatik, Soft-Screen, and Soft-Text are trademarks of Aspen Software.

**trademark of Digital Research *trademark of Tandy Corp.

ASPEN SOFTWARE COMPANY™

P.O. Box 339-C Tijeras, NM 87059 (505) 281-1634

the touch points," which are the points at which the inscribed figure touches the circle. "A skip of 1 will link adjacent points; a skip of 2 will link every other point."

Subsequent displays ask for radius, step size, number of points, skip value, and coordinates of the center. This is one of the very few programs that can draw stars with an even number of points.

Thomas Bartkus

Although the entry from Thomas Bartkus (Rutherford, NJ) is straightforward, it's one of the very few that offer default values if you don't choose to select the location of center (63,23), diameter of circle (6.5), and rotation angle (0 degrees).

Thus you can draw the circle with only three depressions of the ENTER key, after which the program draws in the five-pointed star. Had the program offered options on the drawing of the star, such as number of points, it would have been a winner.

Bartkus has an ingenious feature: "The 'off-screen print routine' at the end recovers from an error caused by trying to set points off-screen. While doing so, it flashes the pixel at the center of the circle to indicate what is happening and that the program is not hung up. This allows the drawing of a figure that is too large or positioned so that it cannot be entirely contained by the screen."

Bartkus, by the way, won the first TRS-80 Software Challenge (his winning program was shown in May 1980, p. 162).

Dan Kegel

The first display in the program from Dan Kegel (Bellevue, WA) asks

```
WOULD YOU LIKE ME TO DRAW.....
      (1) QUICK AND DIRTY, OR
      (2) SLOW AND CAREFUL?
```

which is a nice touch, along with asking if you

```
WANT TO
(1) SEE JUST THE PENTAGRAM, OR
(2)CHOOSE YOUR OWN FAMILY OF FIGURES?
```

which are both fine interactive features.

If you choose your own family of figures, you're asked if you

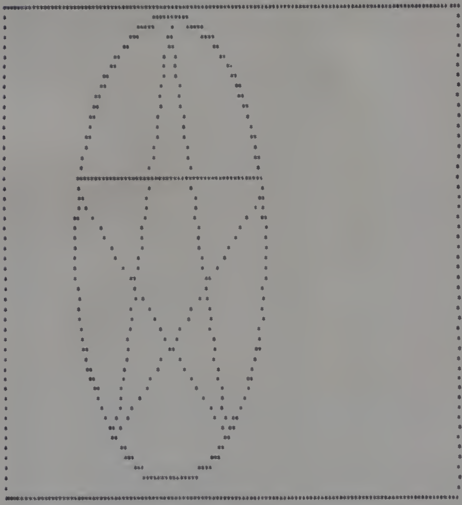
```
WANT TO  (1) LOOK AT JUST ONE FAMILY
             OF FIGURES, OR
(2) LOOK THROUGH ALL FIGURES NONSTOP?
```

and if you choose the latter, and pick six as the number of "sides you want the initial figure to have," you get first a "6-gram, order 2," then a "6-gon," followed by a "7-gram, order 3," "7-gram, order 2," "7-gon," "8-gram, order 3," etc.

This program is the only one that draws the stars from the center out; it also includes a hard-copy routine.

Kegel's program would be a winner if there weren't several others that are just a little more versatile. That's a very subjective opinion, of course, and you might pick this one for the winners' circle.

Figure 1. Ellipse and star, from program by Daniel E. Nickell, the only one to list relevant data on the printout.



CENTER IS AT X = 44 , Y = 10.5714 . DIAMETER OF BASIC CIRCLE IS = 3 INCHES. ECCENTRICITY = .444445

Daniel B. Nickell

The program from Daniel B. Nickell (Laurel, MD) asks for diameter, how far from the left side of the screen shall the center be, how far from the top of the screen shall the center be, and will a printer be used. If you pick a dimension or location beyond the limits, you're told what the limits are, rather than being given the limits in the first place, which is the computer's way of seeing if you're awake.

After the circle and star are drawn, the display asks if you want to

```
(R)EVIEW AGAIN, (E)CCENTRICITY
      ADJUST, (S)TOP
```

and if you press E, you're asked to enter the vertical (VE) and horizontal (HE) eccentricity, and if a printer will be used. If you select the right amount of eccentricity, an ellipse is drawn, the star is inscribed within it, and then the figure is printed out (Figure 1).

Two problems: if you select an eccentricity beyond the display-area limits, you get an FC error; and the output routine is for a printer with at least 130 columns. If you use a printer with less column capacity, you get a printout consisting of an overlapping of the two halves of the figure.

The eccentricity figure at the bottom of the printout is HE/VE. Nickell notes "The program does not try to make the printed version of the circle circular. Thought we'd leave that to someone needing a challenge."

James Jones

A remarkable handwritten program was sent in by James Jones (Lisle, IL), who doesn't "have access to a TRS-80." What's remarkable is not so much what the program does, but that it works as written, because Jones apparently never ran it.

The Jones program asks for a radius between 2 and 5, an integer N greater than 2, and a number S between 1 and N, "relatively prime to N."

That could weed out the non-mathematicians right away, except that if you don't guess correctly, the question keeps repeating until you select a correct S, a very nice touch.

Depending upon your choice of the three variables, you get a variety of figures, which are drawn in a unique fashion: the star is drawn at the same time as the circle.

Integer N turns out to be the number of points in the star. If S is odd, a polygon is drawn; if even, a star; Jones calls S the "step size," which is the same as John Thomas's "skip value."

So an N/S of 5/1 results in a 5-gon (pentagon), while 5/2 produces a 5-gram (pentagram) or five-pointed star (Figure 2). An N/S of 6/5 provides a hexagon in a circle, with the two drawn in opposite directions, one clockwise, the other counterclockwise, using polar coordinates. Using 6/1 draws the same hexagon, but in the same direction as the circle. The catch here is that with an N of 6, the only S values acceptable to the program are 1 or 5, so it can't draw a six-pointed star, or any other star with an even number of points.

An interesting touch: as the sides of the star or polygon reach their maximum length while being drawn, they meet the circle-drawing pixel as it comes around the bend.

Jones gets the accompanying-notes prize for an extended explanation of how his program operates, preceded by a generalized examination of the problem. Among his notes are:

"One *could* draw the circle and *then* draw the polygram, but that seemed less fun than letting them grow together. The line segment meets the arc at the far end just as the arc gets there."

The notes lead up to the use of rotation matrices to draw the segments after the first one. One further note:

"Your prize should go to the person whose program is hardest to lead into roundoff error. That is *not* this program."

Figure 2. The legend beneath James Jones's star, which has an N/S of 5/2, is a "moving sign" that asks you to "hit a key to start again."

John Zvonar

Just outside the winners' circle is the entry by John Zvonar (Austin, TX). His opening display provides four options:

```
INPUT THE OPTION # AS LISTED BELOW
OPTION #1 SINGLE CIRCLE & STAR
OPTION #2 FIVE CIRCLES AND STARS
          ON POINTS
OPTION #3 FIVE CIRCLES ON POINTS
OPTION #4 RND CIRCLES
```

Select any of the four, and you're asked if you want black on white or not, then the radius, step size, and center coordinates. Option 2 provides a star in a circle, plus a circle around each of the five points, and a star within each of those five circles. Option 3 leaves out the five extra stars, and option 4 draws stars in circles of random size at random locations, one after another.

For black on white, Zvonar first paints the screen white, then draws the figure with black pixels. Figure 3 results from Option 3, with circles on the points, black on white, 4.7" circle, 0.1" increments, centered on the screen. However, as the photo (Figure 3) shows, the star sides are not equal in length, which is one of the few things that keeps this entry outside the winners' circle.

Zvonar sent solutions in both Level II and Level III Basic.

Three Winners

Three entries have such a variety of outstanding and different features that there's no way to choose only one of them as the winner. Look over the three, and pick your own.

Douglas Smyth

The first of the three winners is Douglas Smyth (San Simeon, CA), whose program asks for the radius of the circle in inches, a center point (whose given limits derive from the chosen radius), the number of vertices in the star (the number must be odd), degrees of clockwise rotation, whether there is to be shading in the star or not, and whether the figure is to be normal or reversed (black star in a white circle).

While the circle is being drawn, the legend in the lower right corner says

```
DRAWING
CIRCLE
```

and later, when the star segments are being drawn, a number indicates which segment is involved:

```
DRAWING
 SEG.
  1
```

When the drawing is finished, the corner legend says:

```
HIT ANY
KEY TO
RESTART
```

Figure 4 shows a Smyth circle of 3" radius, centered at 63,23, with a star of 15 vertices, 0 degrees rotation, shading in the star, normal (white on black). Although this figure looks nice, it takes forever to draw on the TRS-80.

Figure 3. John Zvonar's program draws circles around the points of the star, and will also draw stars within those circumferential circles, as well as draw black on white.

Figure 4. The sunburst star by Douglas Smyth has 15 vertices and is shaded in. It could optionally have been drawn black on white.

CIRCLE 237 ON READER SERVICE CARD

Figure 5. Program listing by Douglas Smyth. Note line 670.

```
40 REM ****************************
50 REM ** SOFTWARE CHALLENGE #2 **
60 REM ** STAR WITHIN A CIRCLE  **
70 REM ** DOUG SMYTHE   6/30/80 **
80 REM ****************************
90 'INITIALIZE PARAMETERS
99 '
100 DEFINT F-H,N-S,U-Y: FL=0: DIM X1(1),Y1(1), X2(1),Y2(1), DX(1),DY(1),
    M(1), X (1),Y(1)
110 CLS: INPUT "RADIUS (IN INCHES) ";R!
120 DX=63-15.9*R!: DY=23-6.8*R!: IF DX<0 OR DY<0 THEN 180
130 PRINT "CENTER POINT (X=";MID$(STR$(INT(63-DX+.5)),2);"-";MID$(STR$(INT
    (64+DX +.5)),2);
140 PRINT ", Y=";MID$(STR$(INT(23-DY+.5)),2);"-";MID$(STR$(INT
    (24+DY+.5)),2);") ";
150 INPUT CX,CY
160 R1=INT(R!*15.9+.5): R0=INT(R!*6.8+.5)
170 IF CX-R1>=0 AND CX+R1<=126 AND CY-R0>=0 AND CY+R0<=47 THEN 190
180 PRINT "* CIRCLE WON'T FIT ON SCREEN *": FOR X=1 TO 1200: NEXT: GOTO 110
190 INPUT "NUMBER OF VERTICES IN STAR";N: N=INT(N)
200 IF N<=3 OR N/2=INT(N/2) THEN 210  ELSE 220
210 PRINT"  * ERROR *  MUST BE ODD INTEGER GREATER THAN 3": PRINT "PLEASE
    RE-ENTER ";: GOTO 190
220 INPUT "DEGREES OF CLOCKWISE ROTATION";RF
230 IF RF>=180./N OR RF<= -180./N THEN PRINT "TOO MUCH... RE-ENTER ";:
    GOTO 220
240 INPUT "SHADE IN STAR (Y/N) ";F$
250 IF LEFT$(F$,1)="Y" THEN F=1 ELSE F=0
260 INPUT "REVERSE OR NORMAL";F$: IF LEFT$(F$,1)="R" THEN RV=1 ELSE RV=0
265 IF CX<64 THEN SP=56 ELSE SP=0
266 IF CY<24 THEN SP=SP+832
269 '
270 CLS: PRINT @SP, "DRAWING";: PRINT @SP+64, "CIRCLE";
275 FOR A=0 TO 6.3 STEP .06/R!
280  I=CX+R1*SIN(A): J=CY-R0*COS(A)
290  SET(I,J): IF RV=0 SET(I+1,J)
299 '
300 IF RV=1 THEN X1(1)=CX: Y1(1)=CY: X2(1)=I: Y2(1)=J: FL=1: GOSUB 390
310 NEXT
320 B7=180/3.141593: A=CX+SIN(RF/B7)*R1: B=CY-COS(RF/B7)*R0: Z1=180-180
    ./N: FL=0 : RV=1-RV
329 '
330 FOR I=1 TO N
340 PRINT @SP, "DRAWING";: PRINT @SP+64, " SEG. ";: PRINT @SP+129, I;
350 T=I*Z1+RF
360  C=CX+SIN(T/B7)*R1: D=CY-COS(T/B7)*R0: FL=0
370  X1(0)=A: Y1(0)=B: X2(0)=C: Y2(0)=D
380 '       SAVE PARAM. IN ARRAY FOR RE-ENTRY
390  DY(FL)=Y1(FL)-Y2(FL): DX(FL)=X1(FL)-X2(FL): IF DX(FL)=0 THEN 550
400 '       CALCULATE DIFF OF "X" AND DIFF OF "Y". IF VERTICAL, JUMP
410  M(FL)=DY(FL)/CSNG(DX(FL)): IF ABS(M(FL))>1 THEN 550
420 '       JUMP IF MORE VERTICAL (SLOPE>1)
430  FOR X=X1(FL) TO X2(FL) STEP -SGN(DX(FL)): X(FL)=X
440 '       LOOP FOR EACH "X"   MUST SAVE LOOPING VARIABLE TO RESTORE LATER
450   Y(FL)=M(FL)*(X(FL)-X1(FL))+Y1(FL)+.5
460 '       CALCULATE "Y"
470   IF RV=0 RESET (X(FL),Y(FL)) ELSE SET (X(FL),Y(FL))
480   IF FL=1 OR F=0 THEN 530
490   X1(1)=CX: Y1(1)=CY: X2(1)=X(FL): Y2(1)=Y(FL): FL=1: GOSUB 390 : FL=0
500 '       UPDATE THE ENDPTS. TO (FROM) CENTER TO PT. WE JUST DREW
510 '       SET FLAG (FL) TO SAY WE'RE RE-ENTERING SUBROUTINE
520   X=X(FL)
530  NEXT: GOTO 630
540 '       (550-620) IS SAME AS (410-530) ABOVE
550  M(FL)=DX(FL)/DY(FL)
560  FOR Y=Y1(FL) TO Y2(FL) STEP -(SGN(DY(FL))): Y(FL)=Y
570   X(FL)=M(FL)*(Y(FL)-Y1(FL))+X1(FL)+.5
580   IF RV=0 RESET (X(FL),Y(FL)) ELSE SET (X(FL),Y(FL))
590   IF FL=1 OR F=0 THEN 620
600   X1(1)=CX: Y1(1)=CY: X2(1)=X(FL): Y2(1)=Y(FL): FL=1: GOSUB 390 : FL=0
610   Y=Y(FL)
620  NEXT
630  IF FL=1 THEN RETURN '    IF DRAWING MINOR LINE, RETURN TO MAJOR
640 A=C: B=D: NEXT I
650 PRINT @SP, "HIT ANY";: PRINT @SP+64, "KEY TO";: PRINT
    @SP+128, "RESTART";
660 IF INKEY$>"" THEN 110  ELSE 660
670 REM ** NOTE: AUTHOR OF PROGRAM IS ONLY 15 YEARS OLD (!!)
```

In his notes, Smyth "would like to ... thank those Radio Shack managers and others from whom I solicited computer time, since I can't afford one myself." As the last line of the program (Figure 5) shows, Smyth was "only 15 years old" when he wrote it.

Smyth was one of the very few to send in line-by-line comments (Figure 6).

Ian Taylor and Jonathan Mark

The second of the three winners is the team of Ian Taylor and Jonathan Mark (Cambridge, MA), who sent in a machine-language routine "which only displays the required circle and star," and also a Basic program "which goes somewhat beyond the limits of the challenge."

The TRS-80 used didn't have a printer, so they "got a typed copy by copying the program off the screen, entering it into another computer (a DEC System-20), and typing it out."

The first display asks if you want a star (four to ten vertices), a regular polygon (three to ten vertices) or a "self-made figure." If you take the first or second choice, you're asked if you want a second figure; you can display one or two figures at the same time, two stars or two polygons or one of each, with or without the circumscribed circle (Figure 7).

Figure 7. Unique three-layer display by Ian Taylor and Jonathan Mark, displaying star with odd number of vertices, and circumscribed polygon and circle.

The program will draw a star within a circle, or a polygon within a circle, or a star within a polygon, or one star over another. This is one of the very few programs that will draw stars or polygons with an even number of sides, and the only one I remember that will draw an eight-sided polygon around a six-pointed star, for example.

You do not select the size or location of the figure; the program draws a figure about five inches in diameter in the center of the screen.

The idea of a self-made figure is that touch of genius that often separates winners from losers. Ask for item three on the first display, and you get

ATARI — Computers for people.™

800™ $699

410 Recorder	$59 00
810 Disc Drive	$444 00
822 Printer	$359 00
825 Printer	$629 00
830 Modem	$159 00
820 Printer	$269 00
850 Interface	$159 00
New DOS 2 System	$21 00
CX70 Light Pen	$64 00
CX30 Paddle	$18 00
CX40 Joy Stick	$18 00
CX853 16K RAM	$89 00
Microtek 16K RAM	$75 00
Microtek 32K RAM	$169 00
One year extended warrenty	**$50.00**

ATARI 400

16K.... $329
32K.... $478
48K.... $555

Intec 48K Board	**$249**

ATARI SOFTWARE

CX404 Word Processor	$119 00
CX404 PILOT	$68 00
CX413 Microsoft Basic	$68 00
CX4101 Invitation To Programing I	$17 00
CX4102 Kingdom	$13 00
CX4103 Statistics	$17 00
CX4104 Mialing List,	$17 00
CX4105 Blackjack	$13 00
CX4106 Invitation to Programing 2	$20 00
CX4107 Biorythm	$13 00
CX4108 Hangman	$13 00
CX4109 Graph It	$17 00
CX4110 Touch Typing	$20 00
CX4111 SPACE INVADERS	$17 00
CX4112 States & Capitels	$13 00
CX4114 European Countries & Capitals	$13 00
CX4115 Mortgage & Loen Analysis	$13 00
CX4116 Personal Fitness Program	$59 00
CX4117 Invitation To Programing 3	$20 00
CX4118 20 Conversational Languages (ea.)	$45 00
CX4121 Energy Czar	$13 00
CXL4001 Educational Master	$21 00
CX6001 17 Talk & Teach Series (ea.)	$23 00
CX8106 Bond Analysis	$20 00
CX8107 Stock Analysis	$20 00
CX8101 Stock Charting	$20 00
CXL4002 Basic Computing Language	$46 00
CXL4003 Assembler Editor	$46 00
CXL4004 Basketball	$24 00
CXL4005 Video Easel	$24 00
CXL4006 Super Breakout	$30 00
CXL4007 Music Composer	$45 00
CXL4009 Chess	$30 00
CXL4010 3-D Tic-Tac-Toe	$24 00
CLS4011 STAR RAIDERS	$39 00
CXL4012 MISSLE COMMAND	$32 00
CXL4013 ASTEROIDS	$32 00
CXL4015 TeleLink	$20 00
Visicalc	$149 00
Letter Perfect (Word Processor)	$109 00
Source	$89 00

commodore

CBM 8032 $1149

4016	$799 00
4032	$999 99
8096	$1795 00
CBM4022 Printer	$629 00
Tally 8024	$1699 00
CBM C2N Cassette Drive	$69 00
CBM4040 Dual Disk Drive	$1039 00
CBM8050 Dual Disk Drive	$1349 00
CBM 2031 Single Disc Drive	$525 00
CBM 8300 Letter Quality Printer	$1799 00
CBM 8023P 132 Column Printer	$799

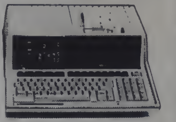
SOFTWARE

WordPro3 Plus	$229 00
WordPro4 Plus	$329 00
Commodore Tax Package	$399 00
Visicalc	$149 00
BPI General Ledger	$329 00
OZZ Information System	$329 00
Dow Jones Portfolio	$129 00
Pascal	$239 00
Legal Time Accounting	$449 00
Word Craft 80	$289 00
Create A Base	$249 00
Power	$89 00
Socket 2 Me	$20 00
Jinsem	$Call
MAGIC	$ Call

VIC 20 $259

Vic-TV Modual	$19 00
Vic Cassette	$69 00
Vic 6 Pack Program	$44 00
VIC1530 Commodore Datassette	$69 00
VIC1540 Disk Drive	$499 00
VIC1515 VIC Graphic Printer	$399 00
VIC1210 3K Memory Expander	$32 00
VIC1110 8K Memory Expander	$53 00
VIC1011 RS232C Terminal Interface	$43 00
VIC1112 VIC IEEE 488 Interface	$86 00
VIC1211 VIC 20 Super Expandar	$53 00
VIC1212 Programmers Aid Cartridge	$45 00
VIC1213 VICMON Machine Language Monitor	$45 00
VIC1901 VIC AVENGERS	$23 00
VIC1904 SUPERSLOT	$23 00
VIC1906 SUPER ALIEN	$19 00
VIC1907 SUPER LANDER	$23 00
VIC1908 DRAW POKER	$23 00
VIC1909 MIDNIGHT DRIVE	$23 00
VT106A Recreation Pack A	$44 00
VT107A Home Calculatron Pack A	$44 00
VT164 Programmable Character/Gramegraphics	$12 00
VT232 VICTerm I Terminal Emulator	$9 00

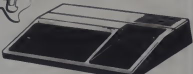
HEWLETT PACKARD



HP•85 $2595

NEW! HP•125	$3295 00
HP•83	$1795 00
HP•85 16K Memory Module	$249 00
5¼" Duel Master Disc Drive	$2129 00
Graphics Plotter (7225B)	$2079 00
Call for HP Software Prices & Information	
Call for Calculator prices	

Texas Instruments



TI-99/4A $379

PHC 004 TI 99/4 Home Computer	$399 00
PHP 1600 Telephone Coupler	$169 00
PHP 1700 RS-232 Accessories Intarface	$169 00
PHP 1800 Disk Drive Controller	$239 00
PHP 1850 Disk Mamory Driva	$389 00
PHP 2200 Mamory Expansion (32K RAM)	$239 00
PHA 2100 R.F. Modulator	$43 00
PHP 1100 Wired Remote Controllers(Pair)	$31 00
PHM 3006 Home Financial Decisions	$28 00
PHM 3013 Personel Record Keeping	$43 00
PHD 5001 Mailing List	$60 00
PHD 5021 Checkbook Manager	$16 00
PHM 3008 Video Chess	$60 00
PHM 3010 Physical Fitness	$26 00
PHM 3009 Football	$26 00
PHM 3018 Video Games I	$26 00
PHM 3024 Indoor Soccer	$26 00
PHM 3025 Mind Challengers	$22 00
PHM 3031 The Attack	$35 00
PHM 3032 Blasto	$22 00
PHM 3033 Blackjack and Poker	$22 00
PHM 3034 Hustle	$22 00
PHM 3036 Zero Zap	$18 00
PHM 3037 Hangman	$18 00
PHM 3038 Connect Four	$18 00
PHM 3039 Yahtzee	$22 00
PHM 3017 Terminal Emulator I	$39 00
PHM 3026 Extended Basic	$88 00
PHM 3035 Terminal Emulator II	$45 00

Call for the best prices on
PRINTERS
by Epson, Diablo, TEC and Tally.

DISKS
by Atari and Maxell.

NO RISK • NO DEPOSIT ON PHONE, C.O.D. OR CREDIT CARD ORDERS.

computer mail order

east
800-233-8950
501 East Third Street
Williamsport, PA 17701
(717) 327-9575

OVER 40 YEARS EXPERIENCE IN SOPHISITICATED ELECTRONICS

HOW TO ORDER:
Phone orders invited or send check or money order and receive free shipping in the continental United States. PA residents add 6% sales tax. Add 3% for VISA or MC. Equipment subject to price change and availability without notice.

west
800-648-3351
P.O. Box 6689
State Line, Nevada 89449

CIRCLE 148 ON READER SERVICE CARD

Challenge, continued...

```
ENTER THE ANGLE MEASURE OF THE POINTS, IN ORDER OF
CONNECTION, ACCORDING TO THE FOLLOWING CHART:
     180
      :         FOR OTHER POSITIONS, JUST GIVE AN
270 -:- 90   INTERMEDIATE NUMBER. THUS, THE UPPER
      :         RIGHT HAND CORNER IS 135.
      0
TO STOP AT THE POINT YOU JUST ENTERED (NOT CONNECT
IT TO THE NEXT POINT) ENTER A -2.
WHEN DONE, ENTER A -1.
ENTER NO MORE THAN 30 POINTS, PLEASE.
```

Figure 6. Program comments by Douglas Smyth. Note the comment on line 670.

```
--------------------------------------------------------------
                        INITIALIZE
100  DEFINT where allowable  (for speed), put FL at  top  of
     variable list, dimension  9  arrays  to  use  0  and 1
     subscripts.
--------------------------------------------------------------
                          INPUT
110  Enter radius (R!).
120  Check for legal radius.
130-140   Print   X-Y  ranges   for   center  point   (Note:
     MID$(STR$(INT(numeric   exp.)),2)  returns   a   string
     representation   of  #  with  no  leading  or  trailing
     blanks.
150-170   Input center (CX,CY), check if R1=radius in blocks
     horizontally, R0=radius in blocks vertically.
180  Indicate circle is too big.
190-210  Enter # of vertices (N), inform if illegal.
220  Enter rotation factor (RF) in degrees.
230  If it tilts  past another  vertex (in normal position),
     ask for re-enter.
240-250  Shade in?  F=1 for yes, 0 for no.
260  Reverse image (black on white)? RV=1 if yes, 0 if no.
265-266  SP=screen position to write messages at.
--------------------------------------------------------------
                          CIRCLE
270  CLS, tell human we're drawing a circle.
275   Start  loop. Step size for  circle  =  0.6/radius,  or
     .06/R!
280  Calculate X,Y co-ords of point (in I,J).
290  Turn it on.  If not reverse, SET the one  on its right,
     too.
300  If reverse,  draw  line  from center  pt. to  point  of
     circle just drawn.
310  NEXT A
--------------------------------------------------------------
                      SET-UP FOR STAR
320   B7=degrees-to-radians   conversion  factor.  Calculate
     first pt. (A,B) Z1=#  of degrees to  rotate  each loop,
     reset FLag, reverse  the reverse (star must be opposite
     shade of that of the circle).
330  Loop once for each segment of star.
340  Indicate in corner.
350  T=total no. of degrees rotated so far.
360  C,D =  co-ordinates of other-end pt.,  reset FLag again
     (each loop).
370  Retain original co-ords.
--------------------------------------------------------------
390  Difference of X and Y  co-ords. If vert. (diff of X=0),
     Jump to 'more vertical.'
410   M=slope.  If  more vertical,  go  to  'more  vertical'
     drawer.
430  Loop for each X.
450  Calculate Y.
470  SET or RESET, depending on ReVerse.
480  If fill-in  not  wanted, skip  next step. Skip  also if
     already in subroutine.
490  Save current  values,  set FLag,  draw line from center
     to most recent point.
520  Restore looping variable.
530  NEXT, skip over 'vert' drawer.
550-620  Just  like 410-530,  but  Xs  and Ys are exchanged,
     for verticality.
630  If this was a subroutine, RETURN.
--------------------------------------------------------------
640  Next 'start' point = previous 'end' point.
--------------------------------------------------------------
650  All done, so label.
660  Wait for key to be struck, then re-start.
670  I love to brag...
--------------------------------------------------------------
```

COMPUTER CENTER

31 East 31st Street • New York, N.Y.
(between Madison & Park Avenues)

480 Lexington Avenue • New York, N.Y.
(American Brands Bldg., between 46th & 47th St.)

presenting the LARGEST SELECTION OF SOFTWARE EVER ASSEMBLED...

for ATARI® • APPLE® • PET® • TRS-80® and other Microcomputers

at SUPER DISCOUNT PRICES!

ATARI
- ☐ MISSILE COMMAND (AT) ... 35.95
- ☐ ASTEROIDS (AT) ... 35.95
- ☐ SPACE INVADERS (AT) ... 35.95
- ☐ ASSEMBLER DEBUG (AT) ... 53.95
- ☐ BASKETBALL (AT) ... 35.95
- ☐ VIDEO EASEL-LIFE (AT) ... 35.95
- ☐ SUPER BREAKOUT (AT) ... 35.95
- ☐ MUSIC COMPOSER (AT) ... 53.95
- ☐ COMPUTER CHESS (AT) ... 28.00
- ☐ 3-D TIC TAC TOE (AT) ... 35.95
- ☐ STAR RAIDERS (AT) ... 44.95
- ☐ PADDLES (AT) ... 17.95
- ☐ JOYSTICKS (AT) ... 17.95

ADVENTURE INTERNATIONAL
- ☐ ADVENTURE #0 (AP,T) ... 6.25
- ☐ ADVENTURE (1,2,3) [D] (AP,T) ... 35.95
- ☐ ADVENTURE (4,5,6) [D] (AP,T) ... 35.95
- ☐ ADVENTURE (7,8,9) [D] (AP,T) ... 35.95
- ☐ ADVENTURE (10,11,12) [D] (AP,T) ... 35.95
- ☐ ADVENTURE (specify 1-12) (AP,T,AT) ... 17.95
- ☐ PROJECT OMEGA (T) [D] ... 22.50
- ☐ PLANETOIDS [D] (AP) ... 17.95
- ☐ MEAN CHECKERS MACHINE (T) ... 17.95
- ☐ DR CHIPS (T) ... 17.95
- ☐ KID-VENTURE 1 (AP,T) ... 17.95
- ☐ LUNAR LANDER (T,AT) ... 17.95
- ☐ MOUNTAIN SHOOT (AT) ... 8.95
- ☐ SLAG (T) ... 17.95
- ☐ STAR TREK 3.5 (AT,T) ... 17.95
- ☐ STAR TREK 3.5 [D] (T) ... 17.95
- ☐ SUNDAY GOLF (AT) ... 13.55
- ☐ ZOSSED IN SPACE (T) ... 17.95
- ☐ SILVER FLASH (T) ... 17.95
- ☐ SILVER FLASH [D] (T) ... 17.95
- ☐ MISSILE ATTACK (T) ... 17.95
- ☐ STAR SCOUT (T) ... 17.95
- ☐ GALACTIC EMPIRE (AT,T) ... 17.95

AVALON HILL
- ☐ MIDWAY (AT,AP,P,T) ... 13.50
- ☐ NUKE WAR (AT,AP,P,T) ... 13.50
- ☐ PLANET MINERS (AT,AP,P,T) ... 13.50
- ☐ CONVOY RAIDER (AT,AP,P,T) ... 13.50
- ☐ B1 BOMBER (AT,AP,P,T) ... 13.50
- ☐ LORDS OF KARMA (AT,AP,P,T) ... 18.00
- ☐ CONFLICT 2500 (AT,AP,P,T) ... 13.50
- ☐ TANKTICS (AT,AP,P,T) ... 21.50

SPECTRUM COMP.
- ☐ GALACTIC CHASE AT [D] ... 26.95
- ☐ GALACTIC CHASE AT ... 22.50

CRYSTAL COMP.
- ☐ WORLD WAR III AP, AT [D] ... 26.95
- ☐ GALACTIC QUEST AP, AT [D] ... 26.95
- ☐ WATERLOO AP, AT [D] ... 44.95
- ☐ HOUSE OF USHER AP, AT [D] ... 26.95
- ☐ QUEST FOR POWER AP, AT [D] ... 35.95
- ☐ FANTASYLAND 2041 AP, AT [D] ... 53.95
- ☐ SANDS OF MARS AP, AT [D] ... 35.95
- ☐ PROTECTOR AP, AT [D] ... 35.95
- ☐ FORGOTTEN ISLAND AP, AT [D] ... 35.95
- ☐ LASAR WARS AP, AT [D] ... 26.95
- ☐ IMPERIAL WALKER AP, AT [D] ... 26.95
- ☐ LITTLE CRYSTAL AP, AT [D] ... 35.95

EPYX-AUTOMATED SIMULATIONS
- ☐ TUESDAY QUARTERBACK [D] (AP,T) ... 26.95
- ☐ STAR WARRIOR [C,D] (AP,AT,T) ... 35.95
- ☐ THREE PACK [D] (AP,P,T) ... 45.00
- ☐ STARFLEET ORION [C,D] (AP,T) ... 22.50

If you don't see it listed, write... we probably have it in stock!

EPYX-AUTOMATED SIMULATIONS
- ☐ STARFLEET ORION [C] (P,T) ... 22.50
- ☐ INVASION ORION [C,D] (AP,AT,T) ... 22.50
- ☐ INVASION ORION [C] (P,AT) ... 22.50
- ☐ TEMPLE OF APSHAI [D] (AP,T) ... 35.95
- ☐ TEMPLE OF APSHAI [C] (P,T) ... 35.95
- ☐ DATESTONES OF RYN [D,C] (AP,AT,T) ... 17.95
- ☐ DATESTONES OF RYN [C] (P,AT) ... 17.95
- ☐ MORLOC TOWER [C,D] (AP,T) ... 17.95
- ☐ MORLOC TOWER [C] (P,AP) ... 17.95
- ☐ RESCUE AT RIGEL [C,D] (AP,AT,T) ... 26.95
- ☐ RESCUE AT RIGEL [C] (P,AT) ... 26.95
- ☐ HELLFIRE WARRIOR [D] (AP,T) ... 35.95
- ☐ HELLFIRE WARRIOR [C] (P) ... 35.95

BIG FIVE SOFTWARE
- ☐ ATTACK FORCE (T) ... 14.30
- ☐ GALAXY INVASION (T) ... 14.30
- ☐ METEOR MISSION II (T) ... 14.30
- ☐ SUPER NOVA (T) ... 14.30
- ☐ COSMIC FIGHTER (T) ... 14.30
- ☐ ROBOT ATTACK (T) ... 14.30

MED SYSTEMS
- ☐ DEATH MAZE 5000 (AP) [D] ... 15.30
- ☐ DEATH MAZE 5000 (T) ... 11.65
- ☐ LABYRINTH (T) ... 11.65
- ☐ RATS REVENGE (T) ... 11.65
- ☐ REALITY ENDS (T) ... 11.65

CALIF. PACIFIC
- ☐ ULTIMA (AP) [D] ... 35.95
- ☐ AKALAPETH (AP) [D] ... 31.50
- ☐ APPLE OIDS (AP) [D] ... 26.95
- ☐ FENDER BENDER (AP) [D] ... 22.50
- ☐ RASTER BLASTER (AP) [D] ... 24.00
- ☐ BUDGE'S SPACE ALBUM (AP) [D] ... 35.95
- ☐ BUDGE'S TRILOGY (AP) [D] ... 26.95

SUB-LOGIC
- ☐ 3D GRAPHICS (AP) ... 45.00
- ☐ 3D GRAPHICS [D] (AP) ... 53.00
- ☐ A-2 FS1 FLIGHT SIMULATOR (AP) ... 22.00
- ☐ A-2 FS1 FLIGHT [D] (AP) ... 29.00
- ☐ T80-FS1 FLIGHT SIMULATOR (T) ... 22.00
- ☐ 3D GRAPHICS (T) ... 26.50

SIRIUS SOFTWARE
- ☐ OUTPOST (AP) [D] ... 26.95
- ☐ EPOCH (AP) [D] ... 31.50
- ☐ SNEAKERS (AP) [D] ... 26.95
- ☐ GORGON (AP) [D] ... 33.00
- ☐ CYBER STRIKE (AP) [D] ... 36.00
- ☐ PHANTOM FIVE (AP) [D] ... 26.95
- ☐ SPACE EGGS (AP) [D] ... 24.00
- ☐ ORBITRON (AP) [D] ... 26.95

SIR-TECH
- ☐ WIZARDRY (AP) [D] ... 44.95
- ☐ GALACTIC ATTACK (AP) [D] ... 26.95

CAVALIER SOFTWARE
- ☐ ASTEROID FIELD (AP) [D] ... 22.50
- ☐ STAR THIEF (AP) [D] ... 26.95
- ☐ BUG ATTACK (AP) [D] ... 26.95

STRATEGIC SIMULATIONS
- ☐ SHATTERED ALLIANCE [D] (AP) ... 51.50
- ☐ COMPUTER BISMARCK [D] (AP,T) ... 51.50
- ☐ MAJOR LEAGUE BASEBALL [D] (AP) ... 31.50
- ☐ COMPUTER CONFLICT [D] (AP) ... 35.00
- ☐ COMPUTER NAPOLEONICS [D] (AP) ... 51.50
- ☐ COMPUTER QUARTERBACK [D] (AP) ... 35.00
- ☐ COMPUTER AIR COMBAT [D] (AP) ... 51.50
- ☐ WARP FACTOR [D] (AP) ... 35.00
- ☐ CARTELS & CUTHROATS [D] (AP) ... 51.50
- ☐ OPERATION APOCALYPSE [D] (AP) ... 51.50
- ☐ TORPEDO FIRE [D] (AP) ... 51.50

MICRO LAB
- ☐ CROWN OF ARITHIAN (AP) [D] ... 31.50
- ☐ DATA FACTORY (AP) [D] ... 130.00
- ☐ MINI FACT (AP) [D] ... 65.95
- ☐ DOG FIGHT (AP) [D] ... 26.95
- ☐ MAD VENTURE (AP) [D] ... 22.50

PERSONAL SOFTWARE
- ☐ DESK TOP PLAN II [D] (AP) ... 175.00
- ☐ VISICALC [D] (AT,P,AP) ... 170.00
- ☐ VISIDEX (AP) [D] ... 170.00
- ☐ VISIPLOT (AP) [D] ... 162.00
- ☐ VISITERM (AP) [D] ... 135.00
- ☐ VISITREND (AP) [D] ... 210.00
- ☐ VISIFILE (AP) [D] ... 220.00

MICROSOFT SOFTWARE
- ☐ ADVENTURE [D] (AP,T) ... 25.50
- ☐ ASSEMBLY DEVELOPMENT [D] (T) ... 85.00
- ☐ BASIC COMPILER [D] (T) ... 175.00
- ☐ EDITOR/ASSEMBLER (T) ... 25.50
- ☐ FORTRAN COMPILER [D] (T) ... 85.00
- ☐ LEVEL III BASIC (T) ... 44.00
- ☐ MuMATH [D] (T) ... 64.00
- ☐ OLYMPIC DECATHALON [D] (T,AP) ... 25.00
- ☐ OLYMPIC DECATHALON (T) ... 20.00
- ☐ TYPING TUTOR (AP,T) ... 13.55
- ☐ TYPING TUTOR [D] (AP) ... 22.50
- ☐ Z-80 SOFTCARD [D] (AP) ... 315.00
- ☐ 16k RAM BOARD (AP) ... 165.00

ON LINE SYSTEMS
- ☐ JAWBREAKER [D] AT ... 26.95
- ☐ SOFT PORN ADVEN [D] AP, AT ... 26.95
- ☐ HI RES ADVEN #0 [D] (AP) ... 17.95
- ☐ HI RES ADVEN #1 [D] (AP) ... 22.50
- ☐ HI RES ADVEN #2 [D] (AP,AT) ... 29.00
- ☐ HI RES ADVEN #3 [D] (AP) ... 31.00
- ☐ HI RES ADVEN #4 [D] (AP) ... 31.50
- ☐ HI-RES FOOTBALL [D] (AP) ... 36.00
- ☐ HI-RES SOCCER [D] (AP) ... 26.95
- ☐ HI-RES CRIBBAGE [D] (AP) ... 22.50
- ☐ MISSILE DEFENSE [D] (AP) ... 26.95
- ☐ SUPERSCRIBE II [D] (AP) ... 115.00

BRODERBUND SOFTWARE
- ☐ GALACTIC EMPIRE (AP) [D] ... 22.50
- ☐ GALACTIC TRADER (AP) [D] ... 22.50
- ☐ GALACTIC REVOLUTION (AP) [D] ... 22.50
- ☐ GALACTIC TRIOLOGY (T) [D] ... 35.95
- ☐ TAWALA'S REDOUBT (AP) [D] ... 26.95
- ☐ HYPER HEAD ON (AP) [D] ... 22.50
- ☐ GALAXY WARS (AP) [D] ... 22.50
- ☐ ALIEN RAIN (AP) [D] ... 20.00
- ☐ APPLE PANIC (AP) [D] ... 26.95
- ☐ ALIEN TYPHOON (AP) [D] ... 22.50
- ☐ SNOGGLE [D] (AP) ... 32.95

SYNERGISTIC SOFTWARE
- ☐ DUNGEON & WILDERNESS [D] (AP) ... 29.00
- ☐ DUNGEON [D] (AP) ... 15.75
- ☐ ODYSSEY [D] (AP) ... 25.00
- ☐ WILDERNESS [D] (AP) ... 18.00
- ☐ PROGRAM LINE EDITOR [D] (AP) ... 36.00
- ☐ THE LINGQUIST (AP) [D] ... 36.00
- ☐ HIGHER GRAPHICS II (AP) [D] ... 31.00
- ☐ HIGHER TEXT II (AP) [D] ... 31.00

SOFTWARE PUBLISHING
- ☐ PERSONAL FILING SYSTEM (AP) [D] ... 85.50
- ☐ PFS REPORT (AP) [D] ... 65.50

SENTIENT SOFTWARE
- ☐ 00-TOPOS (AP) [D] ... 29.70

TG PRODUCTS
- ☐ PADDLES (AP) ... 36.00
- ☐ JOYSTICKS (AP) ... 56.00

Check program desired.
Complete ordering information and mail entire ad.
Immediate Shipments from stock

Ship the above programs as checked to:

Mr./Mrs ______________

Address ______________

City ______________

State ______________ Zip ______

I have a ______________ (Name of Computer)

with ______________ K memory

CREAT. COMP/FEB. 1982

Number of Programs Ordered ... ______

Amount of order ... ______

N.Y. residents add Sales Tax ... ______

Add shipping anywhere in the U.S. **2.00**

Total amount enclosed ... ______

Charge my: ☐ Master Charge ☐ Visa

Signature ______________

Card No ______ Expires ______

Personal Checks please allow 3 weeks.

KEY:
AT-Atari
AP-Apple
P-Pet
T-TRS-80
C-Cassette
D-on Disc.
If not marked-Cassette

Mail to:

DIGIBYTE SYSTEMS CORP.

31 East 31st Street, New York, N.Y. 10016

OUTSIDE NEW YORK CALL TOLL FREE (800) 221-3144

IN NEW YORK CALL (212) 889-8130

Challenge, continued...

This permits drawing stars or polygons with equal or irregular sides. You can also create stars with as many points as you wish, although they begin to look messy beyond a dozen vertices, because of the limited resolution of the TRS-80 raster-scan graphics.

In the listing (Figure 8), lines 90, 300 and 1000 have been spaced to minimize line length; when entering these lines, delete the lengthy spacings. Note the unique use of a label at *both* ends of the listings, for rapid identification just in case the listing, which is two pages long, is cut in two.

In their covering letter, the authors write, "The program is quite simple: it fills an array (P) with the angle measure of each of the vertices (in polar coordinates), and then connects them. It stops when it finds -1 in the point array. When it finds a -2, it doesn't connect the subsequent point with the last one. This is necessary for stars with an even number of vertices."

Note that the program automatically selects "skip values" so that the angle at the star vertices is minimum.

You may find a small bug or two, depending upon what figure you ask for. The detecting and removal of these bugs is, as the textbooks put it, "left as an exercise for the student."

John Craig

The third of the three winners is John Craig (Anaconda, MT). (No, this isn't the John Craig who was the editor of *Creative* after I was; it's the John Craig who submitted one of the best responses to the first TRS-80 Software Challenge.)

The Craig program has several unique features. The first display flickers a rectangle alternately in front of CIRCLE and ELLIPSE, and asks you to

```
PRESS <ENTER> TO STOP
FLICKER NEAR YOUR CHOICE
```

The next display asks if you want to stay in the 2 to 5" diameter range. If you do, a slowly lengthening line, approaching a maximum of 2 1/4," is shown in the middle of the screen; you press ENTER when the radius is "what you want."

Figure 8. Program listing by Ian Taylor and Jonathan Mark. Note labels at both ends.

```
1 REM ********************************************************
2 REM ***    SOLUTION TO TRS-80 SOFTWARE CHALLENGE # 2     ***
3 REM ***                       BY                         ***
4 REM ***           IAN TAYLOR AND JONATHAN MARK           ***
5 REM ***                 CAMBRIOGE, MA.                   ***
6 REM ********************************************************
9 OIM P(30),P1(30)
10 CLS:GOSU8 300
15 INPUT "OO YOU WANT THE CIRCLE OISPLAYEO";A$
16 CLS:IF LEFT$(A$,1)="N" THEN 70
19 REM *** OISPLAY CIRCLE
20 FOR A=0 TO 6.28 STEP .02
30 8=42*SIN(A)+60.5
40 C=18*COS(A)+20.5
50 SET (8,C)
60 NEXT A
69 REM *** OISPLAY FIGURE (POINTS ARE IN P ARRAY)
70 M=1:FR=P(1)
80 M=M+1:T0=P(M)
90 IF T0=-1 THEN PRINT@ 0, "REAOY";:INPUT A$:
   IF A$="STOP" THEN CLS:ENO ELSE 10
95 IF T0=-2 THEN M=M+1:FR=P(M):GOTO 80
97 K=FR*.01745329:K1=T0*.01745329
100 Y1=18*COS(K)
110 X1=42*SIN(K)
120 Y2=18*COS(K1)
130 X2=42*SIN(K1)
150 GOSU8 400
190 FR=T0
200 GOTO 80
210 ENO
299 REM *** WHAT FIGURE OO THEY WANT?
300 PRINT "OO YOU WANT:":PRINT ,"1) A STAR":
    PRINT ,"2) A REGULAR POLYGON":PRINT ,
    "3) A SELF-MAOE FIGURE"
310 INPUT I
320 GOSU8 500:RETURN
399 REM *** ORAW LINE FROM (X1,Y1) TO (X2,Y2)
400 IF ABS(Y2-Y1)>A8S(X2-X1) THEN 460
410 Q=Y1
420 FOR X=X1 TO X2 STEP SGN(X2-X1)
430 SET (X+60.5,Q+20.5)
440 Q=Q+(Y2-Y1)/A8S(X2-X1)
450 NEXT X:RETURN
460 Q=X1
470 FOR Y=Y1 TO Y2 STEP SGN(Y2-Y1)
480 SET (Q+60.5,Y+20.5)
485 Q=Q+(X2-X1)/A8S(Y2-Y1)
490 NEXT Y:RETURN
499 REM *** FILL P ARRAY
500 ON I GOTO 600,700,800
599 REM *** USER WANTS A STAR
600 INPUT "HOW MANY VERTICES (4-10)";V
610 IF V<4 OR V>10 THEN 600
620 IF V/2=INT(V/2) THEN 660
630 FOR I=1 TO V
640 P(I)=(I-1)*(360/V)*INT(V/2)+180
650 NEXT I:P(V+1)=180:P(V+2)=-1:GOTO 1000
660 FOR I=0 TO 1:FOR J=1 TO V/2
670 P(J-(I=1)*(V/2+2))=(2*J-I)*(360/V)+180
680 NEXT J,I:P(V/2+1)=P(1):P(V/2+2)=-2
690 P(V+3)=P(V/2+3):P(V+4)=-1:GOTO 1000
699 REM *** REGULAR POLYGON
700 INPUT "HOW MANY VERTICES (3-10)";V
705 IF V<3 OR V>10 THEN 700
710 FOR I=0 TO V-1
720 P(I+1)=(360/V)*I+180
730 NEXT I:P(V+1)=180:P(V+2)=-1:GOTO 1000
799 REM *** USER CREATEO SHAPE
800 PRINT "ENTER THE ANGLE MEASURE OF THE POINTS, IN OROER OF"
810 PRINT "CONNECTION, ACCOROING TO THE FOLLOWING CHART:"
820 PRINT "     180"
830 PRINT "      :           FOR OTHER POSITIONS, JUST GIVE AN"
840 PRINT "270 -:- 90   INTERMEOIATE NUMBER. THUS, THE UPPER"
850 PRINT "      :      RIGHT HANO CORNER IS 135."
860 PRINT "      0"
870 PRINT "TO STOP AT THE POINT YOU JUST ENTEREO (NOT CONNECT"
880 PRINT "IT TO THE NEXT POINT) ENTER A -2."
890 PRINT "WHEN OONE, ENTER A -1."
895 PRINT "ENTER NO MORE THAN 30 POINTS, PLEASE."
900 I=0
910 I=I+1:INPUT P(I)
920 IF P(I)=-1 THEN RETURN
930 IF I=29 THEN PRINT "YOU ONLY HAVE 1 POINT LEFT."
940 IF I=30 THEN PRINT "THAT'S ALL, SORRY.":P(I)=-1:RETURN
950 GOTO 910
999 REM *** SECONO FIGURE?
1000 IF F9=1 THEN RETURN ELSE INPUT "OO YOU WANT
     A SECONO FIGURE";A$
1010 IF LEFT$(A$,1)="N" THEN RETURN
1020 FOR I=1 TO 20
1030 IF P(I)=-1 THEN M=I:GOTO 1060
1040 P1(I)=P(I)
1050 NEXT I
1060 F9=1
1070 GOSU8 300
1075 F9=0
1080 FOR I=1 TO 30-M
1090 P(I+M)=P(I)
1100 NEXT I
1110 FOR I=1 TO M-1
1120 P(I)=P1(I)
1130 NEXT I
1140 P(M)=-2
1150 RETURN
1200 '*******************************************************
1210 '***    SOLUTION TO TRS-80 SOFTWARE CHALLENGE # 2    ***
1220 '***                       BY                        ***
1230 '***           IAN TAYLOR AND JONATHAN MARK          ***
1240 '***                 CAMBRIOGE, MA.                  ***
1250 '*******************************************************
```

If you select an ellipse, you chose both horizontal and vertical radii by the same line-length method (Figure 9).

On the other hand, if you don't want to stay within the smaller-diameter range, the display permits choosing a radius of up to 3 1/8".

Whether you select a circle or an ellipse, you then "determine a center for your figure." Just to check you out, the display asks if you "want to keep it all on the screen for sure." If you do, you select the center by pressing ENTER when a wandering pixel is in the right place, first as it moves left and right, next as it moves up and down. The limits for this display depend upon the diameter chosen, and range from a large area down to 3" by 3". You get the small display area if you "want to keep it on the screen for sure," or the full area if not. If you don't want to keep all of the star on the screen, only part of it will be drawn, in a corner or on a side; there is no wraparound.

You're asked the

```
NUMBER OF POINTS
ON THE STAR PART
```

and

```
WHAT SEPARATION DISTANCE
N DO YOUR WANT
```

If, for instance, you select six points and an N of 4, the display says

```
BUT THAT WON'T DRAW
A 6-POINTED STAR ...
LET'S TRY AGAIN.
```

and you do until you get it right. However, the only value of N the program accepts for a six-pointed star is 1 or 5, meaning that it really can't draw a six-pointed star, but only a six-sided polygon.

If you choose more than 13 points for the star, the display says

```
WHEW!   I'LL GIVE IT A TRY ...
```

After you've selected a proper value for N, the display asks what orientation you want for the star (Figure 10), by asking if you want one of the points to be at the right, bottom, left, top or some other angle. If you want a particular angle, you're asked to give it.

After the program draws the figure (Figure 11), it ends with a very clever touch: the display flashes back and forth from black-on-white to white-on-black, until you press ENTER (or any other key) to run again.

John Craig's program (Figure 12) is accompanied by an "overview" (Figure 13). Note especially his "String Machine" subroutine, lines 1340-1440, with a "short video inversion routine." He also sent this "discussion of the star part":

"At first it might be assumed that only stars with an odd number of points can be drawn. Not so! For example, by connecting every third point, an eight-pointed star may be drawn. By using a rather large ellipse, the enclosed program draws a striking figure in this manner.

Figure 9. John Craig's program simplifies choosing the radii for circles and ellipses, without the use of numbers.

Figure 10. John Craig asks what orientation to give the star; you press ENTER when the flickering cursor pauses in front of your choice.

Figure 11. John Craig's nine-pointed star in an ellipse flashes back and forth between reverse and normal.

Figure 12. John Craig's program listing, with a "String Machine" subroutine in lines 1340-1440.

```
10 CLS: PRINT TAB(17)"* * *  CHALLENGE TWO  * * *
20 PRINT: PRINT: PRINT "THIS SOLUTION BY:
30 PRINT "JOHN C. CRAIG, 710 LOCUST, ANACONDA MT. 59711
40 PRINT: PRINT: PRINT: PRINT: CLEAR777
50 PRINT "PRESS <ENTER> TO STOP FLICKER NEAR YOUR CHOICE ...
60 PRINT@780, "CIRCLE": PRINT@800, "ELLIPSE"
70 F(1)=16130: F(2)=16150: F(10)=2
80 GOSUB 1300: E=F(0): CLS: PRINT@384, "";
90 PRINI "WANT TO STAY IN THE 2 TO 5 INCH DIAMETER RANGE ? ";
100 T$=INKEY$: IF T$="" THEN 100
110 IF T$<>"Y" THEN GOTO 130
120 XN=40: XN=16: YM=17: YN=7: GOTO 140
130 XN=55: XN=1: YN=23: YN=1
140 CLS: PRINT "PRESS <ENTER> WHEN ";
150 IF E=2 INEN PRINT "HORIZONTAL  RADIUS'";
160 IF E=1 THEN PRINT "RADIUS";
170 PRINT " IS WHAT YOU WANT ..."
180 X=64: Y=24: XR=XN
190 FOR I=64 TO 64+XN: SET(I,Y): NEXT I: SET(64+XN,Y)
200 XR=XR+1: IF XR>XN THEN XR=XN: PRINT@512, CHR$(30): GOTO 190
210 SET(X+XR,Y): FOR T=1 TO 20
220 IF INKEY$="" THEN NEXT T: GOTO 200
230 IF E=1 THEN YR=3*XR/7: GOTO 330
240 PRINT@0,CHR$(30);
250 PRINT "NOW <ENTER> FOR THE DESIRED VERTICAL 'RADIUS'..."
260 X=64: Y=24: YR=YN
270 FOR I=24 TO 24+YN: SET(X,I): NEXT I: SET(X,24+YM)
280 YR=YR+1: IF YR<YN+1 THEN 310
290 FOR I=25 TO 47: RESET(X,I): NEXT T
300 YR=YN: GOIO 270
310 SET(X,Y+YR): FOR T=1 TO 44
320 IF INKEY$="" THEN NEXT T: GOTO 280
330 FOR I=1 TO 123: NEXT T: CLS
340 PRINT "NOW WE NEED TO DETERMINE A CENTER FOR YOUR FIOURE."
350 PRINT "WANT TO KEEP IT ALL ON THE SCREEN FOR SURE ? ";
360 T$=INKEY$: IF T$="" THEN 360
370 MX= -(T$="Y"): CLS
380 PRINT " USE THE <ENTER> KEY TO STOP ME AT THE HORIZONTAL"
390 PRINT "(AND THEN THE VERTICAL) POSITION OF YOUR CHOICE ..."
400 XC=64: YC=24: XI=1: YI=0
410 XI= -SGN(XI): YI= -SGN(YI)
420 RESET(XC,YC): XC=XC+XI: YC=YC+YI: SET(XC,YC)
430 IF MX=0 THEN 460
440 SET(128-XR,48-INT(YR)): SET(128-XR,YR)
450 SET(XR,48-INT(YR)): SET(XR,YR): GOTO480
460 SET(127,47): SET(127,0)
470 SET(0,47): SET(0,0)
480 IF INKEY$< "" THEN 570
490 IF XI=0 THEN 530
500 IF MX=1 THEN IF XC 127-XR OR XC<=XR THEN 410
```

Figure 12, continued.

```
510 IF MX=0 THEN IF XC>126 OR XC<1 THEN 410
520 GOTO 550
530 IF MX=1 THEN IF YC>47-INT(YR) OR YC<=YR THEN 410
540 IF MX=0 THEN IF YC>46 OR YC<1 THEN 410
550 FOR T=1 TO -3*(XI<>0)-19*(YI<>0)
560 NEXT T: GOTO 420
570 IF YI=0 THEN YI=1: XI=0: GOTO 420
580 FOR T=1 TO 333: NEXT T: CLS
590 INPUT "NUMBER OF POINTS ON THE STAR PART"; P
600 IF P=INT(P) AND P>1 THEN 630
610 PRINT "PLEASE ENTER A POSITIVE INTEGER GREATER THAN 1"
620 PRINT "YOU KNOW ... 2,3,4,5,6  ETC.": PRINT: GOTO 590
630 IF P<13 THEN 660
640 PRINT "WHEW !    I'LL GIVE IT A TRY ..."
650 FOR T=1 TO 777: NEXT T
660 CLS: PRINT "A STAR IS DRAWN BY CONNECTING POINTS ";
670 PRINT "SEPARATED N POINTS"
680 PRINT "FROM EACH OTHER ...": PRINT
690 INPUT "WHAT SEPARATION DISTANCE N DO YOU WANT"; PS
700 IF PS>P THEN PS=PS-P: GOTO 700
710 IF PS<0 THEN PS=PS+P: GOTO 710
720 M=0: N=0
730 M=M+PS+P*(M+PS>=P): N=N+1
740 IF N>P THEN 790
750 IF M>0 THEN 730
760 IF N<P THEN 790
770 PRINT: PRINT "THAT SOUNDS OK TO ME ..."
780 FOR T=1 TO 555: NEXT T: GOTO 820
790 PRINT "BUT THAT WON'T DRAW A"P"POINTED STAR ..."
800 PRINT "LET'S TRY AGAIN."
810 FOR T=1 TO 777: NEXT T: CLS: GOTO 590
820 CLS: PRINT "USING <ENTER> TO CHOOSE, LIKE BEFORE ..."
830 PRINT "WHERE DO YOU WANT ONE POINT OF THE  STAR  TO BE ?"
840 PRINT@270, "RIGHT"
850 PRINT@334, "BOTTOM"
860 PRINT@398, "LEFT"
870 PRINT@462, "TOP"
880 PRINT@526, "OTHER ANGLE"
890 F(1)=15627: F(2)=15691: F(3)=15755: F(4)=15819
900 F(5)=15883: F(10)=5: GOSUB 1300
910 PA=(F(0)-1)*3.141593/2
920 IF F(0)<5 THEN 1010
930 F(0)=0: CLS
940 PRINT "THEN WHAT ANGLE DO YOU WANT ?"
950 PRINT "(0=RIGHT 90=STRAIGHT UP  ETC.)
960 PRINT@350, "";: INPUT PA
970 IF PA>360 THEN PA=PA-360: GOTO 970
980 IF PA<0 THEN PA=PA+360: GOTO 980
990 PA=360-PA
1000 PA=PA*3.141593/180
1010 CLS: PRINT@533, "OK ... HERE WE GO !!!"
1020 FOR T=1 TO 555: NEXT T
1030 ST=7*YR/3: IF XR>ST THEN ST=XR
1040 CLS: FOR T=0 TO 6.28319 STEP 1/ST
1050 XS=XR*COS(T)+XC: YS=YR*SIN(T)+YC
1060 IF XS<0 OR XS>=128 THEN 1090
1070 IF YS<0 OR YS>=48 THEN 1090
1080 SET(XS,YS)
1090 NEXT T: T2=PA: DA=3.141593*PS*2/P
1100 X2=XR*COS(T2)+XC
1110 Y2=YR*SIN(T2)+YC
1120 FOR I=1 TO P: T1=T2: T2=T1+DA
1130 X1=X2: Y1=Y2
1140 X2=XR*COS(T2)+XC
1150 Y2=YR*SIN(T2)+YC
1160 GOSUB 1170: NEXT I: GOTO 1340
1170 IF ABS(Y2-Y1)>ABS(X2-X1) THEN 1240
1180 FOR X=X1 TO X2 STEP 1+2*(X2<X1)
1190 YS=(Y2-Y1)*(X-X1)/(X2-X1)+Y1+.5
1200 IF YS<0 OR YS>=48 THEN 1230
1210 IF X<0 OR X>=128 THEN 1230
1220 SET(X,YS)
1230 NEXT X: RETURN
1240 FOR Y=Y1 TO Y2 STEP 1+2*(Y2<Y1)
1250 XS=X1+(X2-X1)*(Y-Y1)/(Y2-Y1)+.5
1260 IF XS<0 OR XS>=128 THEN 1290
1270 IF Y<0 OR Y>=48 THEN 1290
1280 SET(XS,Y)
1290 NEXT Y: RETURN
1300 FOR FI=1 TO F(10): FOR FJ=1 TO 53: F(0)=FI
1310 POKE F(FI),RND(16)+127
1320 IF INKEY$<>"" THEN RETURN
1330 NEXT FJ: POKE F(FI),128: NEXT FI: GOTO 1300
1340 CP=1+(YC>23)-959*(YC<24)
1350 A$="21003C0100047EFE2020023E80EE3F77230B78B120F0C9"
1360 FOR I=1 TO LEN(A$) STEP 2: L=ASC(MID$(A$,I))-48
1370 R=ASC(MID$(A$,I+1))-48: L=L+7*(L>9): R=R+7*(R>9)
1380 IF INKEY$<>"" AND TE=7 THEN RUN
1390 T$=T$+CHR$(16*L+R): NEXT I
1400 POKE 16526,PEEK(VARPTR(T$)+1)
1410 POKE 16527,PEEK(VARPTR(T$)+2)
1420 X=USR(0)
1430 PRINT@CP, "<ENTER> TO RUN AGAIN ";
1440 T$="": TE=7: GOTO 1350
```

Figure 13. John Craig's "program overview" of his listing.

```
10-40      Print heading type information.
50-80      Option: Circle or ellipse?  Uses "flicker" routine at 1300.
90-130     Option: Stay in the 2 to 5 inch diameter range?
140-330    Get horizontal radius via graphic technique.  If ellipse, then
           also get "vertical radius".
340-370    Option: Want figure to stay on the screen?  Otherwise we will
           let it hang off and draw just part of it.
380-580    Locate the desired center for the figure via graphic guidance
           system.  If figure is to stay on screen then the "window" of
           legal centers is restricted.
590-650    Option: Stars with N points may be drawn, see discussion on
           following page.
660-810    Option: Star can be drawn by connecting points at various
           separation distances from each other.  The following page
           explains more on this.
820-1000   Option: The star may have one point put at any angle you wish.
           Uses the "flicker" subroutine again.  See line 1300.
1010-1090  Draw the ellipse.  For a circle the XR and YR factors are
           chosen in the proper ratio.
1100-1160  Draw the star part.  Starting point is at chosen angle and
           the points are connected at the separation chosen.
1170 1290  Subroutine for drawing a straight line from any X1,Y1 to any
           X2,Y2 points. Useful for other graphics programs too.
1300-1330  Flicker entry subroutine for up to N choices. (1<=N<=9).
           F(10) is loaded with N.  F(1) through F(N) are loaded with
           the absolute video addresses (15360 for upper left corner, etc.)
           where each flicker is to appear.  Upon return from the routine
           F(0) contains the users choice number (1 to N).
1340-1440  My "String Machine" subroutine.  Useful for running relocatable
           object code programs.  A$ contains the hexadecimal code for
           a short video inversion routine in this case.  The use of
           "logical variables" helps simplify the hexadecimal to decimal
           conversions.
```

"Lines 690 to 810 of my program allow the user to choose the number of points as well as the connection distance for the star. Lines 700 to 770 analyze the choices to make sure that a legal 'star' will result. An example of an illegal star would be trying to connect every second point out of six, as a triangle would result and three of the six points would be unconnected.

"Because of the flexibility of this test you may try some rather unusual requests and find that they are legal. For instance, referring to a five-pointed star, connecting the points separated 2, 7, 13 or even -3 points apart results in drawing the same star! And, by using -2, 3, 8, etc., the same star will be drawn, but by connecting the points in the reverse order."

Conclusion

There you have it, three winners and nine runners-up. You might have chosen differently; my choices were based mainly on ingenuity and the variety of features.

There may be a third TRS-80 software challenge some day, but not right away, due to the recurrent attacks of lassitude brought on by this one.

As with the first challenge, this second one is not a contest; "there are no prizes, other than the satisfaction of writing a program that leads the TRS-80 through a complex task. Like virtue (or vice), the program is its own reward." □

Educational Excellence

Excellent educational software is the exception rather than the rule.

Excellence in educational software. It's not easily achieved.

Many large publishers have entered the computer software business. Many have flopped. Why? Because producing good software is not the same as producing a textbook.

These disks are protected in 3.2 DOS, no copying or muffining can be done

Tough Criteria

Good educational software must meet specific objects in the teaching/learning process. It must motivate and hold the attention of the students. It must not bore the gifted students nor be over the heads of slower students. It must be "user friendly" to both the teacher and student. And it must be accompanied by clear support material, worksheets and all the material necessary to use it effectively.

A tall order.

But one which MECC has met.

The Minnesota Educational Computer Consortium (MECC) was founded in 1973 with the goal of extending the benefits of computers to every school in the state. Over the years, MECC has developed procedures for finding and perfecting programs from contributors throughout the state.

Few Programs Qualify

Before a program is accepted for the MECC library it is judged on specific criteria. For example:

1) Accuracy ... Is all spelling and grammer correct? Does each question provide for a correct and appropriate response?

2) Audience ... Is the intended audience (grade level and subject) served by the degree of difficulty and scope of the program? Is the reading level of the text material suitable?

3) Clarity ... Are explanations and instructions sufficient, clear and straight forward? Is the presentation well-formatted?

4) Graphics ... Are the graphics appropriate and sufficient in quantity?

Other criteria include documentation, function, programming, and the like. Similar criteria are applied to the documentation. This insures that the reading level is appropriate, that objectives are well-stated and that associated materials are available.

What this all means is that the educational software packages from MECC are among the best available anywhere. They are pedigogically sound, throroughly tested and well documented.

Now the MECC software library is available to both schools and individuals through Creative Computing Software.

MECC software is currently available only on disk for the Apple II. All disks run under DOS 3.2 and require a minimum of 32K memory and Applesoft in ROM or an Apple II Plus.

Software using a printer uses the Apple serial, parallel or communications card.

Order Today

Order in confidence at no risk. All MECC software is covered by an unconditional 30-day money-back guarantee from Creative Computing Software.

To order any MECC software package, send payment plus $2.00 postage and handling to the address below. To charge an order to Visa, MasterCard or American Express include card number and expiration date. Charge orders may also be called in to our toll-free number. School purchase orders should add an additional $2.00 billing fee.

Order MECC software today for the highest quality and best value in educational software available anywhere.

Apple Demonstration Diskette
MECC-701, $19.95

A sample of the different kinds of applications available on the MECC diskettes is shown. The software demonstrates applications in drill and practice, tutorial, simulation, problem solving, and worksheet generation. Samples from music, science, social studies, industrial arts, reading and mathematics are provided.

Elementary—Volume 1 (Mathematics)
MECC-702, $24.95

The first elementary diskette contains programs to be used in the elementary mathematics classroom. Games of logic such as BAGELS, TAXMAN, and NUMBER, drill and practice programs, such as SPEED DRILL, ROUND, and CHANGE, and programs about the metric system such as METRIC ESTIMATE, METRIC LENGTH, and METRIC 21 are included on the diskette.

Elementary—Volume 2 (Language Arts)
MECC-703, $24.95

The teacher can enter lists of spelling words in the computer and have them used by the program SPELL, which drills students on the spelling, MIXUP which presents the word in mixed up order, or WORD FIND, which will create a word find puzzle for the teacher to duplicate. If words and definitions are entered, a CROSS WORD puzzle can be generated or a WORD GAME can be played. Two other programs included on this diskette are TALK, a program designed to introduce students to the computer or AMAZING which prints out worksheet mazes. Several programs on this diskette use a printer.

Elementary—Volume 3 (Social Studies)
MECC-704, $24.95

The sell series, SELL APPLES, SELL PLANTS, SELL LEMONADE, and SELL BICYCLES which appears on the ELEMENTARY VOLUME 3 diskette can be used to teach elementary economics to students in grades 3-6. CIVIL will reinact battles of the CIVIL war while STATES and STATES2 provide drill and practice on the location of states in the U.S. and their capitals.

Elementary—Volume 4 (Mathematics And Science)
MECC-705, $24.95

Two mathematics programs ESTIMATE and MATHGAME provide reinforcement on estimating and basic facts. Food chains in fish can be studied through ODELL LAKE while ODELL WOODS deals with food chains in animals. SOLAR DISTANCE teaches the concepts or distances in space and URSA provides a tutorial on constellations.

Elementary—Volume 5 (Language Arts)
MECC-719, $24.94

ELEMENTARY—VOLUME 5 deals with the reading concept of prefixes. The diskette contains five lessons which both teach the prefixes of UN, RE, DIS, PRE, and IN. Two review drills, DRAGON FIRE and PRE-APP II, are also contained on the diskette.

Elementary—Volume 6
MECC-725, $24.95

Historical simulations, OREGON, VOYAGEUR and FURS are included in the ELEMENTARY—VOLUME 6 diskette. Along with these programs are NOMAD which teaches map reading and SUMER.

Special Needs—Volume 1 (Spelling)
MECC-727, $24.95

This diskette is designed to drill handicapped students on frequently misspelled primary and intermediate words. Students answer problems by either using the game buttons, the game paddles or any key on the keyboard.

Science—Volume 2 (Senior High)
MECC-709, $24.95

Many of the programs on this diskette were developed by Minnesota teachers. PEST, which deals with the use of pesticides, and CELL MEMBRANE which the user takes the part of a cell membrane, can be used in biology classes. SNELL plots light refraction demonstrating SNELL's law while COLLIDE simulates the collision between two bodies. DIFFUSION deals with the diffusion rates of various gasses. NUCLEAR SIMULATION shows radioactive decay of nine different radioisotopes. ICBM and RADAR teach angles and projections on a coordinate system.

Science—Volume 3 (Middle School)
MECC-707, $24.95

The FISH program through the use of low resolution graphics show the circulatory system of a fish. Simulations like ODELL LAKE which is used to explore food chains, URSA which teaches about constellations, and QUAKES which simulates earthquakes are on the diskette. MINERALS can be used in the area of earth science to identify 29 minerals by having students perform simple tests.

Mathematics—Volume 1 (Senior High)
MECC-706, $24.95

BAGELS, SNARK, ICBM, and RADAR will teach students logic while reinforcing the concepts of plotting prints or angle measurements. ALEGBRA provides a drill and practice in solving equations. Three programs on the diskette can be used in plotting equations on a grid. SLOPE which is designed for use in ninth grade with linear functions, POLYGRAPH which will plot any equation on a rectangular coordinate system, and POLAR which graphs functions on polar coordinates.

Aestheometry—Volume 1
MECC-716, $24.95

Aestheometry teaches the topic of curves by viewing curves from two perspectives. The first method demonstrates the "space concepts" of elliptical, parabolic, and hyperbolic curves. Curve sketching designs are developed to provide an aesthetic view of geometric shapes. The second method uses a mathematical approach and defines a curve as the intersection of planes with a cone. The support booklet provides worksheets and classroom ideas.

Teacher Utilities—Volume 1
MECC-715, $24.95

The TEACHER UTILITIES diskette is designed to aid the teacher and would not be used by the student unless the teacher creates questions using the REVIEW program. This program allows the teacher to set up a list of questions which can be used either by the REVIEW program or the TEST GENERATOR program. The teacher can also make CROSS WORD puzzles, WORD FIND puzzles, BLOCK LETTER banners and POSTERS using this program. FREQUENCY and PERCENT can be used to calculate grades and to do statistical analysis. A printer is needed for some of the programs on this diskette.

Programmer's Aid—Volume 1
MECC-720, $32.95

The PROGRAMMER's AID diskette provides help for the programmer. Programs to be able to UPLOAD and DOWNLOAD to the MECC system, programs that work with text files including FP TO TEXT, RANDOM EDITOR, SEQUENTIAL EDITOR, and TEXT LIST along with programs to work with binary files, BINARY FILE INFO, BINARY FILE TO FP are included. Two programs TABLES and MERGE allow the user to create, change and merge graphic shapes for use in a program. FREE SPACE will tell the amount of space on the diskette while HIDDEN CHARACTERS will locate contol character. STARTER will put standard routines such as space bar, music, graphic characters or input into a user's program which is just being created or already created.

MICAS—Volume 1
MECC-721, $32.95

Microcomputer Integrated Computerized Accounting System requires dual disks and 132 characters width printer. The MICAS computerized accounting system provides a realistic experence with automated accounting systems. The package consists of four integrated systems. (1) general ledger, (2) accounts payable, (3) accounts receivable, and (4) inventory control.

Shape Tables—Volume 1
MECC-724, $24.95

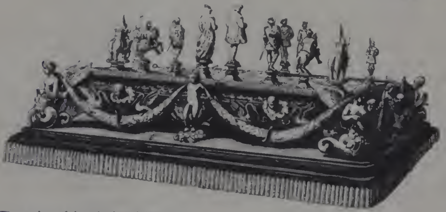
The SHAPE TABLES diskette includes 12 files of 187 shapes that can be incorporated in a user's program. Also included are aids needed to work with shape tables.

creative computing software

Attn: Faith
Morris Plains, NJ 07950
Toll-free **800-631-8112**
(In NJ 201-540-0445)

chess champp

Edgar F. Coudal



The author of the winning chess program in the second European Microcomputer Chess Championship characterizes himself as a "weakish club player," bought his first personal computer only a year ago, and copied the opening book into his tiny program straight from the pages of a paperback bought from a drugstore rack.

"Cyrus," the system written by Richard Lang of Olton, in England's West Midlands, won all five of its games in the 12-entry field, which included such popular and well-known systems as Gambiet 81, Philidor, and Chess Champion Mark V.

The quality of overall play in the tournament, which was held in the Cunard Hotel, London, in conjunction with the fourth Annual Personal Computer World Show, was put in perspective by Michael Stean, a British International Grandmaster who was on hand to analyze the games and comment on the play: "I've just returned from the junior championships," he said, "and these programs would have been a match for many of the players there."

For his win, Lang received £500, a chess set, and the travelling Centronic Trophy. Second place, worth £200, went to another home brew system, Advance 2.0, with third prize worth £100 going to a Dane, 19-year old Kaare Danielsen, playing yet another home-written system. Five commercial systems in the competition failed to place. Dead last was a system called Albatross 3.0 with a perfect 0 on the scoreboard. One wonders what versions 1 and 2 were like.

Edgar F. Coudal, 627 S. Crescent Ave., Park Ridge, IL 60068.

Lang, who wrote Cyrus in about six months of spare time after teaching himself to program, first in Basic, then in Assembler, is a 25-year old risk analyst for British Gas. He bought his personal computer—a Video Genie—less than a year before winning the tournament. The Video-Genie is a British TRS-80 look-alike. "The prize money will buy me disk drives," he said.

Lang decided to write a chess-playing program because it "seemed a good challenge, and the sort of the thing a computer should be able to do well." He said he started by studying the Spraklens' Sargon I and reading International Grandmaster David Levy's magazine articles on computer chess, then "took off from there." Perhaps Levy himself should go back and look at those articles. The two entrants he co-authored, Philidor and Philidor Experimental, each managed three of a possible five points, finishing in the middle of the pack.

"Starting almost fresh, as I did," Lang said, "is the best way of doing it. You're forced to think of your own way of doing things."

It was the first competition for Cyrus, and Lang admitted surprise at the way his program dispatched its opponents. "I had some idea of its strength," he said, "because I've played Sargon II and Gambiet 80 at home, and beaten them convincingly."

According to Stean, Cyrus is particularly strong in its ability to mount powerful coordinated attacks using numerous pieces, without the emphasis on the queen shown by many programs. Cyrus's endplay capabilities are a matter of conjecture; Lang noted, "he usually doesn't get that far before winning." All five games in the tournament were won in the middle game, with the only real fight coming in the opening match against Philidor Experimental.

His program, written in Z-80 assembly language, occupies just over 7K of memory, including an opening book table of 1.25K which "I took straight out of the Penguin paperback of chess openings." Cyrus's opening book contains only 450 moves, and "it gets out of the book rather quickly," he said, "except for something like the Ruy Lopez where it will play to nine moves for each side."

Cyrus has seven levels of play, with level 1 responding in a quarter of a second, and level 7, with its seven-ply search, taking "several hours per move. I've never actually played at Level 7," he said. "I haven't the patience, but perhaps it would be good for postal chess or something of the sort." Cyrus played at Level 5 during the tournament, with an average of about 105 seconds per move.

In explaining how the program operates, Lang said that it has a function which assigns a value to the possible board positions, and selects the move which will lead to the highest total, five moves ahead. "That total can range from 0" he said, "to...well, perhaps I better not say...I don't want to give too much away." He considers the speed and accuracy of that evaluation system to be the strongest part of the program.

In general terms, Cyrus uses a depth first alpha-beta search with the killer heuristic and employs selective "pruning" of the tree. The amount of "pruning" is increased in complex situations to keep the thinking time reasonably constant. Cyrus, he added, examines about 200 positions a second and includes an allowance for future captures in each assessment.

When last seen, Lang was fending off potential marketers while gathering his Video Genie and his mother and father, who had driven in for the tournament. His last comment was, "Cyrus Version 2 is almost finished. It will be considerably stronger. □

THE PERSONAL COMPUTER INDUSTRY:

Potato Chips to Panty Hose

Betsy Staples

Finke.

Gates.

"This year the personal computer market in the USA is about the same size as the total market for potato chips. If we continue at our annual fifty percent growth rate next year, in 1982, the personal computer market will be half the size of the pet food market. And plunging into 1983, the personal computer market should be creeping up on panty hose at $3 billion."

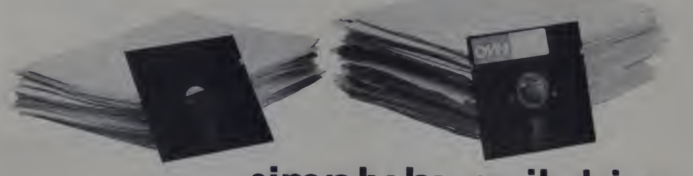
So began Commodore International President James Finke at the Boston Computer Society's forum on The Future of Personal Computers held during the Northeast Computer Show in Boston in October.

BCS President Jonathan Rotenberg once again astonished the industry by assembling probably the most impressive array of personal computing power ever to be gathered in one room: Peter Rosenthal, director of business planning and development for Atari; Philip D. Estridge, "the creator of the IBM personal computer"; Finke; William H. Gates, president of Microsoft; A.C. (Mike) Markkula, president of Apple; Jon Shirley, vice president of Radio Shack computer merchandising; and Nigel Searle, executive vice president of Sinclair Research.

If the showgoers and BCS members who packed the large auditorium were expecting a fight or an accidental pre-announcement, they were disappointed. For the most part, the leading lights of the industry agreed

Participants in the BCS Forum (left to right): Nigel Searle of Sinclair Research, William Gates of Microsoft, James Finke of Commodore, Peter Rosenthal of Atari, Jon Shirley of Radio Shack, Philip Estridge of IBM, Mike Markkula of Apple, and Jonathan Rotenberg of the Boston Computer Society.

Double your disk storage capacity...



simply by switching to Omni's new reversible disk.

If you have an Apple, TRS-80, Zenith, North Star or any other single-sided 5¼" disk drive, you can double disk capacity by simply switching to the Flip/Floppy disk from Omni. It works just like your present disks, except you can flip it over and record on the reverse side. So you can consolidate programs and files that used to require two disks. You can halve your disk requirements. And save money.

Each disk comes with some impressive specifications: They're certified error-free at more than twice the error-threshold of your system. Rated for more than 12 million passes without disk-related errors or significant wear. And precision fabricated with such standard features as reinforced hub rings.

Call Omni toll-free today. Get premium disks. Twice the capacity. A full money-back guarantee. Unbeatable price. And if you order a ten pack now, a free $5.00 storage case as well.

OMNI

Omni Resources Corp.
4 Oak Pond Avenue, Millbury, MA 01527
(800) 343-7620 In Mass. (617) 799-0197

Dealer inquiries invited.
Software Houses: We also offer duplicating and formatting services.

$26.00-Five pack
(Equivalent to 10 single-sided disks)

$50.00-Ten pack
(Equivalent to 20 single-sided disks)

Free
Protective plastic storage case with each 10 pack ordered by 3/31/82

Order toll-free (800) 343-7620.
In Mass. (617) 799-0197.

Send the following Flip/Floppy disks.
I understand they have a full 90 day money-back guarantee if I'm not completely satisfied.

System & model # ____________________

____ Five packs @ **$26.00** $________
____ Ten packs @ **$50.00** * $________
* includes plastic case
Shipping and handling $ 1.50
5% sales tax (Mass. only) $________
Total $________

____ Check (to Omni Resources) ____ C.O.D.
____ Master Card ____ Visa
Card # ____________________ Exp. ________
Name ____________________
Address ____________________
____
Tel ____________________

CIRCLE 204 ON READER SERVICE CARD

that the future would see some changes, but each had a slightly different view of what would change and how.

In addition to putting the size of the personal computer market in perspective, Finke stressed the importance of the consumer and the dealer in the growth of the market. As an example, he described a telephone conversation in which a customer's computer malfunction could be diagnosed and cured over the phone. Apparently "user-friendly" is still a byword at Commodore.

Space Invaders vs. VisiCalc

Rosenthal reiterated Atari's commitment to the home market and underscored the importance of games by comparing the total sales of Space Invaders (2.5 million copies) to sales of VisiCalc (150,000 copies). He also spoke at length about the potential for "electronic services," projecting uses ranging from job searches to software rental.

Markkula spoke about the ergonomics of the interface between the personal computer and "the broadest possible spectrum of users," and spoke optimistically about the standardization of hardware and software among computers manufactured by different companies.


Rosenthal and Shirley.

Down With Software Protection

In perhaps the most surprising and controversial statement of the evening, Markkula urged the elimination of software protection. The software pirates in the audience applauded.

He likened software publishing to traditional publishing, which, he said, "operates on the premise that the content does not determine the value. But rather the cost of manufacturing the media and the cost of distribution determine the value."

He believes that "as our industry matures, and as the volumes get large enough, we will head in that direction." He promised that Apple "will work as diligently as we can to try to eliminate the situation that we call software protection."


Markkula.

Rosenthal responded to Markkula's position with the statement that Atari "is taking a very strong position in trying to get some legislation enacted which will protect software legally—not just the code, but what appears to the end user, regardless of how one gets to that point."

"In the 80s, programming will be the most profitable, most rapidly growing, best investment in the industry."

Shirley, speaking from Radio Shack's perspective, added that "the one major cost in software that makes the software industry different from books and records and tapes is supporting the user. Because, until you reach the ideal situation where using a package is as easy as reading a novel, software is not going to be sold based on the cost of media."

Estridge began by acknowledging the past contributions of the personal computing "pioneers, several of whom are seated at this table with me." He echoed Finke's prediction that "ease of use for the end user and end user productivity will be the keys to success in personal computing the decade to come.

"In the 80s," Estridge said, "programming will be the most profitable, most rapidly growing, best investment in the industry, and the only way to succeed in this critical area is to treat programming and software, its product, as a serious business. The threat to this is copying; it has to stop and it has to stop now." The software manufacturers and authors in the audience applauded.

He discussed the future of programming, and concluded by asking "that programmers not forget that those of us who would like to use the machine don't feel obligated to understand it.'

Uncle Clive Cops Out

No one really believed that Clive Sinclair, president of Sinclair Research, Ltd., would show up for the forum as promised in the announcement, but a few of us, knowing Jonathan's incredible persistence, clung to that promise right up to curtain time.


Estridge.

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 10008 WASHINGTON, D.C.

POSTAGE WILL BE PAID BY ADDRESSEE

NRI Schools
McGraw Hill Continuing
Education Center
3939 Wisconsin Avenue
Washington, D.C. 20016

Now NRI takes you inside the new TRS-80 Model III microcomputer to train you at home as the new breed of computer specialist!

NRI teams up with Radio Shack advanced technology to teach you how to use, program and service state-of-the-art microcomputers...

It's no longer enough to be just a programmer or a technician. With microcomputers moving into the fabric of our lives (over 250,000 of the TRS-80™ alone have been sold), interdisciplinary skills are demanded. And NRI can prepare you with the first course of its kind, covering the complete world of the microcomputer.

Learn At Home in Your Spare Time

With NRI training, the programmer gains practical knowledge of hardware, enabling him to design simpler, more effective programs. And, with advanced programming skills, the technician can test and debug systems quickly and easily.

Only NRI gives you both kinds of training with the convenience of home study. No classroom pressures, no night school, no gasoline wasted. You learn at your convenience, at your own pace. Yet you're always backed by the NRI staff and your instructor, answering questions, giving you guidance, and available for special help if you need it.

You Get Your Own Computer to Learn On and Keep

NRI training is hands-on training, with practical experiments and demonstrations as the very foundation of your knowledge. You don't just program your computer, you go inside it...watch how circuits interact...interface with other systems...gain a real insight into its nature.

You also work with an advanced liquid crystal display hand-held multimeter and the NRI Discovery Lab, performing over 60 separate experiments. You learn troubleshooting procedures and gain greater understanding of the information. Both microcomputer and equipment come as part of your training for you to use and keep.

Send for Free Catalog... No Salesman Will Call

Get all the details on this exciting course in NRI's free, 100-page catalog. It shows all equipment, lesson outlines, and facts on other electronics courses such as Complete Communications with CB, TV/Audio and Video, Digital Electronics, and more. Send today, no salesman will ever bother you. Keep up with the latest technology as you learn on the latest model of the world's most popular computer. If card has been used, write to:

NRI Schools
McGraw-Hill Continuing Education Center
3939 Wisconsin Avenue
Washington, D.C. 20016.

We'll train you for the good jobs!

Training includes new TRS-80 Model III microcomputer, 6-function LCD Beckman multimeter, and the NRI Discovery Lab with hundreds of tests and experiments.

(TRS-80 is a trademark of the Radio Shack division of Tandy Corp.)

Future, continued...

After all, who in the U.S. has ever heard Uncle Clive speak on anything?

We needn't have worried; Sinclair "was detained in England today."

Nigel Searle was a worthy substitute, speaking on the consumer marketplace for personal computers. He began by stating that "there clearly is no consumer marketplace today."

Searle.

Agreeing with Rosenthal, Searle predicted that "the personal computer will become a mass market item when it has a communications capability," and that when that happens, most consumers will use it to deal with financial matters—banking, bill paying, and dealing with the government.

He warned, however, that govenment regulation and groups seeking to "protect" the consumer from invasion of privacy by computers could keep the full potential of personal computers to improve the quality of life from being realized.

Encore?

The conclusion of this year's BCS forum left us wondering what Jonathan will do for an encore—perhaps a panel on copy protection featuring confessed software pirates. □

Needless to say, far more was said in the 2-1/2 hour session than we reported here. The panel painted an insightful picture of how personal computer hardware and applications will evolve in the coming years. The role of the computer in society and its impact on individuals was also discussed at some length.

Two C 90 tape cassettes containing the entire forum—presentations, introductions, questions, answers and audience reactions—are available. The set of two cassettes in hard plastic boxes costs just $25.00 postpaid from Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07950. In a hurry? Order with your credit card by calling toll-free 800-631-8112 (in NJ 201-540-0445).

IF YOU'RE WAITING FOR THE PRICE OF WORD PROCESSORS TO FALL WITHIN REASON,

Everyone expected it would happen sooner or later...with WordPro PLUS™ It already has! Now all the marvelous benefits of expensive and advanced word processing systems are available on Commodore computers, America's largest selling computer line. WordPro PLUS, when combined with the new 80 column CBM 8032, creates a word processing system comparable to virtually any other top quality word processor available—but at savings of thousands of dollars!

New, low cost computer technology is now available at a fraction of what you would expect to pay. This technology allowed Commodore to introduce the new and revolutionary CBM 8032 Computer.

WordPro PLUS turns this new CBM 8032 Computer into a sophisticated, time saving word processing tool. With WordPro PLUS, documents are displayed on the computer's screen. Editing and last minute revisions are simple and easy. No more lengthy re-typing sessions. Letters and documents are easily re-called from memory storage for editing or printing with final drafts printed perfectly at over five hundred words per minute!

CIRCLE 251 ON READER SERVICE CARD

Our nationwide team of professional dealers will show you how your office will benefit by using WordPro PLUS. At a price far less than you realize.

Invest in your office's future...
Invest in WordPro PLUS.
Call us today for the name of the WordPro PLUS dealer nearest you.

Professional Software Inc.
166 Crescent Road
Needham, MA 02194
(617) 444-5224
TELEX: 95 1579

Word Pro is a registered trademark of Professional Software Inc.

Word Pro was designed and written by Steve Punter.

Courting the Digital Muse
—with a little help from microSpeed

James L. Hockenhull

Throughout history, art has been created with a mind-boggling variety of tools and materials including animal hair, ground-up minerals, vacuum-forming presses, mummy dust, cartridge casings, burnt wood, bulldozers, and thin air.

It should come as no surprise, then, that today some people believe that satisfying, evocative art can be made with computers. I am one of them. An artist by profession, with no particular background in science, I discovered computers almost by accident about three years ago.

In this article I will describe my general approach to art-making with a computer, and share some of the thoughts I've accumulated. My object is to inspire more minds to work on this fascinating business.

Art vs Graphics

To clear the air at the beginning, I think it is important to make a distinction between computer art and computer graphics. While the two fields share many of the same tools and methods, their ultimate aims are different. It is the nature of graphics (computer or otherwise) that no matter how "artistic" they may become, they are always done in the service of some goal external to themselves.

Graphics can convey information (by signs and symbols), clarify information (charts, graphs, and illustrations), liven up a dead space (the plague of "supergraphics" visited upon public places), and, of course, sell things (advertising and other forms of visual propaganda).

Art, on the other hand, while it may partake of some or all of these instrumental functions, presumably has some *terminal* function, some purpose in and of itself—art for art's sake, if you will. This is not the place (and I am not the person) to debate the sticky questions raised by all this. I do, however, think that the distinction has some truth to it.

Computer graphics is a well-established discipline, a branch of computer science. It is heavily dependent upon specialized, expensive equipment owned by large institutions. Computer art is unexplored territory, with the excitement, frustration, and danger of any frontier, and I am convinced it can be created on personal computers in the privacy of one's home.

It is important to make a distinction between computer art and computer graphics.

(Note: in the remainder of this article "graphics" will be used in its conventional sense, referring to things that make visual images, e.g. "graphics routines" or "turtle graphics." It will not refer specifically to the discipline of computer graphics.)

The Computer As Instrument

If you were to speculate on ways in which a computer might be used to make visual images, you would probably soon come upon the idea of manipulating input into a program which would transform it into suitable output. A joystick or light pen might be used to draw a picture on a video screen, for example. Since the computer would respond to what the operator is doing and the operator would respond to what the computer is doing, this would be an "interactive" approach. It uses the computer as an instrument to be guided by a human being.

While it is certainly useful for graphics applications, I do not feel that this is the most fruitful approach to art-making. If you want to use a computer interactively to create something akin to a traditional drawing, that is, a visual structure based on human experience, intricately organized and subtly executed, you will need more than a personal computer.

The Apple II high-resolution mode, as good as anything in its price range, deals with a screen 280 dots wide by 192 dots high. You can't even draw a smooth circle at that resolution much less a complex, convincing picture. For that you need access to one of those big, expensive graphics systems I mentioned, which means getting hooked up with a large institution. Access is not always easy, and most of the artists I know are put off by what they perceive as the white-coat-and-clipboard ambience of such places. They'd just as soon buy a stick of charcoal and do their own drawing.

The Computer As Composer

What if, instead of trying to interact with the computer, we designed a program which required no input at all to produce visual images? Such a program could be the embodiment of rules, principles, or "heuristics" which would guide the computer in its development of art works. The program would be an *art idea* stated in a form which the computer could understand.

The long—perhaps endless—series of visual productions generated by the pro-

James L. Hockenhull, SW 205 Snowdrift Ct., Pullman, WA 99163.

Stop the Floppy Shuffle

Announcing
The David Hard Disk Subsystem

Compared to cassettes, floppies were the greatest thing since the integrated chip. But with increased applications, data bases, and speed requirements, a lot of business people are spending more time doing the "Floppy Shuffle" and less time doing work.

Now with Konan's David Hard Disk Subsystem you can have 32 times the storage of a mini-floppy in about the same amount of space. At a cost per megabyte that really makes sense, the David Subsystem is available for a variety of microcomputers.

So if you own a personal computer, check into the David Hard Disk Subsystem at your local dealer and stop doing the Floppy Shuffle. And if you want real timesharing capabilities, a networking card is available.

The David Subsystem is available immediately.

Toll-free Information Line

800-528-4563

KONAN™

KONAN CORPORATION
1448 NORTH 27TH AVE, PHOENIX, AZ 85009
(602) 269-2649, TWX/TELEX 9109511552

CIRCLE 294 ON READER SERVICE CARD

gram would be *implications* of that idea. This resembles the way a human artist works. When we speak of Picasso's Blue Period we are saying that the man had a guiding idea which, when set in motion, allowed him to produce a group of works, each unique, but all having a relationship to one another—each, in fact, an implication of his overall concept. The computer could be doing the same sort of thing, only tirelessly and much, much faster.

There need be no direct human control over the specific configuration of an image at any given moment. The computer could handle all that messy minutiae. The artist would be involved at a higher level, directing his or her attention away from the details of making an object, toward the details of the processes which lie behind (or above) object-making. To use a musical analogy: rather than being an instrument the computer could be a composer.

Procedures are the equivalent of the artist's skill and technical knowledge.

Oh Yeah?

Using the computer as a composer does not require any revolutionary techniques. Such programs already exist. You can easily write one yourself by following this sequence on a computer with graphics capabilities:

Program A

1) Get a random X coordinate.
2) Get a random Y coordinate.
3) Get a random color.
4) Plot a colored dot at X,Y.
5) Do the above 100 times.

Program A requires no input, follows a set of guiding principles, takes care of the details of specific configurations, and, if the random number generator is any good, won't repeat itself from run to run. The images produced will have a family resemblance. The machine will be in its "One Hundred Random Dots" Period. Granted, the rules embodied in the program are ridiculously simple but, on a primitive level, the computer is able to create new, unique things. Program A would be fascinating to watch—for about a minute and a half.

A slightly more sophisticated version could act as a simple kaleidoscope:

Program B

1) Get a random X coordinate on the left half of the screen.
2) Get a random Y coordinate.
3) Get a random color.
4) Plot a colored dot at X,Y.
5) Reflect the X coordinate over onto the right half of the screen.
6) Plot a colored dot there.
7) Do 100 times.

The rules of the program have been altered only slightly, but that alteration has introduced a strong ordering principle, the symmetrical arrangement of dots around a vertical axis. The ordering may well prove to be so strong and so easy to perceive that the visual production will be as dull or duller than those of Program A. It would then be up to the artist/programmer to continue development toward some interesting balance between order and chaos, predictability and surprise.

We are now looking at a very simple model of art making. We have the art idea (which, you will notice, is still formulated by a human being), we have a way to implement the idea, and we have art objects (well, visual images at least) which are implications of that idea.

Procedures and Planning

If we analyze Program B further, we see that parts of the program are about *how* to do things—the part that can plot a point and the part that can reflect a point. Let's consider them to be semi-autonomous little programming entities and give them nice, computerish names in capital letters: PLOT and REFLECT.

Other parts of Program B are concerned with telling PLOT and REFLECT *what* to do: where to plot a point, what color to make it, whether or not to reflect the point (always an affirmative decision in our example), and how many points to plot. The first two of these are stated very explicitly; the others are implicit in the structure of the program.

Planning is analogous to the ideas and overall sensibilities that put the artist's skills to work.

I call the "how" parts of the program *procedures*, the "what" parts *planning*. Another level of complexity has been added to our model of art making. Procedures are the equivalent of the artist's skills and technical knowledge; planning is analogous to the ideas and overall sensibilities that put the artist's skills to work.

Even in a program as trivial as Program B we have been able to lay the groundwork for an approach to thought and work that has a resemblance to the way a regular human artist thinks and works. The way is clear for the artist/programmer to try to "teach" new skills—new procedures—to the computer and to figure out plans of things to do with them.

Modularity

When we consider our procedures to be "semi-autonomous entities" we are thinking in terms of *modularity*, a habit that makes programming much easier. I would go so far as to say that the modular method is the only way in which a program of any significant complexity can be designed.

A *module* is written as a discrete piece of code, usually requiring the input of data from some other part of the program, producing new data as output or creating some other desired side effect. Once a module is working properly it can be treated as a "black box"; its inner mechanism can be ignored.

PLOT, one of our two procedures in Program B, is a module requiring screen coordinates and color as input, producing no output but having the effect of lighting up a dot on the screen. REFLECT has two parts, the first calculating a new X coordinate, the second issuing a call to PLOT. Modules, thus, can be used as building blocks for other modules. Complex procedures are built of simpler procedures which, in turn, are built of even simpler procedures until we reach the bottom-level modules, *primitives*, which finally do the work.

A graphics system needs three such primitives: the ability to move to any point on the drawing field without making a mark, the ability to do the same but plot a point there, and the ability to draw a line or *vector* between two points. (Actually, the line-drawing routine involves calls to the plotting function so it is at a higher level; we'll consider it a primitive anyway.) Using these basic procedures we could, for example, design a simple module which would draw a rectangle given the coordinates of its diagonally opposite corners; we might call it BOX. If, later on, we felt the need to draw a border around the limits of the drawing field we could design a module, BORDER, which would feed the coordinates of those limits to BOX. Simple, huh? And, if BOX works fine but BORDER doesn't, we know exactly where to look for the problem. Modular design lets us debug a program in much the same manner as following the troubleshooting keys in an automobile repair manual: if the right stuff is going into Unit X but the right stuff isn't coming out then something's wrong inside Unit X. Debugging a non-modular program is like looking at a car and seeing nothing but a pile of unrelated parts.

Languages, Basic and Otherwise

So far I've attempted to present an approach to art programming based on a

We don't give them the answer. We show them how to get it.

New Milton Bradley Educational Software.

At last: programs that really make your kids think.
Most software only offers your students drill and practice. They just stare at the computer and press keys. That's why it fails your class.

But with new Milton Bradley programs, they don't just stumble into the answer...they understand how they got it. The computer becomes a tutor: offering encouragement, giving them several tries, leading them step-by-step to the solution.

Clean, clear graphics make the lessons easy to follow, and engaging special effects make the learning fun.

Easy to use for both you and your students.
Just slip in the diskette. Students follow simple instructions; they don't need tutoring to operate the program.

Programs start with the basics and progress through a range of skill levels. Each unit is organized by specific topics, so the student who needs to tackle decimal remainders doesn't have to wade through long generalities about long division. That's why Milton Bradley software adapts so easily to your lesson plans.

Track their progress in seconds.
Milton Bradley has designed a streamlined management system. With a glance, you can see which skills each student has mastered and which areas need more work. Just follow the easy steps in our accompanying Teacher's Guide.

In addition, we've created reproducible activity sheets keyed to each skill. Now you can give more individual help to each student—on or off the computer.

Choose from seven units: **Division Skills; Mixed Numbers; Decimal Skills; Vocabulary Skills:** Prefixes, Suffixes, Root Words; **Vocabulary Skills:** Context Clues; **Punctuation Skills:** Commas; **Punctuation Skills:** Endmarks, Semicolon, Colon.

Only $44.95. For your Apple II computer.
Each unit, sold separately, costs only $44.95. It's designed for Apple II microcomputers in 6th, 7th, and 8th grade classrooms (required 48KRAM, in Applesoft® BASIC).

With Milton Bradley, your best students will be challenged. Your underachievers will get the help they need. And you'll have more time to do what you do best: teach.

For more information...
Call or write to Len Campagna. **Phone: 413-525-6411, ext. 2334. Milton Bradley, 443 Shaker Rd., East Longmeadow, MA 01028.** We'll send you our free brochure. Or contact your local microcomputer software dealer for a demonstration. Take advantage of learning tools that get honors in all subjects.

Milton Bradley Educational Software.
It's First Class.

MB
Key to Learning

CIRCLE 236 ON READER SERVICE CARD

Digital Muse, continued...

Figure 1. Painter 2.1: a typical image. The "skills" of the program lie in a group of procedural subroutines which can draw roughly-symmetrical shapes, assymetrical shapes, squiggly and straight lines. Painter is written in Apple Integer Basic.

Figure 2. Painter 3.0. In this later version the procedures have been expanded to include the production of closed curves; "transparent" shapes; tight, loose, and concentric outlines; and a kind of pseudo-shaping.

Figure 3. "The French Movie." The Painter procedures are called by a planning routine which uses them to draw a landscape and take it through seasonal variations. The exact configuration of the image varies from run to run.

Figure 7. "Faint Squares." An early program which uses the phenomenon of optical mixing to compensate for limited range of colors available on the Apple.

Figure 8.

Figure 9.

Figures 8 and 9. Veils.1. A work-in-progress based on the ideas in "Faint Squares" (Figure 8) but with an expanded set of procedures. The emphasis in this program is on the orchestration of events in time. Veils is written in microSpeed.

very general, highly simplified notion of how a human artist works, a hierarchy of modular procedures analogous to skills and techniques called into service by a high-level planning routine—the overall art idea. I will now discuss suitable languages in which to phrase these concepts. Discussing computer languages is like discussing religion or politics; I'll try to tread as lightly as possible.

My guess would be that most readers of *Creative Computing* are involved with small, personal computers. This, in turn, makes me venture that most readers who program do so in some dialect of interpreted Basic, the *de facto* standard language for home computers. Basic can be used to write programs based on the ideas I've outlined above, with subroutines as the modules. In 1979, using Apple Integer Basic, I wrote a series of art-generating programs, lumped under the family name of Painter, which were built around a cluster of procedural subroutines called up at appropriate times by a main planning routine. In fact, it was during the early stages of Painter's development that the notions of modularity and of the separation of planning and procedure came to me.

The subroutines carry out such art activities as drawing more-or-less symmetrical colored shapes, drawing tight or loose outlines around the shapes, drawing a squiggly line in the general direction of a point, and more. (See Figures 1 and 2.) Once the subroutines were developed I was free to write different "front-end" planning routines to see what effects they might have on the images produced.

I found, as I had expected, that I could achieve great visual variety from the same procedures, even turning my abstract Painter into a landscape painter in a light-hearted program entitled "The French Movie." (See Figure 3.)

Although modular programs can be written in Basic, the language is little help. Modularity does not seem to come naturally to Basic. For instance, subroutines are referred to by line number, the form being GOSUB (line number). The calling program is responsible for somehow generating the correct line number at the proper time. Various Basics have different provisions for this. Integer Basic, for example, permits the *computed GOSUB* which allows the substitution of an arithmetic expression for an actual line number—the computer can calculate a line number on the spot. The computed GOSUB is useful if treated with respect, but it is awfully easy to compute oneself off into the great Programming Void. Applesoft—Apple floating-point Basic—disallows it, providing instead the ON...GOSUB statement of the form: ON (arithmetic expression) GOSUB (line number), (line number), (line number),... where the expression must take on a value corresponding to the position of the desired subroutine in the list of alternate line numbers. I find this statement so unaesthetic that, to the best of my knowledge, I have never used it.

Be that as it may, the point here is that subroutines are *location dependent*, meaning that if they must be expanded beyond their allotted slots in the program or moved somewhere else, lots of adjustments must be made, and that a great deal of programming effort will be spent worrying about line numbers when it could better be spent worrying about ideas.

Parameter Passing

Another hindrance to effective modular programming in Basic lies in *parameter passing*, the business of getting the proper data to the module. In a simple dialect of the language, such as Integer Basic, there is really only one way to do this: have the calling routine assign the correct value to a variable and have the called subroutine use that variable in its operation. All Basic variables are *global*, that is, all parts of the program have access to them. It is very easy to lose track of which values are actually being passed to a subroutine, or even which variable names are in use. A distant part of the program may be having some undetected effect on a variable, leading to many happy hours of debugging.

But look at a statement such as the Integer Basic "RND()." RND(n) produces a random integer in the range 0...n-1. There can be no doubt about the value being used by RND() because it is explicitly stated between the parentheses. RND() is a true *function* requiring an *argument list* (in this case the single integer in parentheses) and returning a *value*. It requires a certain kind of input and produces a certain kind of output.

Functions are a part of the set of commands of any Basic, but they cannot be written in all versions of the language. Where they can be written, they must be kept small, sometimes limited to a single argument and one program line. A computer language is itself a program, but in Basic there is a distinct difference between the way in which the language is written and the way in which programs can be written in the language. This is not true for all computer languages, as we shall see later.

Running Speed

A third problem related to Basic modularity is that of running speed. In 1980 I wrote a series of programs, again in Integer Basic, which created black and white line drawings on the screen by remembering past actions and basing future decisions on that information. (See Figures 4 and 5.) The procedure modules performed such tasks as checking to see if an area of the screen had already been occupied and updating the program's internal representation of the condition of the screen. The planning routine was a formulation of a set of rules governing behavior under all relevant situations.

Figures 4 and 5. Smartsketch does line drawings by remembering its past actions and basing subsequent decisions upon that information, guided by a set of rules which govern behavior under all relevant screen conditions. Slight changes in the rules cause great differences in the drawings, as seen in these two versions of the program.

Slight modifications of the rules often produced great changes in the appearance of the drawings. I am still quite pleased with the program—except that it runs like cold molasses. I want my art programs to be entertaining to watch in action; I don't believe that people will sit quietly for 10 or 15 minutes watching a black line meander around a white screen, no matter how "intelligent" its meanderings may be.

Not only is interpreted Basic slow-running, it gets slower as your programs become more elaborate and sophisticated. You pay a speed penalty ("run-time overhead") for the overall length of the program, for the length of variable names, for the number of variables used, and for the number of comments (REMarks). Speed is affected by the location of routines within the program and of variables within the variable table. This all means that the more modular your program is, the slower it will run.

"It's my pocket computer."

I want my art programs to be entertaining to watch in action.

After several years of experience I am convinced that if you set out to design a language to discourage good programming habits you would end up with something very close to interpreted Basic. (The speed problem is being alleviated by several Basic compilers now on the market. The structural weaknesses remain.)

Fortunately the days of the single-handed rule of Basic over the world of personal computers are coming to an end as more and more high-level languages are made available for small systems. Pascal is the most visible of these but other formidable contenders are making their appearance—powerful languages like LISP and C.

At present I am working with an intriguing language system called microSpeed, a well-integrated combination of software, based on Forth, with a hardware arithmetic processor. MicroSpeed allows, in fact demands, a strictly modular approach to programming. One begins with a system-supplied kernel of commands or modules called *verbs*. Programming consists of using these as building blocks to define new verbs—precisely what I have been describing here. Verbs defined by the user are treated with exactly the same importance as those supplied by the kernel. There is no discernible distinction between the language and what can be written in it. The microSpeed programmer actually designs a customized language for his own purposes.

Arguments (data) are passed to verbs through a *parameter stack*. A stack, one of the most basic data structures, is simply a pile of numbers, often likened to a stack of trays in a cafeteria. You can push a number onto the top of the stack and you can pull a number off the top. This is called a *last-in-first-out* (LIFO) structure. When a microSpeed verb needs an argument it uses whatever number happens to be at the top of the stack. Parameter passing involves making sure that the right

information is in the right place at the right time.

MicroSpeed is a compiled language rather than an interpreted one. (This is not *quite* true, but true enough for our purposes.) Compiled verbs are simply lists of the addresses of their component parts. Program interpretation runs like a thread down through the levels of these lists until it arrives at a machine-language primitive which does the job.

Among other things this means that microSpeed code takes up little room in memory and it runs very fast—faster still because of the hardware arithmetic processor. There is no run-time speed penalty to be paid for program length, length of variable names, location of verbs or variables within a program, nor for comments. A bit of overhead is accumulated with hierarchical depth, that is, with the number of levels through which verbs are used to define verbs, etc.

MicroSpeed code takes up little room in memory and it runs very fast.

MicroSpeed really shines in those situations, familiar to us all, when you find yourself saying "Why doesn't this #*%!! language have a command to (fill in the blank)?" My Basic programs made extensive use of the Integer Basic RND() function, described earlier. The microSpeed kernel doesn't provide such a verb. No problem. I simply defined (wrote) a verb called RANI (*RAN*dom *I*nteger) which takes a single integer as an argument, gets a random floating-point number between 0 and 1 by calling a system verb, multiplies the two together, converts the product to an integer and returns it at the top of the stack.

My 10 RANI works exactly like the Integer Basic RND (10) and I can make it a permanent part of my own customized language if I wish.

The example above points out one of the peculiarities of Forth-based languages. RANI will expect its argument to be on the top of the parameter stack, so the calling program must push that argument onto the stack before invoking RANI. Thus, arguments precede calls to verbs. My 10 RANI says: push 10 onto the stack

At first microSpeed has a kind of backwards feel to it.

then call the verb named RANI which will make use of it. At first microSpeed has a kind of backwards feel to it. (I should say here that if data on the stack is manipulated with excessive "cleverness" microSpeed's parameter passing may become as obscure as Basic's. The key word here is "may"; it doesn't have to.)

Let's look at an example of hypothetical microSpeed code:

```
RIGHTCONDITION?
IF
  NEWACTION
ELSE
  OLDACTION
THEN
```

Since IF is just another microSpeed verb—one which tests a condition—it should come as no surprise that the condition to be tested must be on the stack before IF is invoked. Here RIGHTCONDITION? is a verb which returns a truth value for that purpose. If this value is TRUE (not zero), then the verb NEWACTION will be called. Otherwise OLDACTION will be performed. THEN merely marks the end of the conditional structure. RIGHTCONDITION? may be a simple logical operator or it may be the top level of a vast mountain of programming; the same is true for NEWACTION and OLDACTION. It doesn't matter; they are black boxes.

Now suppose that RIGHTCONDITION? had originally been written to check 37 selected points on the screen and return TRUE if they were all orange. If we decide later that that's a dumb condition with which to be concerned, we could redesign the verb completely, perhaps making it check the time from a clock card. That change would make absolutely no difference to our IF...ELSE...THEN structure. The microSpeed verb modules provide the flexibility needed to revise and "tune" art programs.

So I finally have at my disposal a language that is modular, structured (there is no GOTO), compact, extensible, and very fast. It includes auxiliary verbs for high-resolution and turtle graphics, making it a very attractive package for art-making.

Walkin' the Turtle

In ordinary, run-of-the-mill computer graphics the basic entity is the point which has the two properties of *location* and *color*. In turtle graphics the point is replaced by an entity affectionately known as the "turtle." It has three properties: location, color, and *direction*. The turtle can be thought of as a little animal that can be walked around the screen or as a vehicle which can be turned in any direction and driven any distance on that heading. This seems to relate much more closely to the way an artist guides a drawing tool around a surface than does the system of Cartesian (X,Y) coordinates.

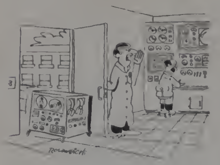
MicroSpeed turtle graphics verbs include MOVETO and TURNTO which perform moves to *absolute* locations or directions on the screen: ⟨x y⟩ MOVETO acts as a normal plot function, placing a dot at point (x,y); ⟨n⟩ TURNTO will point the turtle n degrees clockwise from "north," the top of the screen. The verbs TMOVE and TURN perform moves *relative* to the turtle's current position and heading: ⟨n⟩ TMOVE moves the turtle n units in its present direction, drawing a line in the process; ⟨n⟩ TURN changes the turtle's heading by n degrees, clockwise if n is positive, counterclockwise if negative. A triangle with sides of length 25 could be drawn by typing the sequence

```
 25  TMOVE
120  TURN
 25  TMOVE
120  TURN
 25  TMOVE
```

After a brief learning period with microSpeed, I altered the turtle graphics verbs to better suit my needs, which indicates how flexible and accommodating the language really is. I began by changing MOVETO so that it moved the turtle to a new X,Y position but did not plot a point there. Next, I replaced TMOVE with the verb FORWARD which made a relative move in the turtle's current direction but, unlike TMOVE, had the option of not drawing a line during the move.

To draw or not to draw is determined by the value of the variable PEN. If PEN is TRUE (non-zero) a line is drawn; if PEN is FALSE (zero) the move leaves no trace. The status of PEN can be controlled by the verbs PENDOWN (draw) and PENUP (don't draw).

I also added the verbs RIGHT and LEFT to supplement TURN. RIGHT is merely a renaming of TURN; LEFT first changes the sign of its positive argument



©CREATIVE COMPUTING

"It's the repair technician."


MUSE tm
SOFTWARE
"There is no game on the market like Castle Wolfenstein..."
-SOFTALK, October 1981.
CASTLE WOLFENSTEIN tm
For Apple II or Apple II Plus with 48K.
Copyright 1981 Muse Software, Inc.
Apple is a TM of Apple Computer, Inc.
CIRCLE 226 ON READER SERVICE CARD
Muse Software tm
347 N. CHARLES STREET
BALTIMORE, MD 21201
(301) 659-7212

to negative, then calls TURN, causing a counterclockwise move. To draw a triangle with sides of length 25 with my modified turtle commands we could enter:

```
PENDOWN
 25 FORWARD
120 RIGHT
 25 FORWARD
120 RIGHT
 25 FORWARD
```

Not only do the new verbs give increased flexibility to the turtle graphics routines but their names are more descriptive, clarifying the operation of the command sequence. Incidentally, I based these modifications on turtle graphics written in the Logo language, described by Seymour Papert in his book *Mindstorms: Children, Computers, and Powerful Ideas*. Some of my new verbs have since been incorporated into the microSpeed standard turtle graphics vocabulary.

On The Levels

Having a few years of Basic experience under my belt I have approached microSpeed programming slowly and methodically with an eye to my long-range needs, resisting the urge to plunge in and begin writing full-blown art programs. I began, as mentioned, by altering the turtle graphics verbs somewhat. Next, I wrote a *header file* to be used by all my future art programs. A *file* here refers to a bunch of uncompiled microSpeed *source code*, the stuff you actually write from the keyboard. A header file is one which will be compiled before another source file so that its modules may be accessed by the higher-level file.

I do not believe that a computer professional has a better chance of making good computer art than does a self-taught artist.

Mine includes some general-purpose utilities such as RANI, and declarations of certain universal variables and constants. For example, the variable XL will always represent the value of the left-hand edge of the present "window" or working area. The constant KXL always contains the absolute left-hand limit of the screen. (Constants differ from variables in microSpeed. In Basic, constants are just variables that are never supposed to be assigned new values.) Use of the header file permits an appreciable amount of standardization between my programs, which helps ease the chore of programming.

After writing the header, I put together a file of "graphic utilities"—procedures which are likely to be needed by many art programs. Included are simple verbs like BOX and BORDER and goodies like POLY which, given the arguments N and L, will draw an N-gon with sides of length L, centered on the turtle's current location, and WIGL which behaves like a slightly tipsy turtle attempting to move FORWARD. These files grow and change as my needs become clearer. They are providing a good, solid foundation on which to build my works of art. I have adhered to the principles of modular hierarchies throughout. (See Figure 6.)

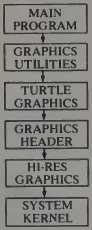


Figure 6. The hierarchy of modules used by the author to write art-generating programs in microSpeed.

But Where's The Art?

I begin work on an art program with an idea for either a procedure or a bit of planning. (I freely admit that procedural ideas are easier to come up with than are planning schemes. Learning how to do something is fairly straightforward compared to figuring out what to do with that knowledge.)

I might try to model some fundamental art-making activity such as drawing a wiggly line; the Painter programs developed from this approach. Or I may deal with some peculiarity of the computer as in my program "Faint Squares" which compensates for the limited range of colors available on the Apple by laying down veils of colored dots to be mixed optically by the viewer—Post-Impressionism for the 1980s. (See Figure 7.) Occasionally a planning idea will come first; Smartsketch is such a program. And sometimes a program will, itself, suggest ideas for new programs. (Figures 8 and 9.)

In any case, I have no fixed idea of how the images will look when I am finished. The surprise of seeing the myriad results of a routine when it is running is one of the pleasures I get from working with a computer. At that point I sit and watch, often for hours, getting the feel of what is happening, and noting where major changes or minor adjustments might be made.

Here, I think, is where computer art is most unlike computer graphics: the artist's goals can be changed as new possibilities and directions suggest themselves. The artist has the luxury of being able to say "Let's see what will happen if ..." (In my recent programming notes I find the phrase, "Desire for complex behavior from simple rules ... different from desire or need for "correctness.")

Here, too, is where computer art most resembles the ordinary kind: the final responsibility lies with the artist, his experiences, skills, sensibilities, and visions.

I do not believe that a computer professional has a better chance of making good computer art than does a self-taught artist, although the professional undoubtedly knows some very helpful stuff. I do not believe that high technology or high degrees of technical skill will automatically make high art. I do not believe that being able to play the banjo faster than Earl Scruggs makes you a better banjo player than Earl Scruggs. I do not believe that you need 1000 x 1000 screen resolution, 64 levels of gray scale, blinking bit-planes, and two million color choices in order to create art with a computer, although all those things might be nice.

I do believe that any tool has its limitations and that true skill lies in working within those limitations, turning them to your advantage.

Contrary to the opinion of what might be called the "art-treasure" school of thought, I do not believe that art is a property of objects. Rather, I think that art is a property of ideas. Objects are just spin-offs of ideas.

Conclusion

I have put forth a very general conceptual framework within which to develop programs for the generation of art. It should prove a useful starting point for those who want to tackle the problem. I have emphasized modularity and hierarchical levels of complexity organized around a clear separation of procedures from planning. Programs written in this manner are capable of squeezing a rich variety of images out of a central idea.

Nobody knows yet what computer art is or what it is capable of becoming. There are no rules, no Academies. It is a wide-open area waiting for imaginative exploration. I hope I have managed to sketch out a rough map and arouse interest in some potential pioneers.

The microSpeed Language System is a product of Applied Analytics Inc., 8910 Brookridge Dr., Upper Marlboro, MD 20870. The user's manual is available separately. □

THE creative computing software ARCADE

Super Invasion
Apple II (requires paddles)
licensed from Astar International
46K Diskette DOS 3.2 CS-4505 $19.95
16K Cassette CS-4006 $19.95
Sorcerer 16K Cassette CS-5011 $19.95
by Matt Hickey

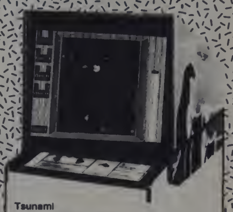
This is the original arcade game, with superb high resolution graphics, high speed action, nail biting tension, and hilarious antics by the moon creatures. Fifty five aliens whiz across the screen, quickening their descent, challenging you to come out from behind your blockades and pick them off with your lasers before they bomb you, destroy your shields, or drop down right on top of you.

Super Invasion by John Varela
32K TRS-80 Model I Diskette CS-3520 $19.95
16K TRS-80 Cassette CS-3020 $19.95

A low resolution, high speed arcade game similar to our Apple and Sorcerer versions. The aliens move back and forth across the screen, dropping ever lower to attack you as you attempt to destroy them with your lasers.

Blisterball and **Mad Bomber**
By Rodney McCauley
Apple II 46K Diskette DOS 3.2 (requires paddles) CS-4511 $24.95

A frantic, fast paced romp that can be played for hours, **Blisterball** is the first truly original arcade-type game for a home computer. As the bouncing balls drop from above, the player moves his laser base and tries to shoot them. It's easy at first—with just one ball. Then come two, then three. It's getting harder. Four balls come, and finally five. Surviving them, the player gets to shoot at inelastic bonus balls. If he makes it this far, the second round starts. The balls bounce lower, the walls close in. Shades of Poe and Newton! Making Superb use of Apple graphics and sound, **Blisterball** can be played by one or two people. **Mad Bomber**, included on the same disk, is another fast paced arcade game. Racks of bombs fill up above you. Whenever four bombs are in any rack, they start to fall. You can shoot them either in the rack or while they are falling, but since there are racks all across the top of the screen, you need to stay ahead of them to survive.



Tsunami
by Rodney McCauley
Apple II 46K Diskette DOS 3.3 (requires paddles) CS-4526 $29.95

Wave after wave of alien attackers attempt to overwhelm your defenses. Each wave comes in a different formation and uses different attack and defense strategies. You get dozens of superior arcade games combined into one program. If you ever master the first set of games on the diskette, where the attackers are without shields, then you are ready for the second set. This time the attackers are sheltered by shields. They can drop bombs right through the shields, but you cannot shoot through them. Successive waves use different strategies. Some move from shield to shield, allowing you to shoot while they are in between. Others just come out briefly to attack, and you must have fast reflexes to get them. Bonus points are awarded for beating the clock, with a countdown timer displayed on screen. This may be our finest arcade game ever!

Torax
by Erol Pekoz
Apple II 46K Diskette DOS 3.2 (requires paddles) CS-4520 $24.95

Defend your home planet against the invading Torids! Try to protect your nuclear fuel tanks, which the aliens are intent on stealing. The Torids drop down, steal a fuel tank and rise up to escape. They are also armed, and will not hesitate to shoot at you. While you whiz by the surface of your planet at incredible speed, you must avoid enemy fire, maneuver your ship, and try to shoot down the Torids without hitting the fuel tanks!

ICBM
Audio visual licensed from Atari, Inc.
32K TRS-80 Model I Diskette CS-3521 $19.95
16K TRS-80 Cassette CS-3021 $19.95

TRS-80 version of the popular arcade game where you must destroy incoming missiles with your own anti-ballistic missiles before they destroy your cities with nuclear warheads.

Order Today

To order any of these software packages, send payment plus $2.00 postage and handling per order to Creative Computing, Morris Plains, NJ 07950. Visa, MasterCard and American Express orders may be called in toll-free.

master charge · AMERICAN EXPRESS · VISA

Order today at no risk. If you are not completely satisified, your money will be promptly and courteously refunded.

Creative Computing Software
Morris Plains, NJ 07950
Toll-free **800-631-8112**
In NJ, 201-540-0445

TRS-80

Sorcerer **Apple II**

Kinetic Color Graphic Art for the Pascal Equipped Apple II

Ross M. Tonkens

One of the features for which I originally purchased my Apple II computer in 1978 was its color graphics capability. I wanted to master it both to satisfy my own scientific needs, and to scratch an artistic itch I had been feeling. When I recently bought a Language Card to teach myself Pascal, I likewise wanted to learn to exploit fully the Apple color graphics enhancements to standard UCSD Pascal.

The accompanying listing of the Apple/UCSD Pascal program, Stringart, resulted from a task I set for myself; I wanted to implement a well-defined graphics problem in Pascal. Stringart produces a fast, continuously evolving color graphics display according to parameters supplied interactively by the user. It is based on algorithms published elsewhere by Louis Ceza with a few new wrinkles of my own which allow the user to participate interactively in determining the general appearance of the patterns generated.

Briefly here is the way the program works. The user is asked to choose the maximum number of colored lines to be displayed at one time on the monitor screen from 1 to 200. He next decides what display mode he wishes, continuous display or mass erasure.

To clarify the distinction between these two modes, imagine you select 40 as the maximum number of lines you wish displayed on the monitor simultaneously. In the continuously evolving display mode the computer will draw 40 lines, then erase the first line before drawing the forty-first one. Thus never more than 40 lines are displayed at once. In the mass erasure mode the computer draws 40 lines, clears the entire screen, then starts over. Once again, never more than the user's specified 40 lines appear on the screen at once.

The computer picks a random color and uses it for a random number of lines. It then selects a new random color and uses it for a new random number of lines. The first line drawn has random end points. The second line has end points equal to those of the first plus a random offset value. This offset value is used for a random number of lines, then changed, and the new offset value used for a new random number of lines. If the end of a line would be off the video screen, that end point is reflected back into the view field.

Sound complicated? It really isn't, and a study of the accompanying commented Pascal listing should clear up any questions.

You don't have to understand the algorithms, though, to enjoy the results (See photographs).

So type in the program, and begin to experiment. The end result is a mesmerizing, continuously evolving kaleidoscope of Apple high resolution color through the interplay of user selected and randomly generated parameters. □

Ross M. Tonkens, M.D., Wilshire Heights Medical Group, 6221 Wilshire Blvd., Los Angeles, CA 90048.

About Variables

Great care was taken during program design to avoid side effects by minimizing the use of global variables. Whenever practical, values are passed to (and from) procedures and to functions as parameters. Where a local variable represents a global counterpart locally, that local variable is given a name similar to its global counterpart (e.g., ITERATION and ITERAYSHUN). While this practice is somewhat wasteful of memory, it avoids major debugging headaches caused by unforeseen side effects of procedures and functions.

TYPE COORDINATE

Purists would argue that a record for each line would be a more appropriate structure for storage of endpoints than a multidimensional array:

```
RECORD
  ONEEND       :  ENDPOINT;
  THEOTHEREND  :  ENDPOINT
END
```

where TYPE ENDPOINT = PACKED ARRAY [X..Y] of INTEGER

FUNCTION RNDOM(F1,F2:INTEGER):INTEGER

This function, when invoked with two integer values, F1 and F2, returns a pseudo random integer between F1 and F2 inclusive.

FUNCTION READPIXEL(XY:CHAR; N,I:INTEGER):INTEGER

This function returns either the x or y coordinate of one (of two) ends of the Ith line. It reads this coordinate out of the multidimensional array, T, in which it is stored. T is indexed by XY, N, and I. XY can assume values "X" or "Y" for x or y coordinate. N is of type WHICHEND and can assume values 1 or 2 since each line has two ends. For I := 0 to the user-specified maximum number of lines, endpoints for the "Ith" line can be read from the array, T, with the READPIXEL function. READPIXEL is used within nested loops which step through the indices (FOR XY := X to Y, FOR N := I to 2) of the Ith line to read coordinates out of the array, T, so they can be manipulated.

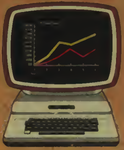
PROCEDURE SETUP(XY:CHAR; I:INTEGER);

This procedure initializes multidimensional arrays, T and DLTA, storing legal random values in the zeroth element. When invoked from within INITIALIZE (below), SETUP chooses random coordinates for the first line to which successive increments will be added by COMPUTECOORD (below). SETUP, when called from within DELTA (below), however, chooses a new set of random increment values to be added to successive line endpoints.

```
(*****************************************************************
*THIS PROGRAM GENERATES A CONTINUOUSLY EVOLVING KINETIC CULOR GRAPHIC *
*DISPLAY.  IT IS DESIGNED TO RUN IN THE APPLE II/UCSD OPERATING SYSTEM*
*SYSTEM ENVIRONMENT.  ATTEMPT HAS BEEN MADE, AS MUCH AS POSSIBLE, TO  *
*ISOLATE THE IMPLEMENTATION SPECIFIC DETAILS.  THE CORE ALGORITHMS ARE*
*VALID FOR ANY ENVIRONMENT.                                           *
*                                                                     *
*THE PROGRAM COULD BE EASILY EXPANDED TO ALLOW USER PARTICIPATION    *
*EITHER PROSPECTIVELY THROUGH SLELCTION OF PAROMETERS TO BE USED IN  *
*EXECUTION OR IN REAL TIME THROUGH JOY STICK INPUT.                   *
*                                                                     *
*INSPIRED BY AN ARTICLE BY LOUIS CESA IN 'BYTE', VOL 5, NOVEMBER, 1980*
*PP. 62-63.                                                           *
*****************************************************************)
(*$S+*)

PROGRAM STRINGART;

USES TURTLEGRAPHICS, APPLESTUFF;

CONST

CLRSCRN = 12;
MINX = 0; MAXX = 279;  (*THESE ARE CONSTRAINTS OF THE *)
MINY = 0; MAXY = 191;  (*THE APPLE II GRAPHICS DISPLAY*)
NOCOLOR = 0; WHIT2   = 7;
LOCOLOR = 1; HICOLOR = 5;
MINCNT = 0; MAXCNT = 50;   (*MAX # OF ITERATIONS OF A GIVEN COLOR*)
MINDELTA = -15; MAXDELTA = 15;  (*LIMITS ON COORDINATE INCREMENTS*)
LOKOUNT = 0; HIKOUNT = 50;  (*MAX# OF ITERATIONS OF A GIVEN DELTA*)
ITERLIM = 200;          (*MAX # OF ITERATIONS BEFORE ERASURE BEGINS*)

TYPE

XYTYPE = 'X'..'Y';
ABTYPE = 'A'..'B';
WHICHEND = I..2;
COLOURTYPE = NOCOLOR..WHIT2;
OLDCOLOURTYPE = NOCOLOR..HICOLOR;
COORDINATE = ARRAY['X'..'Y',WHICHEND,0..ITERLIM] OF INTEGER;
INCREMENT  = ARRAY['A'..'B',WHICHEND] OF MINDELTA..MAXDELTA;
OLDCOLOR   = ARRAY[1..ITERLIM] OF OLDCOLOURTYPE;


VAR

COLORCOUNT   : MINCNT..MAXCNT;    (*COUNTS # OF LINES OF A GIVEN COLOR *)
DELTACOUNT   : LOKOUNT..HIKOUNT;  (*COUNTS # OF LINES OF A GIVEN DELTA *)
T            : COURDINATE;        (*MULTIDIM ARRAY TO STORE COORDINATES*)
DLTA         : INCREMENT;
COLR         : COLOURTYPE;
OLDHUE       : OLDCOLOR;
MAXITERATION : 1..200;
ITERATION    : 1..201;            (*201 BECAUSE ITERATION BECOMES 201  *)
                                  (*BEFORE 'ROLL OVER'                 *)
CH           : CHAR;
FLAG,
CONTINUOUS,
PENOFF,
THATSALL     : BOOLEAN;


FUNCTION RNDOM(F1,F2:INTEGER):INTEGER;

(*GENERATES A PSEUDO RANDOM # BETWEEN F1 & F2 INCLUSIVE*)

(*VALUES ARE NOT EVENLY DISTRIBUTED, BUT FOR THIS      *)
(*APPLICATION IT'S GOOD ENOUGH AND MUCH FASTER THAN THE*)
(*ALGORITHM TO PRODUCE A MORE EVENLY DISTRIBUTED SAMPLE*)

BEGIN(*RNDOM*)
 RNDOM:= F1 + RANDOM MOD(F2 - FI + I)
END(*RNDOM*);



FUNCTION READPIXEL(XY:CHAR; N,I:INTEGER):INTEGER;

(*READS A SET OF COORDINATES OUT OF MULTIDIM ARRAY 'T'  *)

BEGIN(*READPIXEL*)
 READPIXEL:= T[XY,N,I]
END(*READPIXEL*);



PROCEDURE SETUP(XY:CHAR; I:INTEGER);

(*INITIALIZES ARRAYS*)

VAR

N      : WHICHEND;

BEGIN(*SETUP*)
 FOR N:= 1 TO 2 DO
  CASE XY OF
            'A','B': DLTA[XY,N]:= RNDOM(MINDELTA,MAXDELTA);
                'X': T[XY,N,I] := RNDOM(MINX,MAXX);
                'Y': T[XY,N,I] := RNDOM(MINY,MAXY)
  END(*CASE*)
END(*SETUP*);
```

Lead your own company in a game of corporate survival to become "Chairman of the Board".

Conglomerates Collide as you battle Multi-National corporations for world dominance. Land atop your own corporate headquarters and prepare to acquire growth companies, handle bankers and deal in world markets to build the value of your company. Pay close attention



to rapidly changing interest rates, earnings and the P/E ratio. Global news events that effect trade conditions will be reported to World HQ and challenge even the most clever of Presidents. At Decision Central you are on-line to 5 corporate data banks for ready access to vital information.

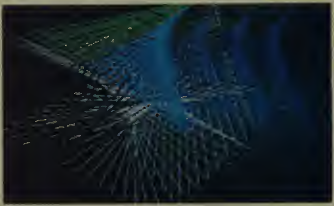
Each player's progress is instantly charted with RockRoy's exclusive color line performance graph (Illustrated). Easy to learn rules and 3 different game play options: solitaire, 2-4 players, or multiple computer opponents. For high scoring "Chairmen of the Board" each game disk comes with 3 entries to the RockRoy prize competition.

For your Apple* (48K, Disk with Applesoft in ROM) $39.95 includes shipping and handling. Visit your local dealer today. To order by mail send your check to RockRoy. VISA and M/C holders order by calling toll-free 800-528-2361 15 day money back guarantee.

ROCKROY INC.

7721 E. Gray Road
Suite 103
Scottsdale, Arizona 85260
Toll-Free 800-528-2361

CIRCLE 221 ON READER SERVICE CARD



PROCEDURE COMPUTECOORD (ITERAYSHUN:INTEGER)

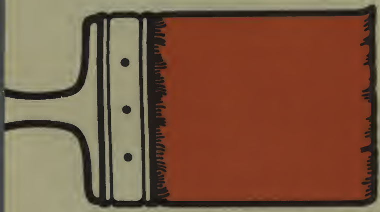
This procedure takes previous line endpoints, adds the selected increments to them, and stores the new endpoints back in the multidimensional array, T. It checks that the new endpoints are within the screen boundaries by invoking the procedure, BOUNDARY.

PROCEDURE DELTA

DELTA selects a random number of lines (DELTACOUNT) for which a given set of endpoint increment values will be repeated. It then decrements DELTACOUNT after each line until, when DELTACOUNT = 0, new increments are selected (by invoking SETUP), along with a new DELTACOUNT.

PROCEDURE BOUNDARY(VAR T,D:INTEGER; MIN,MAX:INTEGER)

This tests the new line endpoints generated by COMPUTECOORD for legality (Do they fall within the screen?), and reflects illegal endpoints back within the screen boundaries.



```
PROCEDURE COMPUTECOORD(ITERAYSHUN:INTEGER);

(*ADDS DELTA TO PREVIOUS COORDINATE AND PLACES NEW VALUE IN T*)

VAR

XORY           : XYTYPE;
WITCHEND       : WHICHEND;


   PROCEDURE DELTA;

   (*DECREMENTS DELTACOUNTER AND SELECTS NEW DELTA ON 0 COUNT *)

   VAR

   AORB         : ABTYPE;

   BEGIN(*DELTA*)
    IF DELTACOUNT [illegible] 0
     THEN
      BEGIN
       FOR AORB:= 'A' TO 'B' DO
        SETUP(AORB,ITERAYSHUN);
       DELTACOUNT:= RANDOM([illegible])
      END
     ELSE
      DELTACOUNT:= DELTACOUNT - 1
   END(*DELTA*);


   PROCEDURE BOUNDARY(VAR T,D:INTEGER; MIN,MAX:INTEGER);

   (*KEEPS LINES WITHIN SCREEN BOUNDS BY 'FOLDING BACK *)
   (*LINES WHICH EXTEND OFF THE SCREEN WITHOUT CLIPPING*)

   BEGIN(*BOUNDARY*)
    IF (T < MIN) OR (T   MAX)
     THEN
      BEGIN
       T:= T - 2 * D;
       D:= -D
      END
   END(*BOUNDARY*);


BEGIN(*COMPUTECOORD*)
 DELTA;
 FOR XORY:= 'X' TO 'Y' DO
  FOR WITCHEND:= 1 TO 2 DO
   IF XORY = 'X'
    THEN
     BEGIN
      T[XORY,WITCHEND,ITERAYSHUN]:= T[XORY,WITCHEND,ITERAYSHUN - 1]
        + DLTA['A',WITCHEND];
      BOUNDARY(T[XORY,WITCHEND,ITERAYSHUN],
                 DLTA['A',WITCHEND],MINX,MAXX)
     END
    ELSE
     BEGIN
      T[XORY,WITCHEND,ITERAYSHUN]:= T[XORY,WITCHEND,ITERAYSHUN - 1]
        + DLTA['B',WITCHEND];
      BOUNDARY(T[XORY,WITCHEND,ITERAYSHUN],
                 DLTA['B',WITCHLND],MINY,MAXY)
     END
END(*COMPUTECOORD*);
```

APPLE • ALTOS • ATARI • MAXELL • DYSAN • EPSON • CCS • SHARP • CASIO • HP • VERBATIM • MEMOREX • SOROC • CORVUS • ADDS

MICRO

BUSINESS WORLD INC.
Information Line (213) 996-2252
TOLL FREE MAIL ORDER LINES
(800) 423-5886 Outside Calif

HEWLETT PACKARD

Special Of The Month

LIMITED QUANTITIES

HP 83

OUR PRICE **$1399.00** Save 951.00
MSL 2250.00

HP DISC DRIVE SINGLE MASTER MODEL 82902M
OUR PRICE **$1099.00** Save 401.00
MSL 1500.00

COMPUTERS

apple computer

	List	Our Price
Apple II-16K	$1330.00	$ 999.00
Apple II-32K	1430.00	
Apple II-48K	1530.00	
Apple II-64K	1725.00	
Apple III 128 K	3915.00	2997.00
Apple II w/interface Dos 3.3	645.00	499.00
Apple II Disk II Drive Only	525.00	429.00

* Available in store ONLY.

HEWLETT PACKARD

	List	Our Price
HP 125 Microcomputer	3750.00	2990.00
HP 85 Microcomputer	3250.00	2475.00
HP 83 Microcomputer	2250.00	1777.00
16K Exp Memory Module	295.00	255.00
Graphics Plotter 7225	2450.00	2075.00
Personality Mod For 7225	750.00	665.00
2631B Impact/Printer/ Hvy Dty	3950.00	3250.00
Option 020 For 2631B	150.00	125.00
8 Drives to Choose from 82902S	1300.00	1125.00
9895A 8" Dual Drive	6850.00	5500.00
Graphics Tablet 9111A	2050.00	1678.00
HP 11C Slim-Line Advanced	135.00	
HP 12C Slim-Line Financial	150.00	
HP-41 CV New 2.2 Bytes Mem	325.00	250.00
HP-41-C Calculator	250.00	185.00
Card Reader For 41CV/C	215.00	162.00
Printer For 41CV/C	385.00	289.00
Optical Wand For 41 CV/C	125.00	97.00
Quad Ram Equals 4 Mem Mods	95.00	81.00
Memory Modules For 41C		25.00
HP-97 Programble Printer	750.00	595.00
HP-67 Programble Calculator	375.00	295.00
HP 34C Programble Scientific	150.00	117.00
HP-38C Programble Bus. R/E	150.00	117.00
HP 32E Adv Scientific	55.00	48.00
HP 37E Business Mgmt	75.00	57.00

commodore

	List	Our Price
8032-32K 80 Col Crt	1495.00	1097.00
4032 32K 40 Col Crt	1295.00	989.00
4016 16K 40 Col Crt	995.00	788.00
8050 Dual Disk 950K	1795.00	1344.00
4040-Dual Disk 343K	1295.00	989.00
C2N Cassette Drive	95.00	77.00
4022 80 Col Printer	795.00	639.00
8024 Mannesman Talley	1995.00	1545.00
2SCPS Starwriter	1895.00	1399.00
CBM-IEEE Modem	279.00	199.00
Voice Synthesizer	395.00	325.00
VIC 20	299.00	255.00
PET to IEEE Cable	39.95	34.00
IEEE to IEEE Cable	49.95	39.00

XEROX

	List	Our Pr
Xerox 820-1 5-1/4" Disk	2995.00	2399.00
Xerox 820-2 8" Disk	3795.00	2995.00
CP/M Operating System	200.00	169.00
Word Processing Software	500.00	429.00
Super Calc	295.00	249.00

ATARI PERSONAL COMPUTERS ATARI

	List	Our Price
400 16K Bytes of Ram	595.00	337.45
800 16K Bytes of Ram	1080.00	739.00
410 Program Recorder	90.00	77.00
810 Disk Drive	600.00	457.00
825 Printer (80 col Centronic 737)	999.95	769.00
820 Printer (40 col impact)	450.00	353.00
830 Acoustic Modem	200.00	155.00
850 Interface Module	220.00	192.00
Atari Visicalc	200.00	164.00
Atari 400 16K	595.00	327.00

TEXAS INSTRUMENTS

	List	Our Price
TI 99/4A Console New Improved	950.00	385.95
10" Color Monitor High Resolution	374.95	317.95
32K Memory Module	399.95	312.95
Speech Synthesizer	149.95	127.95
Disk Memory Drive	499.95	390.95
RF Modulator	49.95	42.50
Telephone Coupler (Modem)	224.95	185.95
Printer (Solid State)	399.95	315.95

	List	Our Price
ALTOS 8CS 8000-15	5990.00	4450.00
SHARP-64K Z80 FULL KBD YX-3200		CALL
NEC PC 8001	1295.00	1050.00

APPLE II STUDENT SYSTEM

- Apple II Plus System-48K RAM
- Disk II Floppy Disk & Interface (DOS 3.3)
- 12" Grn. Phs. Video Monitor

* Available in store ONLY.

SAVE $655

Our Price $1795

List $2450.00

PRINTERS

	List	Our Price
EPSON		
MX 80 FT	$ 745.00	$ 549.00
MX 80 IMPACT	645.00	450.00
MX 70 IMPACT	500.00	390.00
MX 100	995.00	765.00
APPLE SILENTYPE	645.00	299.00
ANADEX 9501	1650.00	1299.00
NEC		
5510	3195.00	2445.00
5515	3295.00	2545.00
3510	2495.00	1795.00
3515	2545.00	1849.00
OKIDATA		
MICROLINE 80	545.00	395.00
MICROLINE 82	649.00	549.00
MICROLINE 83	1050.00	769.00
PAPER TIGER		
445G with Graphics	795.00	695.00
460G with Graphics	1,394.00	899.00
560G New full size	1,695.00	1,139.00
DIABLO (LETTER QUALITY)		
630 R102 bi-directional tractors	2,965.00	2,350.00
1640K109 keyboard tractors	4,000.00	2,899.00
630 RO Receive Only	2,710.00	2,250.00
1650K 136 keyboard tractors	4,000.00	3,100.00

MONITORS

	List	Our Price
BMC Grn Phs 12"	275.00	165.00
NEC Grn Phs 12"	225.00	179.00
Zenith 12"	159.00	119.00

LE MONITOR	List	Our Price
* 9" B & W	179.00	159.00
* 9" Green Phs	189.00	165.00
* 12" B & W	209.00	185.00
* 12" Green Phs.	229.00	199.00
** 12" Green Phs.	199.00	159.00

* Anti Reflective Screen
** T.V Grade Screen

SANYO MONITORS	List	Our Price
13" Color (new) high quality	550.00	388.00
12" Green Phs	[illegible]	140.00
12" B & W	340.00	217.00
15" B & W	370.00	235.00
9" B & W The Best Seller!	235.00	145.00

1 Year Extended WARRANTY

$99.00

INQUIRE

$

XEROX 820

WORD PROCESSING SYSTEM (INCLUDES SOFTWARE)

MSL 3495.00 OUR PRICE $2649.00 Save 846.00

TERMINALS

TELEVIDEO	List	Our Price
910	$ 699.00	$ 599.00
912C	950.00	699.00
920C	995.00	795.00
950C	1,195.00	949.00

DISKETTES SOLD IN BOXES OF 10

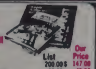
(Min. Purchase) $100

	List	Our Price
DYSAN PRICE PER DISKETTE		
104/1 5" SOFT SECTOR	6.00	3.99
104/1D " DBL DEN SOFT SEC	6.40	4.00
3740/1 8" SOFT SECTOR	7.25	4.75
3740/1D 8" DBL DEN SOFT SECTOR	10.75	6.00
MAXELL		
MD 1 5" SOFT SECTOR/DBL DEN	5.00	3.50
MD 2 " SOFT SECTOR/DBL. SIDE/DBL DEN	7.00	4.90
FD 1 8" SOFT SEC./DBL DEN	0.50	4.50
FD-1 8" SOFT SEC./DBL SIDE/DBL DEN	8.50	5.95

DRIVES

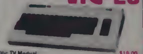
CORVUS	List	Our Price
5 MBYTES	3,750.00	$3,058.00
10 MBYTES	5,350.00	4,449.00
20 MBYTES	6,450.00	5,325.00

SOFTWARE FOR APPLE II



	List	Our Price
Apple Fortran	200.00	$ 147.00
DOS 3.3 (16 Sector)	60.00	45.00
Apple PILOT (16 Sector)	150.00	119.00
Apple FORTRAN (requires A2B0006) (16 Sector)	200.00	159.00
Language System with Apple Pascal	495.00	399.00
BPI General Ledger System	395.00	319.00
BPI Inventory Package	395.00	319.00
Visidex	200.00	159.00
Visicalc	200.00	159.00
Desktop Plan II	200.00	159.00
Microlab Database System	150.00	119.00
Stoneware DB Master	229.00	189.00
Muse Supertext II	150.00	119.00
Softape Magic Window	99.00	72.00

commodore VIC-20



Vic TV Modual	$19.00
Vic Cassette	$69.00
Vic Disk Drive	$ Call
Vic 6 Pack program	$44.00

MSL 299.00 OUR PRICE $255.00 Save 44.00

SOFTWARE FOR COMMODORE

	List	Our Price
Ozz The Information Wizard	395.00	$289.00
Wordcraft 80	395.00	289.00
Imo-Info Retrieval & Mgmt. Aid	495.00	389.00
Dow Jones Portfolio Mgmt.	149.00	119.00
Pascal Development Pkg.	295.00	219.00
Ebs-Receivables Inventory	750.00	569.00
Bpi-General Ledger	395.00	389.00
Word Pro 3-40 Column	250.00	175.00
Word Pro 4 80 Column	375.00	259.00
Word Pro 4 Plus	450.00	319.00

MODEMS

	List	Our Price
NOVATION CAT MODEM	[illegible]	[illegible]
NOVATION D-CAT	199.00	[illegible]
NOVATION APPLE CAT	349.00	[illegible]
HAYES MICROMODEM	379.00	[illegible]
HAYES SMARTMODEM	279.00	[illegible]

CALCULATORS

CASIO	List	Our Price
HR 10 Paper Feed	49.95	39.00
HR 12 Paper Feed	54.95	42.00
FR 100 Paper Feed	79.95	59.00
FR 1210 Paper Feed	129.95	99.00
PQ 20	29.95	23.00
LC 785	12.95	10.00
LC 3165	12.95	10.00
FX-68 Scientific	29.95	23.00
FX-81 Scientific	19.95	17.00
FX 3600P Scientific	39.95	29.95
FX-602P "Computer Talk" 88 Memories Programming Upper & Lower Case Dot Matrix 512 Step	129.95	99.00
FX 702P Solves Problems with Alpha-Numeric Clarity, uses Basic Language	199.95	159.00

TELE. ANSW. DEVICES

PHONE MATE	List	Our Pr
900	119.95	86.00
905 Remote	199.95	144.00
910	159.95	115.00
920	199.95	144.00
925 Remote	239.95	173.00
930 Remote	299.95	216.00
950 Remote	339.95	245.00
960 Remote	399.95	288.00

MICRO BUSINESS WORLD WAREHOUSE
MAIL ORDER
18720 Oxnard, #108 Tarzana, CA 91356
Telex: 182852
Answer: MICKO TZNA
OUTSIDE CA CALL TOLL FREE 1 (800) 423-5886 IN CA (213) 996-2252

Name (Please print) ____________
Address ____________
City ________ State ________ Zip ________

Qty	Make	Model	Description	Price	Total

TOTAL ORDER $ ________
TAX IF APPLICABLE* ________
SHIPPING & HANDLING** ________
TOTAL ENCLOSED $ ________

Certified Check or M.O.
Bank Wire Transfer
Allow 2 weeks clearance for personal check

VISA MasterCard

CREDIT CARD # ____________
Exp Date ____________ Signature ____________

MAXELL • DYSAN • EPSON • CCS • SHARP • CASIO • HP • VERBATIM • MEMOREX • SOROC • CORVUS • PERSONAL SOFTWARE • CCS

HP • D.C. HAYS MICROCOMPUTERS • PAPER TIGER • GTE • DIABLO • BMC • CENTRONIC • NEC • HAZELTINE • MEMOREX • AMPEX • PERSONAL SOFTWARE • ADDS • XEROX • DIABLO

GTE • PERSONAL SOFTWARE • PAPER TIGER • D.C. HAYS MICROCOMPUTERS • NOVATION • CANON • HAYDEN • HITACHI • VERBATIM • AMPEX • HAZELTINE • NEC • CENTRONIC • BMC

CIRCLE 230 ON READER SERVICE CARD

PROCEDURE DRAW

This is the master line drawing routine. First it checks to see which mode (continuous or mass erasure) is set through the Boolean flag, CONTINUOUS. In the continuous drawing mode the procedure first erases the oldest displayed line before drawing a new one. The Boolean variable, FLAG, is set to FALSE until the user-specified number of lines has been drawn. Thus, until FLAG becomes TRUE no lines can be erased. DRAW contains a mechanism for "wrap around" when the highest line number has been reached, and the first element of the line storage array must be accessed again. It is within DRAW that the distinction between continuous display and mass erasure modes is recognized.

PROCEDURE COLOR(IT:INTEGER)

COLOR selects a random high resolution color and a random number of lines to be drawn with that color (COLORCOUNT). It then decrements COLORCOUNT until, at COLORCOUNT = 0, a new random high resolution color is selected along with a new COLORCOUNT, and the whole process starts over.

PROCEDURE LINE(COLER,ITER:INTEGER)

LINE uses READPIXEL to transfer the endpoint coordinates of lines to the actual graphics routines which then draw them.

PROCEDURE ERASELINE

This procedure selects the proper "shade" of black to erase a previous line depending on what color the line was. (This is necessary because of the unusual way in which the Apple displays high resolution colors). It then invokes LINE to draw the previous line in black, thus erasing it selectively. ERASELINE is used in the continuous display mode only.

```
PROCEDURE DRAW;

(*MASTER DRAWING ROUTINE*)

VAR

ENDPOINT       : WHICHEND;
XXYY           : XYTYPE;




   PROCEDURE COLOR(IT:INTEGER);

   (*DECREMENT COLORCOUNTER AND SELECT NEW COLOR ON 0 COUNT*)

   BEGIN(*COLOR*)
    IF COLORCOUNT = 0
     THEN
      BEGIN
       COLR:= RNDOM(LOCOLOR,HICOLOR);
       COLORCOUNT:= RNDOM(MINCNT,MAXCNT)
      END
     ELSE
      COLORCOUNT:= COLORCOUNT - 1;
    OLDHUE[IT]:= COLR
   END(*COLOR*);

 PROCEDURE LINE(COLER,ITER:INTEGER);

 (*FINDS ENDPOINTS AND ACTUALLY DRAWS OR ERASES A LINE*)

 VAR

 X,Y            : ARRAY[1..2] OF INTEGER;


 BEGIN(*LINE*)
  FOR ENDPOINT:= 1 TO 2 DO
   BEGIN
    X[ENDPOINT]:= READPIXEL('X',ENDPOINT,ITER);
    Y[ENDPOINT]:= READPIXEL('Y',ENDPOINT,ITER)
   END;
  PENCOLOR(NONE);
  MOVETO(X[1],Y[1]);
  CASE COLER OF
                  0: PENCOLOR(BLACK);
                  1: PENCOLOR(WHITE);
                  2: PENCOLOR(GREEN);
                  3: PENCOLOR(VIOLET);
                  4: PENCOLOR(ORANGE);
                  5: PENCOLOR(BLUE);
                  6: PENCOLOR(BLACK1);
                  7: PENCOLOR(BLACK2)
  END(*CASE*);
  MOVETO(X[2],Y[2])
 END(*LINE*);



 PROCEDURE ERASELINE;

 (*SELECTS THE PROPER 'TYPE' OF BLACK TO ERASE A PREVIOUS LINE *)
 (*NECESSITATED BY THE PECULIAR WAY THE APPLE II DISPLAYS COLOR*)

 VAR

 ERASECOLOUR  : COLOURTYPE;


 BEGIN(*ERASELINE*)
  CASE OLDHUE[ITERATION] OF
                             0,1: ERASECOLOUR:= 0;
                             2,3: ERASECOLOUR:= 6;
                             4,5: ERASECOLOUR:= 7

  END(*CASE*);
  LINE(ERASECOLOUR,ITERATION)
 END(*ERASELINE*);



 BEGIN(*DRAW*)
  IF (FLAG = TRUE) AND (CONTINUOUS = TRUE)
   THEN
    ERASELINE;
  COMPUTECOORD(ITERATION);
  COLOR(ITERATION);
  IF PENOFF = FALSE
   THEN
    LINE(COLR,ITERATION);
  ITERATION:= ITERATION + 1;
  IF ITERATION > MAXITERATION
   THEN
    BEGIN
     FOR XXYY:= 'X' TO 'Y' DO
      FOR ENDPOINT:= 1 TO 2 DO
       T[XXYY,ENDPOINT,0]:= T[XXYY,ENDPOINT,MAXITERATION];
     ITERATION:= 1;
     FLAG:= TRUE;
     IF CONTINUOUS = FALSE
      THEN INITTURTLE
    END
 END(*DRAW*);
```

THE NEXT GENERATION OF COMPUTER GAMES IS HERE

FROM THE MAKERS OF THE FIRST ANIMATED ADVENTURE GAMES

Synergistic Software

- **APVENTURE TO ATLANTIS** is a new fast action apventure game, by Robert Clardy, continuing the Odyssey Apventure series. The forces of sorcery are gathering to repulse the marauding scientific Atlantean Kingdom. The epic battle can end either in the enslavement of the world or the absolute destruction of Atlantis.
- Computer adventuring has been good. Synergistic Software has just made it better. Can you imagine the most exciting adventure game ever composed with more color and sound, highly detailed animation, arcade like action, true role playing, greater challenge, unending variety and endless enjoyment? That's what the Next Generation of computer games is all about. This professionally designed adventure was specifically written to take full advantage of all the Apple's capabilities. Requires careful planning and strategy, quick thinking and reflexes, as well as a 48K Apple II* with DOS 3.3 and paddles.

Only $40.00

From
Synergistic Software

5221 120TH AVE. S.E
BELLEVUE, WA 98006
(206) 226-3216

*Apple II is a trademark of Apple Computer Inc.

CIRCLE 214 ON READER SERVICE CARD

PROCEDURE INITIALIZE

This procedure initializes all multidimensional arrays.

PROCEDURE MESSAGE

MESSAGE handles computer-user communication. It both prompts the user and accepts input from him. Exactly which message to display is determined by the Boolean software "switch," THATSALL.

PROCEDURE CENTERPRINT

This procedure accepts a string and displays it, centered on the screen.

PROGRAM STRINGART

First THATSALL, the abort flag, is cleared. The user is then prompted for the parameters within which he wishes the computer to generate art (MESSAGE). The pseudo random number generator is invoked (RANDOMIZE), and various multidimensional arrays holding line endpoints and increments are filled with random legal values (INITIALIZE). After the graphics mode is selected (INITTURTLE), drawing commences (DRAW) and continues until key closure is detected. The abort flag is then set. The goodbye message, selected by THATSALL, is assembled on the text screen while still in graphics mode (MESSAGE), and the text mode is reenabled (TEXTMODE), revealing the goodbye message already in place.

```
PROCEDURE INITIALIZE;
(*INITIALIZES VARIABLES AND ARRAYS*)
VAR
Z                 : CHAR;

BEGIN(*INITIALIZE*)
 THATSALL:= FALSE;
 COLORCOUNT:= 0;
 DELTACOUNT:= 0;
 FOR Z:= 'X' TO 'Y' DO
  SETUP(Z,0);
 ITERATION:= 1;
 FLAG:= FALSE;
 PENOFF:= TRUE;
 REPEAT
  DRAW
 UNTIL FLAG = TRUE;
 FLAG:= FALSE;     (*ITERATION ALREADY = 1 AGAIN FROM 'DRAW'*)
 PENOFF:= FALSE
END(*INITIALIZE*);

   PROCEDURE MESSAGE;
   (*TAKES CARE OF ALL USER TEXT I/O BOTH ON ENTRY AND ON EXIT*)
   VAR
   X,Y             : INTEGER;
   MSSG            : STRING;

       PROCEDURE CENTERPRINT;
     (*CENTERS A LINE OF TEXT*)
     VAR
     X               : INTEGER;

     BEGIN(*CENTERPRINT*)
      X:= (40 - LENGTH(MSSG)) DIV 2;
      GOTOXY(X,Y);
      WRITELN(MSSG)
     END(*CENTERPRINT*);

    BEGIN(*MESSAGE*)
     IF THATSALL
      THEN
       BEGIN
        WRITE(CHR(CLRSCRN));
        MSSG:= 'THATS ALL!';
        Y:= 12;
        CENTERPRINT
       END
      ELSE
       BEGIN
        REPEAT
         MSSG:= '****STRING ART****';
         Y:= 12;
         CENTERPRINT;
         X:= 0; Y:= Y + 8;
         GOTOXY(X,Y);
         WRITE('NUMBER OF ITERATIONS (1 TO ',ITERLIM,') ');
         READLN(MAXITERATION)
        UNTIL (MAXITERATION >= 1) AND (MAXITERATION <= ITERLIM);
        WRITE(CHR(CLRSCRN));
        REPEAT
         X:= 0; Y:= 10;
         GOTOXY(X,Y);
         WRITELN('SELECT EITHER: ');
         X:= 2; Y:= Y + 2;
         GOTOXY(X,Y);
         WRITELN('<1> CONTINUOUSLY EVOLVING DISPLAY ');
         X:= 2; Y:= Y + 2;
         GOTOXY(X,Y);
         WRITE('<2> ERASE DISPLAY EVERY ',MAXITERATION,' LINES');
         READ(CH)
        UNTIL (CH = '1') OR (CH = '2');
        CASE CH OF
                 '1'    : CONTINUOUS:= TRUE;
                 '2': CONTINUOUS:= FALSE
        END(*CASE*);
        WRITE(CHR(CLRSCRN));
        MSSG:= 'PRESS ANY KEY ONCE TO CONTINUE';
        Y:= 10;
        CENTERPRING;
        MSSG:= 'AFTER THAT ANY KEYPRESS WILL ABORT';
        Y:= 12;
        CENTERPRINT;
        REPEAT UNTIL KEYPRESS;
        READ(CH);
        WRITE(CHR(CLRSCRN));
        MSSG:= 'ONE MOMENT, PLEASE';
        Y:= 10;
        CENTERPRINT;
        MSSG:= 'INITIALIZING MULTIDIMENSIONAL ARRAYS';
        Y:= 12;
        CENTERPRINT
       END
    END(*MESSAGE*);

    BEGIN(*MAIN PROGRAM 'STRINGART'*)
     MESSAGE;
     RANDOMIZE;
     INITIALIZE;
     INITTURTLE;
     REPEAT
      DRAW
     UNTIL KEYPRESS;
     THATSALL:= TRUE;
     MESSAGE;
     TEXTMODE
    END(*MAIN PROGRAM 'STRINGART'*).
```

Atari SOFTWARE

Air Traffic Controller

In this popular, fast-moving simulation you must successfully control the flight paths of 27 aircraft as they take off, land and fly over your airspace. You give orders to change altitude, turn, maintain a holding pattern, approach and land at two airports. With five different airport configurations and variable skill levels, you won't easily tire of this absorbing and instructive simulation. Cassette CS-7004 $14.95.

Original Adventure

Only the brave enter the Colossal Cave, and only the clever survive. The entire evil cast of this classic game, from deadly dragon to nasty dwarf, will try to stop your quest for treasures. Using English commands, you explore the cave, travel through more than 100 locations, gather treasures, and attempt to think your way out of dangerous situations. Every aspect of the game is faithfully reproduced from the Original Adventure born on large computer systems. For weary travelers, there is even a SAVE GAME feature. Add this classic to your software collection. Order CS-7504 for disk $24.95, CS-7009 for cassette $19.95.

*Dominoes

Take on your computer at a game of draw dominoes. With options for repeating or alternating draw, **Dominoes** gives the game player a tough opponent who's always ready. From Thorn/EMI. Order cassette CS-7007. $11.95.

*Cribbage

Can you be the first to peg twice around the board? Your computer will put up a tough fight in this head-to-head game of cribbage. A graphic display of board and cards highlight this game of skill. From Thorn/EMI. Order cassette CS-7008. $11.95.

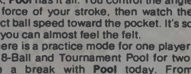
*Tilt

A favorite craze for years, the familiar wood labyrinth that tilts in all directions has entered the computer age. One or two players attempt to navigate balls through a maze and into scoring holes. With nine skill levels and nine speeds, **Tilt** will provide hours of fun. And, since each player can use a different skill level, **Tilt** is ideal for family play. From Thorn/EMI. Order cassette CS-7013 $11.95.

*Pool

Put a games room in your computer. Old pros and beginners alike will thrill to the challenge and realism of **Pool**. From the satisfying click of a tough combination shot to the acccuracy required for a three-cushion bank, **Pool** has it all. You control the angle and force of your stroke, then watch the object ball speed toward the pocket. It's so real you can almost feel the felt.

There is a practice mode for one player, and 8-Ball and Tournament Pool for two. Take a break with **Pool** today. From Thorn/EMI. Order cassette CS-7010 $14.95.



*Darts

Enter the pub, grab a pint of lager and a handful of darts, then try for a bull's eye in this amazing graphic game. One or two players can go at it, testing their aim at ten skill levels. Whether you want to throw a few, or just show your friends what the Atari computer can do, **Darts** is an ideal addition to your software library. This is Britain's most popular Atari game from Thorn/EMI. Order cassette CS-7011 $14.95.

*Billiards

This captivating British game is played with three balls on a standard pool table. Each player attempts to score by sinking a shot or hitting two balls with his cueball. From Thorn/EMI. Order cassette CS-7012 $14.95.

*Snooker

A tough British Game using 26 balls requiring the eye of sharpshooter and the strategy of a chess master. From Thorn/EMI. Not available on cassette.

Atari is a registered trademark of Atari, Inc.

Trucker

This program simulates coast-to-coast trips by an independent trucker hauling various cargos.

If all goes well, you can obey the speed limits, stop for eight hours of sleep each night and still meet the schedule. Bad weather, road construction or flat tires may put you behind schedule. You may try to increase your profit by skimping on sleep, driving fast or carrying an overweight load. Not available on cassette.

Streets of the City

During your tenure, you must construct streets and Interstate highways, repair existing streets, and improve traffic safety. For the Transit Authority you have to upgrade and replace a delapidated bus fleet, increase ridership, reduce maintenance downtime and improve on-schedule performance. Not available on cassette.

Outdoor Games

Fight a raging inferno in Forest Fire. User options allow for endless variety and skill levels. When the fire is out, relax with Fishing Trip, but watch out for sharks. The brave may wish to trek through the wilderness in Treasure Island I and II. Beware the sentinels—they're after you. Order cassette CS-7002 $11.95.

Haunted House

You are trapped in a mansion, alone except for the spirits that haunt the place eternally. Can you find the exit before midnight? This ever-changing game, complete with sound effects, is a perfect companion for dark evenings and rainy days. Order cassette CS-7003 $11.95.

Disk Packages

Pool, Snooker Billiards	CS-7509	$24.95
Darts and Tilt	CS-7506	$24.95
Dominoes and Cribbage	CS-7507	$19.95
Outdoor Games and Haunted House	CS-7502	$19.95
Trucker and Streets	CS-7707	$24.95

Order Today

To order any of these software packages send payment plus $2.00 postage and handling per order to Creative Computing, Morris Plains, NJ 07950. Visa, MasterCard and American Express orders may be called in toll-free.

Order today at no risk. If you are not completely satisfied, your money will be promptly and courteously refunded.

creative computing software

Morris Plains, NJ 07950
Toll-free **800-631-8112**
(in NJ 201-540-0445)

* Licensed from Thorn/EMI Video Programmes Ltd. Available in North America only.

CIRCLE 172 ON READER SERVICE CARD

An Apple Slide Show

Mark Harris

David Lubar's article "Apple Picture Packer" in the June '81 issue of *Creative Computing* showed a way to compress Apple II high-resolution graphics for disk storage. The method is best suited for images with broad areas of single colors, a common situation in graphics. I would like to describe how to further compress a special class of pictures.

I teach Mathematics at Appalachian State University and use the Apple as a classroom tool; my most frequent use of graphics is in displaying the graph of a function or relation. A typical graph consists of two coordinate axes, a curve plotting one variable against another, and a little labeling, all against a black background. Since relatively few of the 280 x 180 pixels are being used, it is desirable to store the graph by describing only the pixels in use. With this in mind I wrote the machine language subroutines GR and LOADGR which store and load compact versions of a graph. I shall describe the strategy used in these programs a little later.

How useful are these programs? An average graph now takes only three or four sectors of disk storage, as compared to 32 for straight storage of a whole graphics page. Because of the modest space requirements, loading of the graphs is very fast, and several can be put into Apple memory at the same time. I can queue about twenty graphs in RAM and cycle through them at a fraction of a second per graph (pausing when I want to). This is the idea behind the Basic program Slide Show (Listing 1).

```
SLIDE SHOW

10 AD =  - 16300
20  HOME : VTAB 10
30 START = 24576: REM  START OF LOADGR SUBROUTINE
40 D$ =  CHR$ (4): REM  CONTROL D
50 S = 1
60  DIM A(20),B(20)
70  PRINT D$;"BLOAD LOADGR.OBJ"
80  PRINT "I WILL DISPLAY GRAPHS STORED BY THE"
90  PRINT
100  PRINT "GR.OBJ0 PROGRAM AS NAME1,NAME2,..."
110  PRINT
120  INPUT "WHAT IS THE NAME? ";G$
130  PRINT : INPUT "HOW MANY GRAPHS? ";N
140 A(1) = START + 80: REM  START OF FIRST COMPACT GRAPH
150  FOR I = 1 TO N
160  PRINT D$;"BLOAD ";G$;I;",A";A(I)
170 L =  PEEK (43616) +  PEEK (43617) * 256: REM  LENGTH OF BLOADED PROGRAM.
180 A(I + 1) = A(I) + L: REM  COMPUTE STARTING ADDRESS FOR NEXT GRAPH
190  NEXT
200  FOR I = 1 TO N
210 B(I) =  INT (A(I) / 256): REM  MSB
220 A(I) = A(I) - B(I) * 256: REM  LSB
230  NEXT
240  HGR2 : HGR
250  POKE  - 16302,0: REM  FULL SCREEN GRAPHICS
260 PG = 1:I = 1: GOSUB 350: REM  LOAD 1ST GRAPH ON PAGE 1
270 PG = 2:I = 2: GOSUB 350: REM  LOAD 2ND GRAPH ON PAGE 2
280 X =  FRE (0): REM  A LITTLE HOUSE-CLEANING
290  GET A$: IF A$ = "S" THEN  TEXT : HOME : END
300  IF A$ =  CHR$ (27) THEN I = I + 1: GOSUB 320: REM  CHECK FOR ESC KEY
310  GOTO 280
320 AD = AD + S: POKE AD,0:S =  - S: REM  FLIPS PAGE
330 PG = (3 + S) / 2
340  IF I > N THEN I = 1
350  POKE 250,B(I): POKE 249,A(I): REM  SET UP ADDRESS OF NEXT GRAPH FOR LOADGR
360  IF PG = 1 THEN  POKE 252,32: CALL START: RETURN
370  POKE 252,64: CALL START: RETURN
```

Listing 1. A sample Applesoft program that displays compressed graphs.

Mark Harris, Math Dept. Appalachian State University, Boone, NC 28608.

Slide Show, continued...

About Slide Show

Use of this Applesoft program requires that several graphs first be BSAVEd under the same name followed by successive numbers, e.g. GRAPH1, GRAPH2, etc. This is done with the GR routine. Slide Show will ask for the name and number of graphs, then load them starting at address $6050 (the subroutine LOADGR is placed at $6000). Next the first two graphs are placed in hi-res pages one and two, and page one is displayed. When the ESC key is depressed, the Apple switches to page two. GRAPH3 is transferred by the LOADGR routine to page one, all done neatly behind the scenes. When ESC is hit again, GRAPH3 is displayed instantly. This loading on the hidden page continues through the entire list of graphs and then starts back with GRAPH1. The graphs appear just about as fast as the ESC key can be depressed. When you're done, just hit the "S" key.

The GR Subroutine

To compress and save a graph using the GR subroutine (Listing 2), first get the graph of your choice on hi-res page one. (I use standard HPLOTing to draw the graph and use the DOS Tool Kit "HRCG" program to label it.) Then get back to the TEXT and type BRUN GR (assuming you have saved the GR program on disk). A message giving the starting address and length of your now-compressed graph will appear on the screen. If these numbers were $0C00 and $FC, typing BSAVE GRAPH4,A$C00,L$FC would save the graph on disk under the name GRAPH4.

```
SOURCE FILE: GR
----- NEXT OBJECT FILE NAME IS GR.OBJ
0C00:                  ORG  $0C00
00F9:          TBL     EQU  $F9    ;LOW BYTE OF TABLE ADDRESS
00FA:          TBH     EQU  $FA
00FB:          PGL     EQU  $FB
00FC:          PGH     EQU  $FC        ;CURRENT PAGE
FDED:          COUT    EQU  $FDED
FDDA:          PRBYTE  EQU  $FDDA
0C00:A2 00             LDX  #0
0C02:86 FB             STX  PGL
0C04:86 F9             STX  TBL
0C06:A9 20             LDA  #$20       ;1ST PG OF HRES GRAPHICS
0C08:85 FC             STA  PGH
0C0A:A9 08             LDA  #$08
0C0C:85 FA             STA  TBH        ;TABLE BEGINS AT $0800
0C0E:          ;A ZERO BYTE MARKS END OF PAGE
0C0E:          ;TABLE ORGANIZATION:
0C0E:          ;DATA,ADRS,DTA,ADRS,...,ZBYTE,...
0C0E:A0 00     NWPG    LDY  #0
0C10:B1 FB     ICHK    LDA  (PGL),Y
0C12:F0 0B             BEQ  CT
0C14:81 F9             STA  (TBL,X)    ;STORE NONZERO DATA
0C16:20 34 0C          JSR  PTR
0C19:98                TYA
0C1A:81 F9             STA  (TBL,X)    ;STORE LOW BYTE OF ADRS
0C1C:20 34 0C          JSR  PTR
0C1F:C8        CT      INY
0C20:D0 EE             BNE  ICHK
0C22:A9 00             LDA  #0
0C24:81 F9             STA  (TBL,X)
0C26:20 34 0C          JSR  PTR
0C29:E6 FC             INC  PGH
0C2B:A5 FC             LDA  PGH
0C2D:C9 40             CMP  #$40
0C2F:F0 0A             BEQ  DONE
0C31:4C 0E 0C          JMP  NWPG       ;CHECK NEW PAGE
0C34:E6 F9     PTR     INC  TBL        ;SBR TO MOVE POINTER
0C36:D0 02             BNE  RET
0C38:E6 FA             INC  TBH
0C3A:60        RET     RTS
0C3B:A0 00     DONE    LDY  #0
0C3D:B9 59 0C  FTCH    LDA  MSG,Y      ;GET CHAR FOR MESSAGE
0C40:F0 07             BEQ  LGTH
0C42:          ;ZERO MARKS END OF MESSAGE;
0C42:20 ED FD          JSR  COUT
0C45:C8                INY
0C46:4C 3D 0C          JMP  FTCH
0C49:A5 FA     LGTH    LDA  TBH        ;FIND LENGTH OF TABLE
0C4B:38                SEC
0C4C:E9 08             SBC  #$08
0C4E:20 DA FD          JSR  PRBYTE
0C51:A5 F9             LDA  TBL
0C53:20 DA FD          JSR  PRBYTE
0C56:4C D0 03          JMP  $3D0       ;GO TO BASIC
0C59:8D 8D 8D  MSG     DFB  $8D,$8D,$8D
0C5C:A0 A0 A0          ASC  "              FINISHED."
0C5F:A0 A0 C6
0C62:C9 CE C9
0C65:D3 C8 C5
0C68:C4 AE
0C6A:8D 8D             DFB  $8D,$8D
0C6C:A0 A0 A0          ASC  "              ADDRESS = $0800"
0C6F:A0 A0 C1
0C72:C4 C4 D2
0C75:C5 D3 D3
0C78:A0 BD A0
0C7B:A4 B0 B8
0C7E:B0 B0
0C80:8D 8D             DFB  $8D,$8D
0C82:A0 A0 A0          ASC  "              LENGTH = $"
0C85:A0 A0 CC
0C88:C5 CE C7
0C8B:D4 C8 A0
0C8E:BD A0 A4
0C91:00                DFB  0

*** SUCCESSFUL ASSEMBLY: NO ERRORS
```

Listing 2. This machine language routine compresses hi-res data.

Packed Thoughts

An Apple Slide Show and *Picture Packer Revisited* show two excellent and diverse extensions of the packing concept. By tackling a specific area of graphics, namely plotted functions, Mr. Harris has achieved not only an extraordinary compactness of data, but also a very fast display routine. This combination need not be limited to graphs, but could also be applied, in some cases, to animation. A series of line drawings could be rapidly cycled through the screen. To carry the idea a step further, if the data were placed on the screen with an Exclusive OR, objects could be moved across a background scene. I believe readers will find many applications for the programs created by Mr. Harris.

In *Picture Packer Revisited* (see page 116), Mr. Haley has taken a quantum leap beyond the original program. His approach is elegant, and the degree of compression is impressive. One slight extension readers might wish to try would be to append a routine that turns all $00 bytes of the picture to $80. This would have no effect on the picture since $00 and $80 both produce seven unset pixels on the screen. And with no $00 bytes in the picture, $00 could be used as a signal byte. In this way, there would be no need to check for a byte which might be data or might be a flag, and BEQ could be used in place of comparing the value against $FE. Beyond this, I almost feel Mr. Haley has taken the packing concept as far as it can go. But such speculation usually turns out to be wrong. Which brings up a personal note.

I want to thank readers who have the curiosity and drive to push a concept beyond its limits. There is great pleasure in seeing a better way, in hearing from someone who has made an imaginative leap or found a new approach. While there is nothing wrong with using a printed program as is, there can be great rewards in asking yourself "Is this program as good as it can be?" Someone is going to surprise us. But it really shouldn't be a surprise. I've come to expect innovation and excellence from you. Thanks.—D.L.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 230 RIVERSIDE, N.J.

POSTAGE WILL BE PAID BY ADDRESSEE

The Library of Computer and Information Sciences

Riverside, New Jersey 08075

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

4 Good Reasons to Join

1. The Finest Books. Of the hundreds and hundreds of books submitted to us each year, only the very finest are selected and offered. Moreover, our books are always of equal quality to publishers' editions, *never* economy editions.

2. Big Savings. In addition to getting the PERSONAL COMPUTING LIBRARY for $2.95 when you join, you keep saving substantially—up to 30% and occasionally even more. (For example, your total savings as a trial member—including this introductory offer—can easily be over 50%. That's like getting every other book free!)

3. Bonus Books. Also, you will immediately become eligible to participate in our Bonus Book Plan, with savings up to 70% off publishers' prices.

4. Convenient Service. At 3-4 week intervals (16 times per year) you will receive the Book Club NEWS, describing the Main Selection and Alternate Selections, together with a dated reply card. If you want the Main Selection, do nothing and it will be sent to you automatically. If you prefer another selection, or no book at all, simply indicate your choice on the card, and return it by the date specified. You will have at least 10 days to decide. If, because of late mail delivery of the NEWS, you should receive a book you do not want, we guarantee return postage.

TAKE THE 3-VOLUME PERSONAL COMPUTING LIBRARY FOR ONLY $2.95

when you join **THE LIBRARY OF COMPUTER AND INFORMATION SCIENCES**

You simply agree to buy 3 more books—at handsome discounts—within the next 12 months.

Enjoy the challenge and reap the benefits of microcomputing with the Personal Computing Library. This set of three carefully-selected books provides you with hours of thought-provoking computer projects. For only $2.95—it's a value you can't afford to pass up.

Take a look at the books you'll get!

MICROPROCESSORS: From Chips to Systems.

Rodnay Zaks' *Microprocessors: From Chips to Systems* brings the hobbyist and the computer professional a complete, progressive guide to microprocessors—the phenomena that is revolutionizing modern technology.

In over 400 fact-filled pages, *Microprocessors: From Chips to Systems* details the most up-to-date information. Topics include internal microprocessor operation, system components and their interconnection, basic interfacing techniques, principles of programming, a comparison of major microprocessors and much more. Detailed examples, photographs and diagrams supplement the ten extensive chapters. The book also describes a "standard" microprocessor system and is applicable to all microprocessors. A helpful index, appendix and bibliography make complete this excellent introduction to the exciting world of microprocessors. "...(A) thorough review of all the popular microprocessors..."—Interface Age Publisher's Price $25.00

CIARCIA'S CIRCUIT CELLAR: Volumes I and II.

Tinkering with microchip assemblies and personal computers is a hobby for many computer enthusiasts. It's a passion for Steve Ciarcia, personal computing specialist whose popular series in BYTE magazine has made him a "computer folkhero".

CIARCIA'S CIRCUIT CELLAR: Volumes I and II provides a complete tutorial to the construction of over 30 microcomputer projects.

Volume I includes:
- how to build a dual voltage converter, and various methods to help you achieve voltage multiplication
- classical I/O decoding and memory mapped methods
- how to construct an 8 channel 3½ digit DC digital voltmeter interface
- how to build an inexpensive address state analyzer which provides dynamic display of the microprocessor address bus during program execution

Volume II includes:
- how to build a computer controlled security system for your home
- a design for a computer controlled wood stove
- an introduction to 16-Bit Computing
- how to add nonvolatile memory to your computer

Publisher's Price $20.95 (softcover).

What is The Library of Computer and Information Sciences?

It's the oldest and largest book club especially designed for the computer professional. In the incredibly fast-moving world of data processing, where up-to-date knowledge is essential, we make it easy for you to keep totally informed on all areas of the information sciences. In addition, books are offered at discounts up to 30% off publishers' prices.

Begin enjoying the club's benefits by accepting the PERSONAL COMPUTING LIBRARY. It's the perfect reference for computer professionals... and it's a great bargain, too.

If the reply card has been removed, please write to
The Library of Computer and Information Sciences
Dept.CO72Y7, Riverside, N.J. 08075
to obtain membership information and an application.

How It Works

Each address in Apple memory consists of two bytes. The first byte is sometimes called the page number (not to be confused with the hi-res graphics pages) and the second byte gives the locations on that page. A hi-res picture occupies either memory \$2000-\$3FFF (hi-res page one) or \$4000-5FFF (page 2). Hence a graphics page takes 32 pages of memory.

The GR program starts at the first memory page, say \$2000, and finds the addresses and contents of all non-zero bytes on that page. Using a zero byte as a separator (we know it will never occur as a data byte under this scheme), the program moves on to the second page and so on up to the 32nd page. The storage format for each page is:

data byte, address byte, data byte, address byte, ... , zero byte.

Since we can keep track of the page byte and change it only when a zero byte is reached, we require only one byte for the address.

The efficiency of this method depends on the percentage of zero bytes on the graphics page. With the graphs I normally encounter, about 95% of the bytes are zero (corresponding to black background) and compact storage takes only about 10% of the original \$2000 bytes. For a picture with no zero bytes, we would have a disaster; it would require more than twice the original space to store the same graph.

Other Uses

The Slide Show program illustrates one use of the LOADGR routine (Listing 3), but you may want to use it in other ways. For example, the following program puts a single graph on HGR page one and then quits:

Closing Comments

The programs listed here work well for compressing graphs which sparsely occupy an HGR page. It would be easy to change the programs to accommodate a background color other than black, but displaying staid mathematical curves against a violet page would be a little tacky.

The programs listed here work well for compressing graphs which sparsely occupy an HGR page.

```
SOURCE FILE: LOADGR
                 ***********************************************************************
0000:            *
0000:            * SUBROUTINE LOADGR
0000:            *
0000:            * THIS SUBROUTINE CLEARS A HIGH-RES GRAPHICS PAGE (1 OR 2) AND LOADS A GRAPH
0000:            * WHICH HAS BEEN STORED BY THE GR.OBJ SUBROUTINE.
0000:            * TO CALL, THE PAGE # AND THE STARTING ADDRESS OF THE GRAPH MUST BE GIVEN.
0000:            * PAGE #: STORE $20 (FOR PAGE 1) OR $40 (FOR PAGE 2) IN PGH (DEFINED BELOW
0000:            * AS $FC).
0000:            * GRAPH ADDRESS: STORE LOW BYTE IN TBL ($F9), HIGH BYTE IN TBH ($FA).
0000:            *
                 ***********************************************************************
----- NEXT OBJECT FILE NAME IS LOADGR.OBJ
6000:                     ORG  $6000
00F9:            TBL      EQU  $F9
00FA:            TBH      EQU  $FA
00FB:            PGL      EQU  $FB
00FC:            PGH      EQU  $FC
6000:18                   CLC
6001:A5 FC                LDA  PGH
6003:8D 4D 60             STA  ADR
6006:69 20                ADC  #$20      ;COMPUTE END ADDRESS OF GRAPHICS PAGE
6008:8D 4E 60             STA  ENDADR
600B:            * CLEAR PAGE TO BLACK:
600B:A0 00                LDY  #0
600D:84 FB                STY  PGL
600F:A9 00                LDA  #0
6011:91 FB       LOOP     STA  (PGL),Y
6013:C8                   INY
6014:D0 FB                BNE  LOOP
6016:E6 FC                INC  PGH
6018:A6 FC                LDX  PGH
601A:EC 4E 60             CPX  ENDADR    ;END?
601D:D0 F2                BNE  LOOP
601F:AA                   TAX             ;ZERO X REG
6020:AD 4D 60             LDA  ADR
6023:85 FC                STA  PGH
6025:A1 F9       LOAD     LDA  (TBL,X)
6027:F0 10                BEQ  CHPG      ;INCREASE HIGH BYTE IF NECESSARY
6029:20 46 60             JSR  PTR
602C:48                   PHA
602D:A1 F9                LDA  (TBL,X)
602F:A8                   TAY
6030:68                   PLA
6031:91 FB                STA  (PGL),Y
6033:20 46 60             JSR  PTR
6036:4C 25 60             JMP  LOAD
6039:E6 FC       CHPG     INC  PGH
603B:A5 FC                LDA  PGH
603D:20 46 60             JSR  PTR
6040:CD 4E 60             CMP  ENDADR    ;END?
6043:D0 E0                BNE  LOAD
6045:60                   RTS
6046:E6 F9       PTR      INC  TBL
6048:D0 02                BNE  RET
604A:E6 FA                INC  TBH
604C:60          RET      RTS
604D:            ADR      DS   1
604E:            ENDADR   DS   1

*** SUCCESSFUL ASSEMBLY: NO ERRORS
```

Listing 3. A routine to restore the compressed graphs.

If you want to use Slide Show as part of a presentation to an audience, you may want to substitute a paddle button for the escape key to change graphs. This allows you to face the group and control the Apple from a distance. To make this change, just replace lines 290 and 300 with:

290 IF PEEK(49249) > 127 THEN I=I+1:GOSUB 320

Both Basic programs listed in this article call the LOADGR subroutine under the name LOADGR.OBJ, so either store it that way or change the program to agree with the name you choose.

Slide Show is designed for an Apple with 48K, but the other programs can be used with less memory.

After you are finished using Slide Show, it's a good idea to type the command "FP" to restore the computer to its usual good-natured self. □

Apple II

Power Tools for Programmers

creative computing software

Shape Master

This powerful utility allows you to rapidly create, combine display, edit, save, and print out high resolution shapes for use in your Apple programs Two separate, convenient entry methods on five user-selected grid sizes ranging from 13 by 23 to 39 by 69 allow for easy definition of many different shapes A built in character set in three different sizes makes it easy to mix text and graphics in your displays The smart printout routines allow you to make a hard copy of your shapes, even with a non-graphics printer A reverse command allows a quick mirror

image of any one of your shapes The edit commands allow you to edit shapes and shape tables, thus you can create, load, merge and delete individual shapes from your shape table The illustrated, comprehensive manual includes tips on using shapes in your programs Four games and two graphics demos are included on the diskette to illustrate what you can do with this program This package was reviewed in *Creative Computing* June 1981, page 44

Requires 48K Apple II Plus or Applesoft in ROM Diskette CS-4805 $24 95

Disk Doctor

Read and modify Apple diskettes with this easy-to-use diskette track-and-sector editor, whether they were created by DOS 3 2, DOS 3 3, the Pascal system or Apple CP/M Simple editing commands allow you to display any sector and freely edit it on screen, entering changes either as hex or character data Special commands allow you to print a hard copy of the sector in either 40- or 80-column format. Disk Doctor will also test your diskettes, verifying every sector, whether vacant or filled with data You can also format and verify a disk in one operation

This powerful tool should be in your library Whether you need to verify the reliability of your diskettes, patch DOS, edit a data file in place, or repair a damaged sector, you can t afford to be without Disk Doctor

32K or larger Apple II or Apple II Plus, diskette CS-4806 $19 95

Order Today

To order these software packages, send payment plus $2 00 postage and handling (per order) to the address given Visa, MasterCard, and American Express orders may be called in toll free Order today at no risk If you are not completely satisfied, your money will be promptly and courteously refunded.

Creative Computing Software
Morris Plains New Jersey 07950
Toll-free **800-631-8112**
In N J 201-540-0445

master charge · AMERICAN EXPRESS · VISA

Bill Budge's

Raster Blaster

Real pinball flippers make this a game of strategy & skilled shot making.

Animated shields can shoot a lost ball back into play.

Raster Blaster for the Apple II and the Apple II Plus may be the first Apple II game that is copied for the arcade machines. It is so technically sophisticated and fun to play that it is sure to attract the big arcade manufacturers. But you can get it right now for your Apple!

Three animated claws trap the ball if they are enabled. When three balls become trapped all are released for exciting multi-ball play.

Three sets of targets test your aim and timing. Hit all of them to enable the claws

Plus kickers, thumper-bumpers and an animated **spinner** help to provide unmatched realism.

Dealer inquires invited:
BudgeCo, 428 Pala Ave.
Piedmont, CA 94611
(415)658-8141

VIDEO PINBALL FOR THE APPLE II

Requires a 48K Apple II

Apple II is a registered trademark of Apple Computer, Inc.

CIRCLE 151 ON READER SERVICE CARD

BudgeCo 1981

PICTURE PACKER Revisited

Kenneth M. Haley

David Lubar's Apple Picture Packer 3.0 (*Creative Computing*, June, 1981, pp. 128-138) is a handy disk saving tool. After using it for a while, I became intrigued (as he did) with the question of whether the routine could be improved. Upon reviewing his method, several possible improvements occurred to me and I decided to try them out.

First of all (as Mr. Lubar suggests at the end of his article), the screen should be scanned in the order it appears rather than in ascending memory sequence. But more importantly, the screen should be scanned vertically instead of horizontally. There are only 40 bytes in a horizontal row compared with 192 bytes in each vertical column. So, vertical scanning improves the likelihood of finding the longer strings of recurring bytes. Furthermore, the odd-even alternating pattern that appears during horizontal scanning is eliminated. This avoids the necessity of multiple passes.

The other area I changed was the packing algorithm itself. There isn't a significant difference in actual savings here, but there are two advantages: 1) it is virtually impossible for a picture to expand in size, and 2) it is easier to code.

It works this way: Every byte in the original picture is copied to the packed picture until a string of four or more (up to 255) identical bytes is found. Each such string is replaced with the three-byte sequence: repeat-code, count, byte. For example:

01 02 03 04 05 06 06 06 06 06 06 06 07

would be packed as

01 02 03 04 05 05 05 FF 07 06 07

saving four characters. I used a hex "FE" for the repeat-code because it seems to be rare in hi-res pictures. If any string of repeat-codes is found in the original screen, it must always be replaced with the three-byte sequence even if it is only one byte long (this is the only way the packed picture could possibly increase in size). Fortunately that is not a big problem. In the 22 pictures I tested, I didn't find a single FE.

After coding the new packing and unpacking algorithms (HR.PACKER and HR.UNPACKER), I packed 22 pictures using both methods. The pictures I used are the ones found in Apple Contributed Software, Volumes 2 and 4.

Table 1 shows the number of bytes and sectors used by each method for each of the pictures. A total of 72 additional sectors were saved by HR.PACKER. That's an average of just over three additional sectors per picture—a significant improvement. Now I had enough room to put all 22 pictures, all the associated software, a copy of HR.UNPACKER, and SHOW (see Listing 1) all on one 16-sector diskette (see Figure 1). SHOW (Listing 1) is a simple Applesoft program to read, unpack, and display all 22 pictures.

Program Notes

Both HR.PACKER and HR.UNPACKER use hi-res page 1 ($2000-$3FFF) for the normal picture and hi-res page 2 ($4000-$5FFF) for the packed version. Both programs contain a considerable amount of code to do the vertical scanning. This is found between the "MAIN LINE" and "END OF JOB" comments in each source listing. Basically, it consists of four nested loops. Each column of the screen is scanned from bottom to top and the columns are scanned from right to left. It seems to me that it shouldn't be so cumbersome to do this, but I couldn't seem to improve on it (any suggestions, readers?).

Table 1.

Picture	Picture Packer 3.0 Bytes	Picture Packer 3.0 Sectors	HR.PACKER Bytes	HR.PACKER Sectors	Sectors Saved
MUSIC	1614	8	1637	8	0
WORLD MAP	4489	19	2173	10	9
TEQUILA	6944	29	5744	24	5
DOUBLE BESSEL FUNCTION	3220	14	2760	12	2
WLM SHAKESPEARE	6173	26	4770	20	6
UNCLE SAM	4502	19	2294	10	9
JOE SENT ME...	7895	32	7377	30	2
SPIRALLEL OGRAM	4221	18	3478	15	3
ROCKY RACCOON	6913	29	5910	25	4
CHARACTERS	2674	12	1987	9	3
DOLLAR	4643	20	4119	18	2
RANDOM LADY	6373	26	5470	23	3
LADY BE GOOD	6883	28	6187	26	2
MACROMETER	5791	24	5234	22	2
DIP CHIPS	6555	27	6443	27	0
TEX	5852	24	4764	20	4
SQUEEZE	4881	21	4786	20	1
THE TIME MACHINE	4957	21	2959	13	8
WINSTON CHURCHILL	6689	28	5968	25	3
HOPALONG CASSIDY	5647	24	5030	21	3
A GIRL'S BEST FRIEND	7220	30	6956	29	1
BABY JANE	5781	24	5764	24	0

Kenneth M. Haley, 5916 S. Kenton St., Englewood, CO 80111.

```
100  DATA MUSIC
110  DATA WORLD MAP
120  DATA TEQUILA
130  DATA DOUBLE BESSEL FUNCTION
140  DATA WLM SHAKESPEARE
150  DATA UNCLE SAM
160  DATA JOE SENT ME...
170  DATA SPIRALLELOGRAM
180  DATA ROCKY RACCOON
190  DATA CHARACTERS
200  DATA DOLLAR
210  DATA RANDOM LADY
220  DATA LADY BE GOOD
230  DATA MACROMETER
240  DATA DIP CHIPS
250  DATA TEX
260  DATA SQUEEZE
270  DATA THE TIME MACHINE
280  DATA WINSTON CHURCHILL
290  DATA HOPALONG CASSIDY
300  DATA A GIRL'S BEST FRIEND
310  DATA BABY JANE
320 D$ =  CHR$ (4)
330  PRINT D$;"BLOAD HR.UNPACKER"
340  HGR : POKE  - 16302,0
350  FOR I = 1 TO 22
360  READ X$
370  PRINT D$;"BLOAD ";X$;".PIC"
380  CALL 768
390  NEXT I
400  END
```

Listing 1.

```
 A 002 HELLO
 B 002 HR.UNPACKER
 A 003 SHOW
 B 008 MUSIC.PIC
 B 010 WORLD MAP.PIC
 B 024 TEQUILA.PIC
 B 012 DOUBLE BESSEL FUNCTION.PIC
 B 020 WLM SHAKESPEARE.PIC
 B 010 UNCLE SAM.PIC
 B 030 JOE SENT ME....PIC
 B 015 SPIRALLELOGRAM.PIC
 B 025 ROCKY RACCOON.PIC
 B 009 CHARACTERS.PIC
 B 018 DOLLAR.PIC
 I 022 SLIDE SHOW 1
 B 023 RANDOM LADY.PIC
 B 026 LADY BE GOOD.PIC
 B 022 MACROMETER.PIC
 B 027 DIP CHIPS.PIC
 B 020 TEX.PIC
 B 020 SQUEEZE.PIC
 B 013 THE TIME MACHINE.PIC
 B 025 WINSTON CHURCHILL.PIC
 B 021 HOPALONG CASSIDY.PIC
 B 029 A GIRL'S BEST FRIEND.PIC
 B 024 BABY JANE.PIC
 I 022 SLIDE SHOW 2
```

Figure 1.

The remainder of the programs deal with the packing and unpacking logic as described above. The simpler packing method saves quite a bit of code here; so, even with additional code for vertical scanning, HR.PACKER turned out to be slightly shorter than Picture Packer 3.0 and HR.UNPACKER came out only slightly longer than Unpacker 3.0.

I retained Mr. Lubar's idea of using only relative branches, so the routines may be loaded into any available memory space. I also used the same page zero location for the end-of-table pointer ($00-$01). So the routines are used in precisely the same way as Mr. Lubar's are. □

Packer, continued...

```
HR.PACKER          VERSION: 1.0

----- NEXT OBJECT FILE NAME IS HR.PACKER.OBJ0
1000:                      ORG  $1000
                   ***********************************************************
1000:              *-PROGRAM: HR.PACKER
1000:              *-VERSION: 1.0
1000:              *-WRITTEN BY: KEN HALEY
1000:              *-DATE: 7/15/81
1000:              *-HI-RES SCREEN DATA COMPACTION ROUTINE
1000:              *- IDEA FROM PICTURE PACKER 3.0, DAVID LUBAR.  DESCRIBED
1000:              *- IN CREATIVE COMPUTING, JUNE, 1981, PP. 128-138.
                   ***********************************************************
0000:                     DSECT          ; PAGE ZERO VARIABLES
0000:                     ORG   0        ; .
0000:00 00         TBPTR  DW    0        ; POINTER TO END OF PACKED PICTURE
0002:00 00         B2     DW    0        ; LOOP2 COUNTER
0004:00 00         B3     DW    0        ; LOOP3 COUNTER
0006:00 00         B4     DW    0        ; LOOP4 COUNTER
0008:00            PREVX  DFB   0        ; PREVIOUS BYTE IN SCREEN
0009:00            RPTCD  DFB   0        ; REPEAT CODE (WILL = '$FE')
000A:00            RPTCT  DFB   0        ; COUNT OF REPEATING BYTES
000B:00            FTSW   DFB   0        ; FIRST TIME SWITCH (MSB ON = YES)
000C:00            EOJSW  DFB   0        ; END OF JOB SWITCH (MSB ON = YES)
1000:                     DEND           ; (END OF PAGE ZERO DEFINITIONS)
1000:              *-----INITIALIZATION
1000:A9 00                LDA   #$00     ; SET TBPTR = $4000.
1002:85 00                STA   TBPTR    ; .
1004:A9 40                LDA   #$40     ; .
1006:85 01                STA   TBPTR+1  ; .
1008:A9 FE                LDA   #$FE     ; SET RPTCD = $FE.
100A:85 09                STA   RPTCD    ; .
100C:A9 80                LDA   #$80     ; SET FTSW = YES.
100E:85 0B                STA   FTSW     ; .
1010:A9 00                LDA   #0       ; SET EOJSW = NO.
1012:85 0C                STA   EOJSW    ; .
1014:              *
1014:              *-----MAIN LINE
1014:A0 27                LDY   #39      ; SET Y = 39.
1016:              * (Y-REG NOW CONTAINS COLUMN NO.)
1016:              LOOP1  EQU   *
1016:A9 78                LDA   #$78     ; SET B2 = $2078.
1018:85 02                STA   B2       ; .
101A:A9 20                LDA   #$20     ; .
101C:85 03                STA   B2+1     ; .
101E:              LOOP2  EQU   *
101E:A5 02                LDA   B2       ; SUBTRACT $28 FROM B2.
1020:38                   SEC            ; .
1021:E9 28                SBC   #$28     ; .
1023:85 02                STA   B2       ; .
1025:B0 02                BCS   L2A      ; .
1027:C6 03                DEC   B2+1     ; .
1029:              L2A    EQU   *
1029:A5 02                LDA   B2       ; SET B3 = B2 + $400.
102B:85 04                STA   B3       ; .
102D:A5 03                LDA   B2+1     ; .
102F:18                   CLC            ; .
1030:69 04                ADC   #$4      ; .
1032:85 05                STA   B3+1     ; .
1034:              LOOP3  EQU   *
1034:A5 04                LDA   B3       ; SUBTRACT $80 FROM B3.
1036:38                   SEC            ; .
1037:E9 80                SBC   #$80     ; .
1039:85 04                STA   B3       ; .
103B:B0 02                BCS   L3A      ; .
103D:C6 05                DEC   B3+1     ; .
103F:              L3A    EQU   *
103F:A5 04                LDA   B3       ; SET B4 = B3 + $2000.
1041:85 06                STA   B4       ; .
1043:A5 05                LDA   B3+1     ; .
1045:18                   CLC            ; .
1046:69 20                ADC   #$20     ; .
1048:85 07                STA   B4+1     ; .
104A:              LOOP4  EQU   *
104A:A5 07                LDA   B4+1     ; SUBTRACT $400 FROM B4.
104C:38                   SEC            ; .
104D:E9 04                SBC   #$4      ; .
104F:85 07                STA   B4+1     ; .
1051:18                   CLC            ; (FORCE NEXT BRANCH)
1052:90 20                BCC   PRSB     ; PROCESS SCREEN BYTE.
1054:              NXT4   EQU   *
1054:A5 07                LDA   B4+1     ; B4 = B3?
1056:C5 05                CMP   B3+1     ; .
1058:D0 F0                BNE   LOOP4    ; NO, REPEAT LOOP4.
105A:              NXT3   EQU   *
```

COLLEGE BOARD SAT PREPARATION SERIES

TRS-80, APPLE, PET, OSI, ATARI, CP/M, PDP-11

Each program confronts the user with a virtually limitless series of questions and answers. Each is based on past exams and presents material of the same level of difficulty and in the same form used in the S.A.T. Scoring is provided in accordance with the formula used by College Boards.

S.A.T., P.S.A.T., N.M.S.Q.T. — Educator Edition set includes 25 programs covering Vocabulary, Word Relationships, Reading Comprehension, Sentence Completion, and Mathematics. Price **$229.95**

Independent Tests of S.A.T. series performance show a mean total increase of 70 points in students' scores.

G.R.E. Series — Educator Edition includes 28 programs covering Vocabulary, Word Relationships, Reading Comprehension, Sentence Completion, Mathematics, Analytical Reasoning and Logical Diagrams. Price **$289.95**

COMPETENCY EXAM PREPARATION SERIES

This comprehensive set of programs consists of simulated exam modules, a thorough diagnostic package, and a complete set of instructional programs. It is designed to teach concepts and operations, provide drill and practice and assess achievement levels through pre and post testing. The Competency Exam Preparation Series provides a structured, sequential, curriculum encompassing mathematical, reading and writing instruction.

This program is designed for individual student use or use in a classroom setting. Programs provide optional printer capability covering worksheet generation and performance monitoring. C.E.P.S. are available in three software formats.

National Proficiency Series	$1,299.00	★ **Special**
N.Y.S. Regents Competency Test, Preparation Series	$1,299.00	**Introductory**
California Proficiency Assessment Test, Preparation Series	$1,299.00	**Price**

If desired separate Mathematics and Verbal packages are available for $799.00 ea. A Spanish language version of the Mathematics Instruction Package is available at no extra charge. ★ **Prices as of February 1, 1982 — $2499.00**

INQUIRE FOR UNIQUE M.I.T. APPLE™ LOGO APPLICATIONS SOFTWARE

FIG NEWTON

Full Graphics Newton. This version of Isaac Newton presents all data in graphic form. Because data is graphic rather than symbolic, this game is suitable for very young children. Players may however, select difficulty levels challenging to the most skilled adults. Note: Fig Newton is available free of charge to all purchasers of Isaac Newton before January 1, 1982. If purchased thereafter or when purchased separately . . . **$24.95**

ISAAC NEWTON

Perhaps the most fascinating and valuable educational game ever devised - ISAAC NEWTON challenges the players (1-4) to assemble evidence and discern the underlying "Laws of Nature" that have produced this evidence. ISAAC NEWTON is an inductive game that allows players to intervene actively by proposing experiments to determine if new data conform to the "Laws of Nature" in question. Players may set the level of difficulty from simple to fiendishly complex.

For insight into some of the basic principles underlying **ISAAC NEWTON** see *Godel, Escher, Bach* by Douglas R. Hofstadter, Chapter XIX and Martin Gardner's "Mathematical Games" column in **Scientific American**, October, 1977 and June, 1959. **$24.95**

MINI FLOPPY DISKS

Memorex Disks — Single Density, Single Sided (with or without ring)

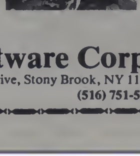
$35 per box
Minimum 2 boxes

☆ *NEW* ☆

☆ Pythagoras and The Dragon ☆

Mathematics in a fantasy game context. Based on **The Sword of Zedek**, **Pythagoras and The Dragon** introduces Pythagoras as a mentor to the player. When called on for aid, Pythagoras poses math questions, and depending on the speed and accuracy of the player response, confers secret information. With Pythagoras as an ally, the quest to overthrow Ra, The Master of Evil, assumes a new dimension of complexity. Depending on the level chosen, problems range from arithmetic through plane geometry.

32K **$39.95**



PROGRAMS AVAILABLE FOR TRS-80, APPLE II, PET & ATARI

Disk or cassette, *please specify*. N.Y.S. residents add sales tax.

All programs require 16K • TRS-80 programs require LEVEL II BASIC • APPLE programs require Applesoft BASIC

Krell Software Corp.

21 Millbrook Drive, Stony Brook, NY 11790

(516) 751-5139

Packer, continued...

```
105A:A5 04          LDA   B3        ; B3 = B2?
105C:C5 02          CMP   B2        ; .
105E:D0 D4          BNE   LOOP3     ; NO, REPEAT LOOP3.
1060:A5 05          LDA   B3+1      ; .
1062:C5 03          CMP   B2+1      ; .
1064:D0 CE          BNE   LOOP3     ; .
1066:        NXT2   EQU   *
1066:A5 02          LDA   B2        ; B2 (LO BYTE) = $00?
1068:D0 B4          BNE   LOOP2     ; NO, REPEAT LOOP2.
106A:        NXT1   EQU   *
106A:88             DEY             ; DECREMENT COL. POINTER.
106B:10 A9          BPL   LOOP1     ; REPEAT UNTIL COL.   0.
106D:        *-----END OF JOB
106D:A9 80          LDA   #$80      ; SET EOJ INDICATOR.
106F:85 0C          STA   EOJSW     ; .
1071:18             CLC             ; (FORCE NEXT BRANCH)
1072:90 2A          BCC   NOTEQ     ; CAUSES FINAL TABLE ENTRY.
1074:        *-----PROCESS SCREEN BYTE
1074:        PRSB   EQU   *
1074:B1 06          LDA   (B4),Y    ; LOAD SCREEN BYTE.
1076:24 0B          BIT   FTSW      ; FIRST TIME?
1078:30 24          BMI   NOTEQ     ; YES, TREAT AS NOT EQ.
107A:C5 08          CMP   PREVX     ; SCREEN BYTE = PREV.?
107C:D0 20          BNE   NOTEQ     ; NO, GOTO NOT EQUAL ROUTINE.
107E:A6 0A          LDX   RPTCT     ; HAS RPTCT REACHED
                                      MAXIMUM ($FF)?
1080:E0 FF          CPX   #$FF      ; .
1082:F0 1A          BEQ   NOTEQ     ; YES, TREAT AS NOT EQ.
1084:E6 0A          INC   RPTCT     ; BUMP REPEAT COUNT.
1086:E8             INX             ; AND X-REG (CONTAINING A
                                      TEMP. COPY).
1087:E0 04          CPX   #4        ; REPEAT COUNT >= 4?
1089:B0 0E          BGE   SAVBYTE   ; YES, SKIP DOWN TO SAVBYTE.
108B:        PRSB1  EQU   *
108B:C5 09          CMP   RPTCD     ; SCREEN BYTE = RPTCD?
108D:F0 0A          BEQ   SAVBYTE   ; YES, SKIP DOWN TO SAVBYTE.
108F:A2 00          LDX   #0        ; (FOR NEXT INST. ONLY)
1091:81 00          STA   (TBPTR,X) ; COPY SCREEN BYTE TO TABLE.
1093:E6 00          INC   TBPTR     ; INCREMENT TBPTR.
1095:D0 02          BNE   SAVBYTE   ; .
1097:E6 01          INC   TBPTR+1   ; .
1099:        SAVBYTE EQU  *
1099:85 08          STA   PREVX     ; SAVE SCREEN BYTE FOR
                                      CMP TO NEXT.
109B:18             CLC             ; (FORCE NEXT BRANCH)
109C:90 B6          BCC   NXT4      ; RETURN TO MAIN LINE.
109E:        NOTEQ  EQU   *
109E:AA             TAX             ; SAVE A-REG.
109F:48             PHA             ; .
10A0:98             TYA             ; SAVE Y-REG.
10A1:48             PHA             ; .
10A2:8A             TXA             ; (GET A BACK.)
10A3:A2 00          LDX   #0        ; CLEAR X-REG.
10A5:        * X-REG TO INDICATE IF RPTCD FOUND IN SCREEN
                                      (0=NO, 1=YES).
10A5:C5 09          CMP   RPTCD     ; SCREEN BYTE = RPTCD?
10A7:D0 05          BNE   N1        ; NO, SKIP TO N1.
10A9:A0 02          LDY   #2        ; SET POINTER OFFSET = 2.
10AB:91 00          STA   (TBPTR),Y ; PUT SCRN BYTE IN TBL
                                      AT TBPTR+2.
10AD:E8             INX             ; INDICATE THAT RPTCD WAS FOUND.
10AE:        N1     EQU   *
10AE:A5 00          LDA   TBPTR     ; SUBTRACT 3 FROM TBPTR.
10B0:38             SEC             ; .
10B1:E9 03          SBC   #3        ; .
10B3:85 00          STA   TBPTR     ; .
10B5:B0 02          BCS   N2        ; .
10B7:C6 01          DEC   TBPTR+1   ; .
10B9:        N2     EQU   *
10B9:24 0B          BIT   FTSW      ; FIRST TIME, GOTO N4.
10BB:30 17          BMI   N4        ; .
10BD:A5 0A          LDA   RPTCT     ; RPTCT >= 4?
10BF:C9 04          CMP   #4        ; .
10C1:B0 06          BGE   N3        ; YES, GOTO N3.
10C3:A5 08          LDA   PREVX     ; PREVX = RPTCD?
10C5:C5 09          CMP   RPTCD     ; .
10C7:D0 0B          BNE   N4        ; NO, SKIP TO N4.
10C9:        N3     EQU   *
10C9:A0 00          LDY   #0        ; ZERO POINTER OFFSET.
10CB:A5 09          LDA   RPTCD     ; STORE RPTCD IN TABLE.
10CD:91 00          STA   (TBPTR),Y ; .
10CF:C8             INY             ; BUMP OFFSET.
10D0:A5 0A          LDA   RPTCT     ; STORE RPTCT IN TABLE.
10D2:91 00          STA   (TBPTR),Y ; .
10D4:        N4     EQU   *
10D4:86 0B          STX   FTSW      ; TURN OFF FTSW (X=0 OR 1 HERE).
10D6:A5 00          LDA   TBPTR     ; GET TBPTR.
10D8:E0 01          CPX   #1        ; RPTCD FOUND IN TABLE?
10DA:18             CLC             ; (...'ADC' COMING)
10DB:D0 05          BNE   N4A       ; NO, SKIP DOWN...
```

Computer Exchange

National Sales Dept. of CUSTOM COMPUTER 926
P.O. Box 1380, Jacksonville, OR 97530

FOR YOUR APPLE II

Apple II +

48K	CALL	
Disk II W/3.3 DOS	CALL	
All 48K's are 1981 models with Apple RAM		
APPLE *III*	CALL	
Apple Monitor 12" Green	$ 249	25%

HARDWARE

		SAVE
Disk II and 3 3 Controller	CALL	CALL
Disk II only	CALL	CALL
NEW **Direct Substitute for Apple Drives**		
A2 Drives from Micro-Sci ---Save $300 on a dual disk system The A2 does not include DOS software		
Micro-Sci 5" Drives for Apple II		
A2, 143KK, 5" Drives	$ 395	18%
A2 Controller Card for A2 Drive	$ 85	15%
A 70, 286K, 5" Drive	$ 489	20%
A 40, 160K, 5" Driva	$ 369	18%
Controllar Card for A70 or A40	$ 79	21%
MONITORS		
★ ATI 9 B&W	$ 119	30 [illegible]
NEC 12 Color	$ 359	24 [illegible]
12 Green	$ 169	22%
SANYO: 9 B&W	$ 159	32%
NEW 9" green	CALL	CALL
NEW 12 B&W	CALL	CALL
NEW 12 Green	CALL	CALL
13 Color	$ 399	38 [illegible]
ZENITH 12 Green	$ 119	20%
DISKETTES, 5 box of 10		
★ Apple	$ 44	21%
Maxell	$ 39	33 [illegible]
Memorex	$ 25	45 [illegible]
80 COLUMN VIDEO CARDS		
Appla, Smarterm	$ 289	20 [illegible]
Videx Videoterm	$ 249	16 [illegible]
M&R Sup R Term	$ 319	19 [illegible]
MISCELLANEOUS		
Appla: Graphics Tablet	$ 695	13%
1 Yr Extanded Warranty	$ 175	20%
IEEE-488 Card	$ 339	25 [illegible]
CCS Serial Interface Card	$ [illegible]9	2[illegible]
Parallel Interfaca Card	$ 99	2[illegible]
★ **Hayes**: Micromodem II	$ 299	26 [illegible]
Smartmodem	$ 249	11 [illegible]
Keyboard Campany: Joystick II	$ 45	10 [illegible]
Numaric Kaypad	$ 119	21%
M&R RF Modulator	$ 25	27%
SUP R FAN	$ 39	25%
★ **Micrasaft**:		
Z80 Softcard	$ 299	33%
16K RAM Card	$ 159	20%
Mountain: CPS Multifunction Card	$ [illegible]9	13 [illegible]
Clock Calandar	$ [illegible]39	1[illegible]
Orange Micro Grappler	$ 129	21%
SSM AIO Serial/Para Interface	$ 159	20%
★ **ALS**: Smarterm 80 Col Card	$ 289	20%
Z-Card (Z-80)	$ 209	22%
Addram 16K Card	$ 119	20%
Synergizer Packaga	$ 549	27%
PRINTERS:		
Appla, Silentype w/Interface	$ 329	17 [illegible]

SOFTWARE

		SAVE
Apple:		
Appla Fortran	$ 149	25%
Apple Pilot	$ 119	27%
Apple Plot	$ 49	30%
Apple Writer	$ 59	21%
DOS 3 3	$ 49	20%
DOS Tool Kit	$ 59	22%
Dow Jones News & Quotes	$ 69	28%
Dow Jones Portfolio Eval	$ 45	10%
Language Pascal System	$ 379	25%
Microcourier	$ 189	24%
Broderbund Software	CALL	CALL
★ **Central Point Software**		
Copy II Plus	$ 35	10%
Will copy most copy protected softwara for your backup in 45 seconds! NEW!		
Epson, MX 80 Graphics Dump	$ 7	30%
Haydan, Sargon II (chess)	$ 29	22%
Info Unlim Easywriter (PRO)	$ 199	13%
★ **Insoft**		
ALD System II	$ 110	10%
TransFORTH II	$ 110	10%
Accounting Software	$ 365	66%
A full professional quality integrated GL, A/R A/P Payroll package Hotlina support available Sand for free sample printouts Requiras Z80 and 16K RAM card		
Micro Pro		
WordStar	$ 239	36%
Super Sort	$ 129	36%
Mail Merger	$ 79	36%
Data Star	$ 189	36%
Spell Star	$ 159	36%
Microsoft (on disks)		
A[illegible]DS	$ 110	10%
BASIC Compiler	$ 299	25%
Cobol 80	$ 559	25%
Fortran 80	$ 149	25%
Olympic Decathlon	$ 24	24%
TASC Compiler	$ 159	22%
Typing Tutor II	$ 19	30%
Musa, Super Text II	$ 109	27%
Peachtree Software	CALL	CALL
Personal Software		
Desktop Plan II	$ 159	21%
Visicalc 3 3	$ 159	25%
Visiplot	$ 1[illegible]	28%
Visitrend Visiplot	$ 199	31%
Visidex	$ 159	30%
Visiterm	$ 1[illegible]9	27%
Visifile	$ 199	30%
Software Publishing:		
PFS Filing/Data Base	$ 69	28 [illegible]
PFS Report	$ 69	28 [illegible]
Stoneware, DB Master (new version)	$ 179	22%

Epson

		SAVE
MX80	$ 495	36%
MX 80 F/T	$ 629	20%
MX100 F/T w/graphics	$ 779	22%
MX 80/100 Appla Interface and Cable	$ 95	15%
MX 80 Friction feed adaptar	$ 59	22%
MX 80 Graftrax	$ 79	20%
MX 80/100 Atari Cable	$ 29	22%
MX 80/100 TRS 80 Cable	$ 29	22%

★ Corvus

		SAVE
5 Meg Hard Disk	$ 2995	21%
10 Meg Hard Disk	$ 4345	20%
20 Meg Hard Disk	$ 5245	20%
Omni-Net	CALL	CALL
Constellation	CALL	CALL
Mirror	CALL	CALL
Other Accessories	CALL	CALL

INTERTEC DATA SYSTEMS® SUPERBRAIN

SAVE 60% $ 1995

★ Superbrain 64K Double Density

Superbrain 64K Quad Density $ 2895 28%

ATARI® 800 16K

$759

ATARI® SAVE 30%

		SAVE
Atari 820 Printer	$ 249	17%
Atari 810 Disk Drive	$ 425	29%
Atari 410 Program Recorder	$ 59	34%
Atari 16K RAM Module	$ 83	27%
Atari 850 Interface	$ 149	32%
Atari/Epson Cable	$ 29	22%
Atari Software	CALL	CALL

HEWLETT PACKARD

		SAVE
HP-85A Microcomputer with built-in printer and monitor	$ 2395	27%
HP-125 New! Microcomputer 64K CPU/Terminal/Keyboard/Monitor	$ 3095	18%
HP-41CV New! 2 2K Mamory Calculator	$ 245	25%
HP-41C Calculator	$ 185	26%
Memory modula for HP41C	$ 25	25%

Call for other HP equipment, software and accessories!

Above prices for mail orders only Our store showroom is 126 NE "F" St, Grants Pass, OR Store prices, which include software service, differ from mail order prices No mail order sales at store. CALL ORDER DESK

ORDERING INFORMATION:

Minimum order $100 Money Orders, Cashier Checks or Bank Wire welcomed. Visa and MC orders add 3%. Personal or company checks are accepted (allow 20 days to clear). Add 3% for shipping, handling and insurance. UPS ground is standard 6% total for UPS Blue or 10% total for foreign orders or US Parcel Post. include your telephone number No COD's Prices are subject to change without notice Order desk hours are 8 to 5 PST, 10 to 3 Saturdays

REFERENCES:

Custom Computer has been an Apple dealer since 1978 Our bank reference is First Interstate Bank (503) 776-5620 We belong to the Chamber of Commerce (503) 772-6293

Technical Hotline
(503) 772-3803
(CUSTOMERS ONLY-PLEASE HAVE INVOICE # OR PACKING SLIP #)

Oregon Order Desk
(503) 772-3803

VISA master charge

★ STAR INDICATES SPECIAL VALUE

NO SALES TAX

For specific software not listed, CALL

TOLL FREE
NATIONAL ORDER DESK
(800)547-1289

apple computer Sales and Service

We are an authorized dealer and repair center and will repair all Apple equipment regardless of where you purchased it, in or out of warranty. Normally our turn-around time on repairs is 24 hours. Call before sending equipment.

Repair Department
(503) 772-4401

CIRCLE 141 ON READER SERVICE CARD

Packer, continued...

```
10DD:69 06           ADC   #6         ; YES, ADD 6.
10DF:B8              CLV              ; (FORCE NEXT BRANCH)
10E0:50 02           BVC   N4B        ; CONTINUE.
10E2:           N4A  EQU   *
10E2:69 03           ADC   #3         ; ADD 3, INSTEAD.
10E4:           N4B  EQU   *
10E4:85 00           STA   TBPTR      ; BUMPS TBPTR TO NEXT AVAIL LOC.
10E6:90 02           BCC   N5         ; .
10E8:E6 01           INC   TBPTR+1    ; .
10EA:           N5   EQU   *
10EA:A9 01           LDA   #1         ; RESET RPTCT TO 1.
10EC:85 0A           STA   RPTCT      ; .
10EE:68              PLA              ; RESTORE Y.
10EF:A8              TAY              ; .
10F0:68              PLA              ; RESTORE A.
10F1:24 0C           BIT   EOJSW      ; END OF JOB?
10F3:10 96           BPL   PRSB1      ; NO, FINISH PROCESSING
                                        SCREEN BYTE.
10F5:60              RTS              ; YES, RETURN TO CALLER.

*** SUCCESSFUL ASSEMBLY: NO ERRORS
```

```
----- NEXT OBJECT FILE NAME IS HR.UNPACKER.OBJ0
0300:                ORG   $300
      *****************************************************
0300:           *-PROGRAM: HR.UNPACKER
0300:           *-VERSION: 1.0
0300:           *-WRITTEN BY: KEN HALEY
0300:           *-DATE: 7/15/81
0300:           *-HI-RES SCREEN EXPANSION ROUTINE
0300:           *- RESTORES HI-RES SCREEN FROM COMPRESSED
0300:           *- DATA BUILT BY HR.PACKER.
      *****************************************************
0000:                DSECT            ; PAGE ZERO VARIABLES.
0000:                ORG   0          ; .
0000:00 00      TBPTR DW   0          ; POINTER TO END OF PACKED
                                        PICTURE.
0002:00 00      B2   DW    0          ; LOOP2 COUNTER
0004:00 00      B3   DW    0          ; LOOP3 COUNTER
0006:00 00      B4   DW    0          ; LOOP4 COUNTER
0008:00         RPTCD DFB  0          ; REPEAT CODE (WILL = '$FE')
0009:00         RPTCT DFB  0          ; COUNT OF REPEATING BYTES
000A:00         RPTSW DFB  0          ; REPEATING IN PROGRESS?
                                        (MSB ON = YES)
000B:00         CURCH DFB  0          ; CURRENT CHARACTER (FROM TABLE)
0300:                DEND             ; (END OF PAGE ZERO DEFINITIONS)
0300:           *-----INITIALIZATION
0300:A9 00           LDA   #$00       ; SET TBPTR = $4000.
0302:85 00           STA   TBPTR      ; .
0304:A9 40           LDA   #$40       ; .
0306:85 01           STA   TBPTR+1    ; .
0308:A9 FE           LDA   #$FE       ; SET RPTCD = $FE.
030A:85 08           STA   RPTCD      ; .
030C:A9 00           LDA   #0         ; SET RPTSW OFF.
030E:85 0A           STA   RPTSW      ; .
0310:           *
0310:           *-----MAIN LINE
0310:A0 27           LDY   #39        ; SET Y = 39.
0312:           * (Y-REG NOW CONTAINS COLUMN NO.)
0312:           LOOP1 EQU  *
0312:A9 78           LDA   #$78       ; SET B2 = $2078.
0314:85 02           STA   B2         ; .
0316:A9 20           LDA   #$20       ; .
0318:85 03           STA   B2+1       ; .
031A:           LOOP2 EQU  *
031A:A5 02           LDA   B2         ; SUBTRACT $28 FROM B2.
031C:38              SEC              ; .
031D:E9 28           SBC   #$28       ; .
031F:85 02           STA   B2         ; .
0321:B0 02           BCS   L2A        ; .
0323:C6 03           DEC   B2+1       ; .
0325:           L2A  EQU   *
0325:A5 02           LDA   B2         ; SET B3 = B2 + $400
0327:85 04           STA   B3         ; .
0329:A5 03           LDA   B2+1       ; .
032B:18              CLC              ; .
032C:69 04           ADC   #$4        ; .
032E:85 05           STA   B3+1       ; .
0330:           LOOP3 EQU  *
0330:A5 04           LDA   B3         ; SUBTRACT $80 FROM B3.
0332:38              SEC              ; .
0333:E9 80           SBC   #$80       ; .
```

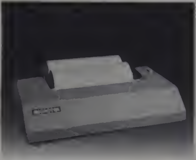
Packer, continued...

```
Ø335:85 Ø4                 STA  B3           ; .
Ø337:BØ Ø2                 BCS  L3A          ; .
Ø339:C6 Ø5                 DEC  B3+1         ; .
Ø33B:           L3A        EQU  *
Ø33B:A5 Ø4                 LDA  B3           ; SET B4 = B3 + $2ØØØ.
Ø33D:85 Ø6                 STA  B4           ; .
Ø33F:A5 Ø5                 LDA  B3+1         ; .
Ø341:18                    CLC               ; .
Ø342:69 2Ø                 ADC  #$2Ø         ; .
Ø344:85 Ø7                 STA  B4+1         ; .
Ø346:           LOOP4      EQU  *
Ø346:A5 Ø7                 LDA  B4+1         ; SUBTRACT $4ØØ FROM B4.
Ø348:38                    SEC               ; .
Ø349:E9 Ø4                 SBC  #$4          ; .
Ø34B:85 Ø7                 STA  B4+1         ; .
Ø34D:18                    CLC               ; (FORCE NEXT BRANCH)
Ø34E:9Ø 1A                 BCC  PRSB         ; PROCESS SCREEN BYTE.
Ø35Ø:           NXT4       EQU  *
Ø35Ø:A5 Ø7                 LDA  B4+1         ; B4 = B3?
Ø352:C5 Ø5                 CMP  B3+1         ; .
Ø354:DØ FØ                 BNE  LOOP4        ; NO, REPEAT LOOP4.
Ø356:           NXT3       EQU  *
Ø356:A5 Ø4                 LDA  B3           ; B3 = B2?
Ø358:C5 Ø2                 CMP  B2           ; .
Ø35A:DØ D4                 BNE  LOOP3        ; NO, REPEAT LOOP3.
Ø35C:A5 Ø5                 LDA  B3+1         ; .
Ø35E:C5 Ø3                 CMP  B2+1         ; .
Ø36Ø:DØ CE                 BNE  LOOP3        ; .
Ø362:           NXT2       EQU  *
Ø362:A5 Ø2                 LDA  B2           ; B2 (LO BYTE) = $ØØ?
Ø364:DØ B4                 BNE  LOOP2        ; NO, REPEAT LOOP2.
Ø366:           NXT1       EQU  *
Ø366:88                    DEY               ; DECREMENT COL. POINTER.
Ø367:1Ø A9                 BPL  LOOP1        ; REPEAT UNTIL COL.   Ø.
Ø369:           *-----END OF JOB
Ø369:6Ø                    RTS               ; RETURN TO CALLER.
Ø36A:           *-----PROCESS SCREEN BYTE
Ø36A:           PRSB       EQU  *
Ø36A:24 ØA                 BIT  RPTSW        ; REPEAT IN PROGRESS?
Ø36C:3Ø 38                 BMI  PRSB2        ; YES, GOTO PRSB2.
Ø36E:A2 ØØ                 LDX  #Ø           ; (FOR NEXT INST.)
Ø37Ø:A1 ØØ                 LDA  (TBPTR,X)    ; GET TABLE BYTE.
Ø372:85 ØB                 STA  CURCH        ; SAVE IT.
Ø374:C5 Ø8                 CMP  RPTCD        ; = REPEAT CODE?
Ø376:DØ 21                 BNE  PRSB1        ; NO, SKIP DOWN...
Ø378:E6 ØØ                 INC  TBPTR        ; YES, BUMP TABLE POINTER.
Ø37A:DØ Ø2                 BNE  N1           ; .
Ø37C:E6 Ø1                 INC  TBPTR+1      ; .
Ø37E:           N1         EQU  *
Ø37E:A1 ØØ                 LDA  (TBPTR,X)    ; GET RPTCT FROM TABLE.
Ø38Ø:85 Ø9                 STA  RPTCT        ; .
Ø382:E6 ØØ                 INC  TBPTR        ; BUMP TABLE POINTER.
Ø384:DØ Ø2                 BNE  N2           ; .
Ø386:E6 Ø1                 INC  TBPTR+1      ; .
Ø388:           N2         EQU  *
Ø388:A1 ØØ                 LDA  (TBPTR,X)    ; GET CURCH FROM TABLE.
Ø38A:85 ØB                 STA  CURCH        ; .
Ø38C:E6 ØØ                 INC  TBPTR        ; BUMP TABLE POINTER.
Ø38E:DØ Ø2                 BNE  N3           ; .
Ø39Ø:E6 Ø1                 INC  TBPTR+1      ; .
Ø392:           N3         EQU  *
Ø392:A9 8Ø                 LDA  #$8Ø         ; SET RPTSW.
Ø394:85 ØA                 STA  RPTSW        ; .
Ø396:18                    CLC               ; (FORCE NEXT BRANCH)
Ø397:9Ø ØD                 BCC  PRSB2        ; GOTO PRSB2.
Ø399:           PRSB1      EQU  *
Ø399:A5 ØB                 LDA  CURCH        ; PUT CURCH ONTO SCREEN.
Ø39B:91 Ø6                 STA  (B4),Y       ; .
Ø39D:E6 ØØ                 INC  TBPTR        ; BUMP TABLE POINTER.
Ø39F:DØ Ø2                 BNE  N4           ; .
Ø3A1:E6 Ø1                 INC  TBPTR+1      ; .
Ø3A3:           N4         EQU  *
Ø3A3:18                    CLC               ; (FORCE NEXT BRANCH)
Ø3A4:9Ø AA                 BCC  NXT4         ; RETURN TO MAIN LINE.
Ø3A6:           PRSB2      EQU  *
Ø3A6:A5 ØB                 LDA  CURCH        ; PUT CURCH ONTO SCREEN.
Ø3A8:91 Ø6                 STA  (B4),Y       ; .
Ø3AA:C6 Ø9                 DEC  RPTCT        ; DECREMENT REPEAT COUNTER.
Ø3AC:DØ A2                 BNE  NXT4         ; RETURN TO MAINLINE IF STILL +.
Ø3AE:A9 ØØ                 LDA  #Ø           ; OTHERWISE TURN OFF RPTSW.
Ø3BØ:85 ØA                 STA  RPTSW        ; .
Ø3B2:FØ 9C                 BEQ  NXT4         ; ...AND RETURN.

*** SUCCESSFUL ASSEMBLY: NO ERRORS
```

NEW PRINTERS. NEW PERIPHERALS. SAME OLD RELIABLE QUALITY AND VALUE.

1982 will find more OEM's, businesses, dealers and personal computer users turning to MICROTEK than ever before.

TekWriter-1



80 Column Dot Matrix Printer
(Formerly BYTEWRITER-1)

The Tekwriter-1 printer is, dollar for dollar, the finest value in the industry. And we've proved it by comparing the Tekwriter-1 to the Epson MX-80. Our print speed is 14 lines per minute faster, our life expectancy is longer, the character sets are the same, and the interface, warranty and printhead replacement cost are all identical.* But the biggest difference is the price. The Tekwriter-1 is about $300 less.

Our extensive testing has proved that the Tekwriter-1 interfaces problem-free to the TRS-80, the Apple II and the Atari 400 and 800.

The Tekwriter-1 is tough to beat for performance and quality.

*Data Source: Epson MX-800 Operation Manual

$349

TekWriter-2

NEW! 80/132 Column Dot Mattix Printer

The Tekwriter-2 is perfectly suited to personal, business or OEM applications. Tekwriter-2 is designed to accept single sheet, roll or pin feed paper. It has a 9-wire dot matrix impact print head which produces crisp characters and has underlining capability. The printer is manufactured to run extremely quietly even while operating at peak output levels.

Tekwriter-2 is especially well suited to handle an abundance of text entry because of its data buffer expansion capability to 25K. This ability makes it an efficient graphics generator.

Parallel interface (Centronics type). Interfaces all models of TRS-80, Apple, and Atari 400/800, and most computers with Centronics printer interface.

$695

Peripherals

16K Memory Board, AMB-16

16K 4116 RAM (200NS)
• Assembled and tested • No modifications — hardware or software • Compatible with Atari 800

32K Memory Board, AMB-32

32K 4116 RAM (200NS) • Assembled and tested • No modifications — hardware or software • Compatible with Atari 400/800

Atari (RS-232) Serial Printer Cable

Pre-tested • 3′ length • DB15 to DB25 connectors

Atari Parallel Printer Cable

Pre-tested • 3′ length • Centronics compatible • DB15 to Amphenal 57-30360

16K Apple Memory Card

Expands Apple II to 64K RAM memory. Works with MICROSOFT Z-80 Softcard, Apple PASCAL and Visicalc software.

Quantity and OEM discounts available.

Continuing our quest for excellence.

MICROTEK inc.

MICROTEK
9514 Chesapeake Drive
San Diego, CA 92123
(714) 278-0633
Outside CA call
Toll Free (800) 854-1081
TWX. 910-335-1269

CIRCLE 342 ON READER SERVICE CARD

BUSINESS and UTILITIES

SPELLGUARD™ (8" CP/M only) — List Price: $269, DYNACOMP Price: $219.95 Disk

SPELLGUARD is a revolutionary new product which increases the value of your current word processing system (WORDSTAR, MAGIC WAND, ELECTRIC PENCIL, TEXTED EDITOR II and others). Written entirely in assembly language, SPELLGUARD™ rapidly assists the user in eliminating spelling and typographical errors by comparing each word of the text against a dictionary (expandable) of over 20,000 of the most common English words. Words appearing in the text but not found in the dictionary are "flagged" for easy identification and correction. Most administrative staff familiar with word processing equipment will be able to use SPELLGUARD™ in only a few minutes.

MAIL LIST 2.2 (Apple, Atari and North Star diskette only) — Price: $34.95

This program is unmatched in its ability to store a maximum number of addresses on one diskette (minimum of 1100 per disk unit, more than 2200 for "double density" systems!) Its many features include alphabetic and zip code sorting, label printing (1, 2, or 3 up), merging of files and a unique keyword sorting routine which retrieves entries by a virtually limitless selection of user defined codes. Mail List 2.2 will even find and delete duplicate entries. A very valuable program!

FORM LETTER SYSTEM rel. 2 (Atari, North Star and Apple Diskettes only) — Price: $34.95

FORM LETTER SYSTEM (FLS) is the ideal program for creating and editing form letters and address lists. It contains an easy-to-use text editor which produces fully justified text. Special codes are used in the address list to obtain personalized salutations. Form letters are produced by automatically inserting each address into a predetermined portion of your letter. FLS is completely compatible with MAIL LIST 2.2, which may be used to manage and sort your address files.

FLS and MAIL LIST 2.2 are available in a combined package for $59.95

SORTIT (North Star only) — Price: $29.95 Diskette

SORTIT is a general purpose sorting program written in 8080 assembly language. This program will sort sequential data files generated by NORTH STAR BASIC. Primary and optional secondary keys may be numeric or one to nine character strings. SORTIT is easily used with files generated by DYNACOMP's MAIL LIST program and is very versatile in its capabilities for all other BASIC data file sorting.

PERSONAL FINANCE SYSTEM (Atari and North Star only) — Price: $34.95 Diskette

PFS is a single diskette, menu-oriented system composed of six different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee and display information on expenditures by any of 26 user defined codes by month or by payee. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations.

FAMILY BUDGET (Apple only) — Price: $34.95 Diskette

FAMILY BUDGET is a very convenient financial record keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries to any of 21 different expense accounts as well as in 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

INTELINK (Atari only) — Price: $49.95 Diskette

This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a very smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later in controlling input for a time share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed, batch processing. All this adds up to saving both connect time and your time.

TEXT EDITOR II (CP/M) — Price: $29.95 Diskette/$33.45 Disk

This is the second release version of DYNACOMP's popular TEXT EDITOR I and contains many new features. With TEXT EDITOR II you may build text files in chunks and assemble them for later display. Blocks of text may be appended, inserted or deleted. Files may be saved on disk/diskette in right justified centered format to be later printed by either TEXT EDITOR II or the CP/M ED facility. Further, ASCII CP/M files (including BASIC and assembly language programs) may be read by the editor and processed. In fact, text files can be built using ED and later formatted using TEXT EDITOR II. All in all, TEXT EDITOR II is an inexpensive, easy to use, but very flexible editing system.

DFILE (Atari and North Star diskettes only) — Price: $19.95

This handy program allows North Star and Atari disk users to maintain a specialized data base of all files and programs in the stack of disks which invariably accumulates. DFILE is easy to set up and use. It will organize your disks to provide efficient locating of the desired file or program.

FINDIT (North Star only) — Price: $19.95

This is a three-in-one program which maintains information accessible by keywords of three types: Personal (eg. last name), Commercial (eg. plumbers) and Reference (eg. magazine articles, record albums, etc.). In addition to keyword searches there are birthday, anniversary and appointment searches for the personal records and appointment searches for the commercial records. Reference records are accessed by a single keyword or by cross-referencing two or three keywords.

SHOPPING LIST (Atari only) — Price: $12.95 Cassette/$16.95 Diskette

SHOPPING LIST is ... information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

TAX OPTIMIZER (North Star only) — Price: $89.95 Diskette

The TAX OPTIMIZER is an easy-to-use, menu oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, income averaging, maximum and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files. TAX OPTIMIZER is tax deductible!

EDUCATION

HODGE PODGE (Apple only, 48K Applesoft or Integer BASIC) — Price: $19.95 Cassette/$23.95 Diskette

Let HODGE PODGE be your child's baby sitter. Pressing any key on your Apple will result in a different and intriguing "happening" related to the letter or number of the chosen key. The program's graphics, color and sound are a delight for children from ages 1½ to 9. HODGE PODGE is a non-intimidating teaching device which brings a new dimension to the use of computers in education.

TEACHER'S PET I (Available for all computers) — Price: $11.95 Cassette/$15.95 Diskette

This is the first of DYNACOMP's educational packages. Primarily intended for pre-school to grade 3, TEACHER'S PET provides the young student with counting practice, letter-word recognition and three levels of math skill exercises.

MISCELLANEOUS

CRYSTALS (Atari only) — Price: $ 8.95 Cassette/$13.95 Diskette

A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY

DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.

Price: $9.95 each/$7.95 each (4 or more)
The complete collection may be purchased for $149.95

DYNACOMP CASSETTES

DYNACOMP now offers high quality DYNACOMP brand name C-30 cassettes for computer use. Each cassette is guaranteed to be defect free.

Box of 10 cassettes $15.95 postpaid
Box of 30 cassettes $39.95 postpaid

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskettes. Additionally, most programs can be obtained on standard (IBM format) 8" CP/M floppy disks for systems running under MBASIC. 5¼" CP/M diskettes are available for North Star and Osborne computer systems.

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) — Price: $39.95 Cassette/$43.95 Diskette

DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter functions or choose from a menu of filter forms. The filter forms are subsequently converted into non-recursive convolution coefficients which permit rapid data processing. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may optionally also be smoothed with a Hanning function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.

DATA SMOOTHER (Not available for Atari) — Price: $19.95 Cassette/$23.95 Diskette

This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) — Price: $19.95 Cassette/$23.95 Diskette

This is a special software package which may be used to evaluate the transfer functions of systems such as hi fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

HARMONIC ANALYZER (Available for all computers) — Price: $24.95 Cassette/$28.95 Diskette

HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of $49.95 (three cassettes) and $59.95 (three diskettes).

REGRESSION I (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy, an automatic degree determination option, an extensive internal library of fitting functions, data editing, automatic data and curve plotting, a statistical analysis (eg. standard deviation, correlation coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (PARAFIT) (Available for all computers) — Price: $19.95 Cassette/$23.95 Diskette

PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data and results may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) — Price: $24.95 Cassette/$28.95 Diskette

MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.

REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for $51.95 (three cassettes) or $63.95 (three diskettes).

ANOVA (Not available for PET/CBM) — Price: $39.95 Cassette/$43.95 Diskette

In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those conversant with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2^{K-P} factorial designs. For those unfamiliar with ANOVA, do not worry. The accompanying documentation was written in a tutorial fashion (by a professor in the subject) and serves as an excellent introduction to the subject. Accompanying ANOVA is a support program for building the data base. Included are several convenient features including data editing, deleting and appending.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)

DYNACOMP is the exclusive distributor for the software keyed to the popular texts *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

Volume 1
- Collection #1 — Chapters 2 and 3 — Data and function plotting, complex variables and functions
- Collection #2 — Chapter 4 — Extended matrix and vector operations
- Collection #3 — Chapters 5 and 8 — Random number generators (Poisson, Gaussian, etc.), series approximations

Price per collection: $14.95 Cassette/$18.95 Diskette

All three collections are available for $39.95 (three cassettes) and $49.95 (three diskettes).

Volume 2
- Collection #1 — Chapter 1 — Linear, polynomial, multi-dimensional, parametric least squares
- Collection #2 — Chapter 2 — Series approximation techniques (economization, inversion, reversion, shifting, etc.)
- Collection #3 — Chapter 3 — Functional approximations by iteration and recursion
- Collection #4 — Chapter 4 — CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions
- Collection #5 — Chapter 5 — Table interpolation, differentiation and integration (Newton, LaGrange, splines)
- Collection #6 — Chapter 6 — Methods for finding the real roots of functions
- Collection #7 — Chapter 7 — Methods for finding the complex roots of functions
- Collection #8 — Chapter 8 — Optimization by steepest descent

Price per collection: $14.95 Cassette/$18.95 Diskette

All eight collections are available for $99.95 (eight cassettes) and $129.95 (eight diskettes).

Because the texts are a vital part of the documentation, *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* are available from DYNACOMP.

BASIC SCIENTIFIC SUBROUTINES, Vol 1 (319 pages) $18.95 + 75¢ postage
BASIC SCIENTIFIC SUBROUTINES, Vol 2 (790 pages) $23.95 + $1.95 postage
See reviews in KILOBAUD and Dr. Dobbs

ROOTS (Available for all computers) — Price: $10.95 Cassette/$14.95 Diskette

In a nutshell, ROOTS simultaneously determines all the zeros of a polynomial having real coefficients. There is no limit on the degree of the polynomial, and because the procedure is iterative, the accuracy is generally very good. No initial guesses are required as input, and the calculated roots are substituted back into the polynomial and the residuals displayed.

ACTIVE CIRCUIT ANALYSIS (ACAP) (48K Apple only) — Price: $25.95 Cassette/$29.95 Diskette

ACAP is the analog circuit designer's answer to LOGIC SIMULATOR. With ACAP you may analyze the response of an active or passive component circuit (e.g., a transistor amplifier, band pass filter, etc.). The circuit may be probed at equal steps in frequency, and the resulting complex (i.e., real and imaginary) voltages at each component juncture examined. By plotting the magnitude of these voltages, the frequency response of a filter or amplifier may be completely determined with respect to both amplitude and phase. In addition, ACAP prints a statistical analysis of the range of voltage responses which result from tolerance variations in the components. ACAP is easy to learn and use. Simply describe the circuit in terms of the elements and their placement, and execute. Circuit descriptions may be saved onto cassette or diskette to be recalled at a later time for execution or editing. ACAP should be part of every circuit designer's program library.

LOGIC SIMULATOR (Apple only; 48K RAM) — Price: $24.95 Cassette/$28.95 Diskette

With LOGIC SIMULATOR you may easily test your complicated digital logic design with respect to given set of inputs to determine how well the circuit will operate. The elements which may be simulated include multiple input AND, OR, NOR, EXOR, EXNOR and NAND gates, as well as inverters, J-K and D flip flops, and one shots. The response of the system is available every clock cycle. Inputs may be clocked in with varying clock cycle lengths/displacements and delays may be introduced to probe for glitches and race conditions. At the user's option, a timing diagram for any given set of nodes may be plotted using HIRES graphics. Save your breadboarding until the circuit is checked by LOGIC SIMULATOR.

ORDERING INFORMATION

All orders are processed and shipped within 48 hours. Please enclose payment with order and include the appropriate computer information. If paying by VISA or Master Card, include all numbers on card.

Shipping and Handling Charges
Within North America: Add $1.95
Outside North America: Add 10% (Air Mail)

Delivery
All orders (excluding books) are sent First Class

Quantity Discounts
Deduct 10% when ordering 3 or more programs. Dealer discount schedules are available upon request.

8" CP/M Disks
Add $2.50 to the listed diskette price for each 8" floppy disk (IBM soft sectored CP/M format). Programs run under Microsoft MBASIC or BASIC-80.

5¼" CP/M Disks
All software available on 8" CP/M disks is also available on 5¼" disks, North Star format.

Ask for DYNACOMP programs at your local software dealer. Write for detailed descriptions of these and other programs from DYNACOMP.

DYNACOMP, Inc. (Dept. C)
1427 Monroe Avenue
Rochester, New York 14618
24 hour order phone: (716)442-8731 recording
Office phone (9AM-5PM EST): (716)442-8960

New York State residents please add 7% NYS sales tax

PAGE FLIPPING

David Lubar

The switches that flip between various text and graphic modes on the Apple allow for some interesting effects. At the high end, smooth animation is possible by drawing on the unseen screen, then flipping it into view. While such feats are beyond the scope of this article, a few simple techniques that show some of the potential of screen flipping will be discussed. The key numbers to keep in mind are those from 49232 to 49239. Poking any of these locations will set a specific switch. Depending on the other switches, various combinations of text and graphics will be produced. See Table 1 for a chart of the switches. Now let's put some of this information to work. Suppose you have a hi-res display, and you want a quick flash of something else. Being trite, assume the phrase 'YOU LOSE" is displayed in large block letters on the lo-res screen. The message could be flashed with the following code

```
100 POKE 49238,0 :REM TURN ON LO-
    RES
110 FOR D=1 TO 100 : NEXT D :REM
    DELAY A BIT
120 POKE 49239,0 : REM BACK TO HI-
    RES
```

Now, how does the image get on the lo-res screen? In most cases it can be drawn by the program. Even if the hi-res display is on, lo-res commands will be carried out. The computer doesn't care what is being displayed. But what if you need several different images to flash at different times, or what if there is no time for the program to create the display? The answer is a short (very short) machine language program (Listing 1) that takes a screen image from elsewhere in RAM and puts it in the lo-res memory. The nice feature of the program is that it leaves any text in the window undisturbed.

The program can be accessed from Basic. The user pokes the address of the image he has saved into locations 0 and 1. For instance, if the image is stored at $6000, the user would POKE 0,0 and POKE 1,96. The way to avoid disturbing the text window is to use some sort of signal or flag byte. In this example $AB is used since it probably won't occur in lo-res data. Whenever the routine encounters $AB, that byte isn't moved. To avoid the drudgery of putting $AB into many locations, the Basic program in Listing 2 sets up the screen image. The entire process is as follows. First, the desired lo-res image is created using graphics commands such as PLOT and VLIN. Next, the image must be moved into location $1000. This is done by entering the monitor with CALL -151 and typing 1000 < 400.7FFM. Next, get

```
:ASM
                *ROUTINE TO MOVE A SCREEN
                *IMAGE INTO LO-RES MEMORY
                *USER MUST PUT POINTERS
                *TO IMAGE INTO LOCATIONS
                *$00 AND $01
                *
                *PROGRAM IS RELOCATABLE
                *
                          ORG  $300
                SRCLO     EQU  $0
                SRCHI     EQU  $01
                DESTLO    EQU  $02
                DESTHI    EQU  $03
                *
0300: A9 04     START     LDA  #$04    ;HI BYTE OF SCREEN START
0302: 85 03               STA  DESTHI  ;SET UP ZERO PAGE POINTERS
0304: AA                  TAX          ;CONVENIENT COUNTER
0305: A9 00               LDA  #$0
0307: 85 02               STA  DESTLO
                *DESTLO NOW POINTS TO $400
0309: A8                  TAY          ;ZERO OUT Y
030A: B1 00     LOOP      LDA  (SRCLO),Y ;GET A BYTE FROM THE SOURCE
030C: C9 AB               CMP  #$AB    ;SHOULD IT BE TRANSFERRED?
030E: F0 02               BEQ  NEXT    ;NO
0310: 91 02               STA  (DESTLO),Y ;YES, PUTY IT ON THE SCREEN
0312: C8        NEXT      INY          ;POINT TO NEXT BYTE
0313: D0 F5               BNE  LOOP    ;TRANSFER A FULL PAGE
0315: E6 01               INC  SRCHI   ;INCREASE HI BYTES OF POINTERS
0317: E6 03               INC  DESTHI  ;FOR NEXT PAGE
0319: CA                  DEX          ;FOUR PAGES DONE?
031A: D0 EE               BNE  LOOP    ;NO
031C: 60                  RTS          ;YES


--- END ASSEMBLY ---

TOTAL ERRORS: 0

29 BYTES GENERATED THIS ASSEMBLY
```

Listing 1.

```
1   REM  THIS PROGRAM FLAGS THE FOUR TEXT LINES IN A SCREEN IMAGE
2   REM  THE IMAGE MUST BE AT $1000
10   FOR I = 4688 TO 4688 + 47
20   FOR J = 0 TO 3
30   POKE I + J * 128,171
40   NEXT J,I
```

Listing 2.

back to Basic with 3D0G (for DOS users) or Control-C (for cassette users) and run the program in Listing 2. The image is now ready and can be saved to disk with BSAVE NAME. A$1000.L$3F8 (the last eight bytes are unneeded and will just waste an extra disk sector). For cassette, the 400.7F8W from the monitor. Later, the image can be brought into any free area of memory and put on the screen using the program in Listing 1.

Unlike the Atari, the Apple is not blessed with internal knowledge of the video signal. This means that rapid page flipping can lead to undesirable results. It works like this. The television is slaving away at what seems like high speed to us mortals. It fills the screen with lines, jumps back to the top, then does it again. To the 6502 chip in the Apple, this process takes forever. The 6502 can perform thousands of operations while the TV electron gun

consumer computers Mail Order DISCOUNTS

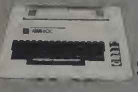
ORDER TOLL-FREE

NEC Microcomputer

PC-8001A 32K Computer	.CALL
PC-8012A I/O Unit w 32K RAM	.CALL
PC-8013A Dual Mini-Disk Drive Unit.	.CALL
PC-8001 Multi Cardware (FDI O & 32K)	.CALL
CP M 2 2 Operating System for NEC	129
WordStar configured for NEC	299
SuperCalc configured for NEC	279
NEC Wordprocessor & Accounting Software.	.CALL

Many more software packages and languages: (Pascal, Fortran, Cobol, etc) are available configured for the NEC 8001A Computer.
Please call or write for a product price list.

ATARI 800 16K $749



Atari 400 w 16K	349
410 Program Recorder.	65
810 Disk Drive.	.449
825 80 col. 7x8 Dot matrix impact printer	699
822 40 col. Quiet Thermal Printer	349
850 Interface Module.	159
Atari 16K Ram Module.	69
Axlon Ramcram 32K Module.	189

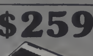
Video Monitors

Amdek/Leedex Video 100 12" B&W	155
Amdek/Leedex Video 100G 12" Green Phosphor.	179
Amdek (Hitachi) 13" Color w/audio output	389
NEC 12" Green Phosphor Display JB-1201M	CALL
NEC 12" Lo-Res Color Display.	.CALL
NEC 12" Hi-Res RGB Color Display.	.CALL
Sanyo 9" B&W Display	185
Sanyo 9" Green Phosphor Display.	.CALL
Sanyo 12" B&W Display	.269
Sanyo 12" Green Phosphor Display	.285
Sanyo 13" Color Display	.449
Zenith 12" Green Phosphor Display ZVM-121	149

ZENITH 12" GREEN $149

VIC20™ $259

Personal Computer



Color * Sound * Graphics
Call or write for more info.
Disk drives available soon!

apple computer

Authorized Dealer

APPLE II PLUS

16K *NOW* $1025
48K *NOW* $1089
64K* *NOW* $1199

*48K Apple with 16K RamBoard

APPLE DISK DRIVES

$439

w/controller and DOS 3.3 $499

Apple Cards and Hardware

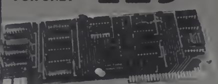
Language System w Pascal & BASICS	.379
Silentype Printer w Interface card	.349
Hayes Micromodem II	.299
Novation Apple-Cat	.339
Videx Videoterm 80 column card	.269
Videx Keyboard Enhancer	115
Z-80 Softcard by Microsoft	.299
16 K RamCard by Microsoft	169
CPS Multi-function card	.109

Software for the Apple

VisiCalc version 3.3	.159
VisiFile (NEW data base manager)	.199
VisiTrend/VisiPlot	219
DB Master	.169
WordStar (Apple 80 col. version)	249
Dow Jones Portfolio Evaluator	45
Apple Post	45
Apple Writer	65
Dow Jones News & Quotes Reporter	85
Apple Plot	.60
Tax Preparer	.99
Real Estate Analyzer	129

16K RAMBOARD *by ConComp* for Apple II Computers

FOR ONLY $129.95



AVAILABLE NOW

S-100

California Computer Systems

Floppy Disk Controller	$369
64K Dynamic Ram Board, 200ns	$499
Z-80 CPU board w monitor ROM	$269
16K Static memory board, 200ns.	369
32K Static memory board, 200ns.	599
S-100 12 Slot Mainframe	.475
4-Port Serial Interface.	.299
2-Port Serial 2-Port Parallel Interface.	.299
4-Port Parallel Interface.	229

Printers

Silentype
w Apple II interface
$349

Epson MX-80 or MX-80 FT CALL

Anadex 9501 w/2K Buffer.	1349
C. Itoh Starwriter 25 CPS daisywheel.	1449
C. Itoh Starwriter 45 CPS daisywheel.	1649
Epson MX-70	.CALL
Epson MX-80 & MX-80 F T	.CALL
Epson MX-100	.CALL
NEC 8023 Impact Dot Matrix.	695
NEC Spinwriters (Latest models)	.CALL
Paper Tiger IDS-445G w/graphics	699
Paper Tiger IDS-460G w/graphics.	.949
Paper Tiger IDS-560G w/graphics	1249
Silentype Printer w/Apple Interface.	349
Qume Sprint Daisywheels (Latest models)	.CALL

ORDER TOLL FREE

800-854-6654

In California and outside continental U.S.

(714) 698-8088

Telex 695-000 Beta CCMO

Send Orders To:

Ordering information Phone orders using VISA MASTERCARD AMERICAN EXPRESS DINER S CLUB CARTE BLANCHE bank wire transfer cashier s or certified check money order or personal check (allow ten days to clear) Unless prepaid with cash please add 5% for shipping handling and insurance (minimum 5.00) California residents add 6% sales tax We accept CODs OEM s Institutions and corporations please send for a written quotation All equipment is subject to price change and availability without notice All equipment is new and complete with manufacturer's warranty usually 90 days) Showroom prices may differ from mail order prices

consumer computers Mail Order

8314 Parkway Drive
La Mesa, Calif. 92041

CIRCLE 140 ON READER SERVICE CARD

```
0  REM  A SHORT AND VAGUELY INTERESTING PROGRAM BY DAVID LUBAR
1  REM  HIT ANY KEY TO STOP
2  REM  ERIC WOLCOTT HAD A HAND IN THIS
10  HGR : HCOLOR= 3: HPLOT 0,0 TO 279,191: HPLOT 279,0 TO 0,191:
 HGR2 : HPLOT 140,0 TO 140,191
50  FOR I = 768 TO 795: READ A: POKE I,A: NEXT I: CALL 768
100  DATA  173,80,192,173,87,192,173,84,192,169,11,32,168,252,17
3,85,192,169,11,32,168,252,173,0,192,16,235,96
```

Listing 3.

```
:ASM
                *A FAIRLY USELESS EXAMPLE
                *OF THE CONFLICT BETWEEN
                *SCREEN FLIPPING AND
                *RASTER SCANS
                *
                *RELOCATABLE CODE
                *
                         ORG  $300
0300: AD 50 C0           LDA  $C050  ;TURN ON GRAPHICS MODE
0303: AD 57 C0           LDA  $C057  ;TURN ON HI-RES
0306: AD 54 C0    LOOP   LDA  $C054  ;TURN ON PAGE ONE
0309: A9 0B              LDA  #$0B    ;THIS VALUE SEEMS TO WORK WELL
030B: 20 A8 FC           JSR  $FCA8  ;MONITOR DELAY ROUTINE
030E: AD 55 C0           LDA  $C055  ;TURN ON PAGE TWO
0311: A9 0B              LDA  #$0B    ;USE SAME DELAY
0313: 20 A8 FC           JSR  $FCA8
0316: AD 00 C0           LDA  $C000  ;CHECK FOR KEYPRESS
0319: 10 EB              BPL  LOOP   ;NO PRESS
031B: 60                 RTS        ;SOMEBODY WANTS OUT
--- END ASSEMBLY ---
TOTAL ERRORS: 0
28 BYTES GENERATED THIS ASSEMBLY
```

Listing 4.

Page Flipping, continued...

is making one pass on the screen. If the computer flips pages in less time than it takes the TV to refresh the screen, alternate chunks from the two pages will be displayed. Suppose the switch takes place with a delay equal to the time the TV requires to create ten lines. The top ten lines will be from the first page. The next ten will be from the second page, and so on. Slight differences in total timing will cause the whole pattern to drift. This can be seen in the Basic program from Listing 3. The program puts lines on the two hi-res pages, then calls a machine language routine. The routine, which is poked from Basic, is shown with comments in Listing 4. To experiment with this, try changing the values used in the two delays.

This problem can produce results that range from a slight flicker to temporary disappearance of a figure on the screen. Fortunately, applications of page flipping that use Basic usually operate at a slow enough relative speed to avoid this problem.

Page flipping can be a very valuable tool on the Apple, and on other computers with similar capabilities. The potential applications are quite diverse, and there are probably many new applications that can be found for this technique. □

CIRCLE 146 ON READER SERVICE CARD

Three-Dimensional Apple Graphics

Mark Pelczarski

Welcome to the world of 3-D graphics! The words you read on this page are certainly on a two-dimensional surface, but step back a minute and survey your surroundings. The world around you has another dimension: depth. Imagine looking at a computer screen; it is definitely two-dimensional. But on the same screen you can view television shows and movies that give the illusion of that third dimension. As people on the screen move further away, they appear to get smaller, as they move closer, they appear larger. Think about it.

The program accompanying this article works on an Apple II with 48K, disk drive, and Applesoft firmware (or the language system). It allows you to create line drawings that you can rotate, scale, and move around the screen in what will appear to be three dimensions. The program is in Basic, so don't expect to be able to do rapid 3-D animations with it. It is accurate, however, and fairly easy to use.

The program was sold for a short time, and to be fair, anyone who bought a copy is welcome to contact Co-op Software about trading it in for "The Complete Graphics System," which has, among other things, a much-improved machine language version of the 3-D program. The address for Co-op Software is P.O. Box 432, West Chicago, IL 60185, and the phone number is (312) 231-0912.

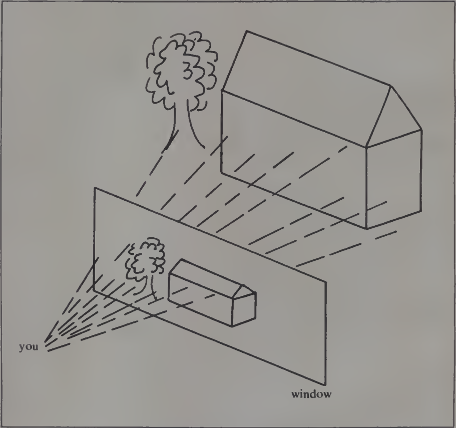


Figure 1. Projecting a 3-D subject onto a 2-D surface.

Projecting 3-D Images

To start, let's look at a technique for making an object appear three-dimensional on a two-dimensional screen, trying not to worry too much about mathematics, yet. Imagine your television screen as a window, with real 3-D objects behind it. Better yet, find a window and a grease pencil. Sit close enough so you can reach the window, and trace what you see outside onto the surface of the window with the pencil (before you start, you'd better make sure you can erase what you draw). You should wind up with a two-dimensional (the window surface) rendition of the three-dimensional outside; and it should be pretty accurate, or, as they say in 3-D graphics-land, in "true perspective."

How does it work, and how can that idea be transferred to a computer? See the drawing in Figure 1. Light travels in a straight line from the actual object, through the window, to your eyes (technical fiends will please disallow any refraction through the window). Where the lines intersect the window, you have an outline of the objects outside, projected on a two-dimensional surface. It's the same thing that happens on film in cam-

Mark Pelczarski, 1206 Kings Circle, West Chicago, IL 60185.

We'd like your apple® to meet The Executive Secretary™

The professional word processing system for the Apple™ computer

check this chart:

GENERAL		
Editing, printing, form letters, mail-marge, and electronic mail all in one package at one price?	✓	
User's manual designed for the user?	✓	
User-controlled configuration of printers, slots, drives, and 40/80 column editing?	✓	
THE MANUAL		
Complete index included?	✓	
Organized as a set of lessons?	✓	
Easel-bound for ease of use?	✓	
THE DOCUMENT PRINTER		
Integrates files from DB MASTER's Utility Pack™, The Data Factory™, Visicalc™, Information Master™, and most DIF™ files.	✓	
Accepts keyboard input at print time?	✓	
Supports all major printers, including Centronics 737 and IBM ET- series?	✓	
Has IF and related commands to allow conditional printing of information based on the contents of a database or on keyboard input?	✓	
Prints page headers of arbitrary complexity?	✓	
Prints page numbers wherever you want them?	✓	
Automatically generates alphabetical index for words you specify?	✓	
Supports file chaining and file nesting?	✓	
Has multi-level outline indenting?	✓	
Has left- and right-justified tab stops?	✓	
Gives full control of all margins, dynamic text reformatting, centering, and justification?	✓	
Supports Thunderclock™ and the CCS clockcard for automatic dating?	✓	

INTEGRATED CARD FILE FEATURES		
Allows multiple card files per disk?	✓	
Allows user to define size and content of 'cards' in each file?	✓	
Generates new subset card files based on search or sort criteria for an existing file?	✓	
Incorporates one/multiple line report printer for card files?	✓	
Allows totals and subtotals during report printing?	✓	
THE DOCUMENT EDITOR		
Keeps up with professional typing speeds?	✓	
User-defined phrase abbreviations?	✓	
40 or 80 character edit modes user-selectable?	✓	
Supports Smarterm™, Superterm™, Videoterm™ and Full View 80™.	✓	
Uses real shift key?	✓	
Supports file merge and unmerge?	✓	
Global search and replace?	✓	
Block operations: move, transfer, delete?	✓	
Character/word/line: insert/replace/delete?	✓	
Allows embedded commands to control special printer functions?	✓	
ELECTRONIC MAIL SYSTEM		
Menu driven?	✓	
Multiple document queuing?	✓	
Fully automatic with Hayes modem?	✓	

Published by: SOF/SYS, INC.
4306 Upton Avenue South
Minneapolis, Minnesota 55410
Phone (612) 929-7104

Distributed by:

Aurora Systems
2040 East Washington Ave.
Madison, WI 53704
(608) 249-5875

Eastern Software
17 Commerce Street
Baltimore, MD 21012
(301) 539-5022

Software Express
2615 Miller Avenue
Mountain View, CA 94041
(415) 949-1118

eras. The mathematical key is that there are points on one side of a plane, connected with lines to a point on the other side of the plane, and where those lines intersect the plane is the two-dimensional projection. The points on one side are the object, the point on the other side is your eyes, the plane is the window, and the lines are the light.

Defining Some Program Storage

Now to set some structure to what we need for a computer rendition of all this. We'll define our objects as stick figures. We'll store a set of points with three-dimensional coordinates: X, Y, and Z. To stay somewhat consistent with what you already know about screen graphics, X will measure across the screen, left to right, Y will measure from the bottom of the screen to the top, and Z will measure the depth, from the screen surface, with positive values toward the back (see Figure 2). The point (0,0,0) will be at the center of the screen, on the screen. (Those of you familiar with 3-D coordinates will notice that the axes are tilted 90 degrees back from their usual orientation, to enable us to reference here to Z as depth.)

The points whose coordinates will be stored in memory will simply be endpoints of lines. No need to store every point of the line, since projected lines will still connect their projected endpoints. In addition to the coordinates of the endpoints, then, we'll also store a list of lines. These will be identified by the numbers of their two endpoints—sort of a three-dimensional "connect-the dots." Figure 3 shows how the cube in Figure 2 would be stored.

In a 48K Apple, there is comfortable room for 500 points and 750 lines, so define the following for storage:

X(499)—the x-coordinate of each point, 0 to 499

Y(499)—the y-coordinate of each point

Z(499)—the z-coordinate of each point

L%(749,1)—endpoints of lines 0 to 749; L%(I,0) is the number of one endpoint, and L%(I,1) is the other. The "%" makes L% an integer variable, which takes 2 bytes per element rather than 5, which it would take as a floating point variable.

The actual coordinates of an endpoint would be found using something like X(L%(I,0)), Y(L%(I,0)), and Z(L%(I,0)), where I is the number of the line, and L%(I,0) holds the point number.

If that's not confusing enough, the actual program uses an array P(499,2) for the points, rather than X, Y, and Z. If N is a point number, P(N,0) is the x-coordinate, P(N,1) is the y-coordinate, and P(N,2) is the z-coordinate. This shortens parts of the program by allowing loops, but for the purposes of this article, we'll use X, Y, and Z.

Putting an Object on the Screen

All the necessary factors are there: points are stored, the screen is the xy-plane, and your eye is somewhere out on the negative end of the z-axis (D1 is that distance in the program). When I started this part of program development, I assumed there would be some pretty heavy mathematics involved. After days of poring over old math books, going over three-dimensional equations of lines, equations for planes, techniques for finding intersections of lines and planes, all the equations for finding the projected points came down to a relatively simple relation: proportions. You need X and Y coordinates on the screen, and you have X, Y, and Z coordinates for the point you

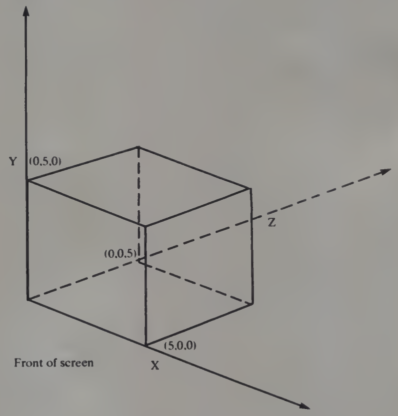


Figure 2. Axes.

Points

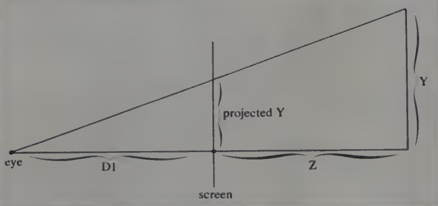
#	X	Y	Z
0	0	0	0
1	5	0	0
2	5	5	0
3	0	5	0
4	0	0	5
5	5	0	5
6	5	5	5
7	0	5	5

Lines

#	From	To
0	0	1
1	1	2
2	2	3
3	3	0
4	4	5
5	5	6
6	6	7
7	7	4
8	0	4
9	1	5
10	2	6
11	3	7

Figure 3. Points and lines for a cube.

Figure 4. Projecting Y onto the screen.



want projected. Imagining the lines shown in Figure 4 gives two similar triangles. You can compute the X and Y separately; the figure and following computation shows finding Y.

$$\frac{Y}{D1+Z} = \frac{\text{project } Y}{D1}$$

or

$$\text{project } Y = \frac{Y*D1.}{D1+Z.}$$

This computation is running around somewhere in lines 4385 and 4390 of the program. Unfortunately, by then I've already changed D1 to VZ, which does some scaling for the purposes of getting a decent size on the screen. 'TR' is the point, TRanslated onto the screen. Once this is done for the X and Y coordinates of each endpoint of a line, a line is drawn connecting the translated points. The process is repeated for each set of endpoints and each line.

More Fun—Moving an Object

Just looking at a 3-D object projected on the screen isn't actually a barrel of thrills unless you can do something to it, such as move it or turn it to see another angle. It's nicer to be able to see something on the screen like the little sports car that just came around the corner outside the window. First you see its side, then the front as it turns, then it gets larger (or appears to) as it approaches and drives past. (It's a good thing the car came by; I was about to try describing the building next door doing a 90 degree turn.)

There are two approaches to viewing other angles of an object: move the object, or move your viewpoint. Moving the object requires changing all the coordinates of the object. Moving the viewpoint would seem to require movement of only one point, but it makes translation to two dimensions a little more lengthy. With this program it's more beneficial to move the object, since later we'll also talk about having more than one object on the screen and moving each independently (such as moving one box so it's on top of another).

There are three basic operations we can do with an object: shifting, rotating, and scaling. Each operation somehow affects the coordinates of each point that is stored. None of the operations affects the line information, as lines simply connect their endpoints.

Shifting

Shifting is moving an object in a direction, and is the easiest. We can shift an object left or right by adding a negative or positive number, respectively, to every

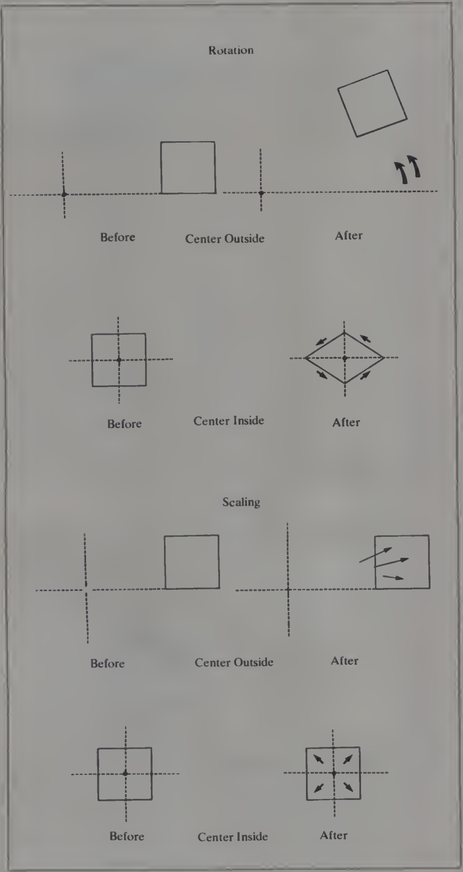


Figure 5. Scaling and Rotating with centers inside and outside object.

x-coordinate of the object. Shifting down or up is accomplished by adding to the y-coordinates, and shifting forward (towards you) or back (away) is accomplished by modifying the z-coordinates. The effect on the screen when shifting up, down, left, or right will be to move the object in that direction, but you will also get more (or less) view of the side of the object. It is comparable to looking at a building straight-on, then looking at it from slightly down the street. Down the street you'll not only see the front, you'll see some of the side. Shifting an object forward or back will make it appear larger or smaller, as real objects appear when you're closer or further from them.

Scaling

Rotation and scaling pose a new problem: both require some type of reference point. In scaling you need a point to scale out from. In rotating, you need a point to turn the object around. In both cases, it is usually most convenient to have this point in the center of the object. Figure 5 shows examples of both operations, each done with the reference point outside the object, then inside the object. In most cases, having this point outside the object will cause rotation or scaling to throw the object right off the screen (over in the closet, on my desk, or in the kitchen).

To solve this, a center point for the figure is computed before any operations are done. This is accomplished by averaging the largest and smallest x-value, the largest and smallest y-value, then the largest and smallest z-value. In the program, it's done in lines 3032-3038, and CR(0), CR(2) are the X, Y, and Z values of the computed center.

To scale a figure, the main step is to multiply every coordinate by a scaling factor, such as 2, to double the dimensions. This operation done to the cube in Figures 2 and 3 would change all the 5's to 10's, doubling the lengths of its sides. Without regarding a center, however, you can also send objects off into never-neverland, or off the screen, whichever comes first. The apparent center of a straight multiplication is the point 0,0,0. To incorporate your own center (the one that we computed) into the scaling involves a three-step process:

Step 1—Subtract the coordinates of the center from every point. This translates the figure to an identical figure that has 0,0,0 as the center.

Step 2—Multiply every coordinate by the scaling constant. This scales it out from the point 0,0,0, which is now within the figure.

Step 3—Add the coordinates of the original center back onto every coordinate. This puts the center back where it orginally was, but the figure is now scaled outward from it.

WE WILL NOT BE UNDERSOLD

DISK DRIVES

FOR TRS-80* Model I

CCI-100	5¼", 40 Track (102K)	$299

ADD-ON DRIVES FOR ZENITH Z-89

CCI-189	5¼", 40 Track (102K)	$389
Z-87	Dual 5¼" system	$995

External card edge and power supply included. 90 day warranty/one year on power supply.

CORVUS	5 mg $3089	10 mg $4489	Mirror	$609
RAW DRIVES		8" SHUGART 801R		$399
5¼" TANDON	$ CALL		POWER SUPPLIES	$ CALL

DISKETTES — Box of 10

5¼"	Maxell	$40	BASF/Verbatim	$26.95
8"	Maxell	$45	BASF/Verbatim	$36.00
PLASTIC FILE BOX-Holds 50 5¼" diskettes				$19.00
PLASTIC LIBRARY CASE		5¼" $3.00	8"	$ 4.00
HEAD CLEANING DISKETTE				$25.00
FLOPPY SAVER	$10.95		RINGS	$ 6.95

16K RAM KITS

	2 for $37	$19
200ns for TRS-80,* Apple II, (specify):	Jumpers	$2.50

COMPUTERS/SYSTEMS

ALTOS	ACS8000 Series	$CALL
ZENITH	48K, all-in-one computer	$2149
ATARI	400	$ 359
	800	$ 789
APPLE PERIPHERALS		$CALL

TERMINALS

ADDS	Viewpoint	$CALL
ZENITH	Z-19	$719
TELEVIDEO	910	$559
	920C	$729
	950	$929

S-100 CALIFORNIA COMPUTER SYSTEMS

MAINFRAME	$349	Z80 CPU	$ 239
64K RAM	$569	FLOPPY DISC CNTRL	$ 339
INTEGRATED SYSTEM W/INTERNAL CABLES, TESTED			$1975

2P + 2S I/O	$ 289
4 PORT SERIAL I/O	$ 249
4 PORT PARALLEL I/O	$ 179
CABLES	$CALL

CASIO CALCULATORS

POCKET COMPUTER	FX702	$199.00
DESK PRINTER/CALCULATOR	FR100	$ 79.95
SCIENTIFIC CALCULATOR	FX8100	$ 49.95
GAME WATCH	CA90 Plastic	$ 49.95
GAME WATCH	CA901 Steel	$ 69.95
SPORT WATCH	AX210 Calendar	$ 59.95

BUSINESS SOFTWARE

WORDSTAR for Apple II	$ 329
WORDSTAR for Zenith Z89	$ 329

PRINTERS

NEC SPINWRITER

7710 R.O. Par	$2395
7710 R.O. Par w/tractor	$2595
7720 KSR w/tractor	$2795
7730 R.O. Ser	$2395
7730 R.O. Ser w/tractor	$2595
NEW 3500 Series	$CALL

EPSON	MX-70	MX-80	MX-80FT	MX100	$CALL

PAPER TIGER

IDS 445	Graphics & 2K buffer			$CALL
IDS 460	Graphics & 2K buffer			$CALL
IDS 560	Graphics			$CALL
ACCESSORIES				$CALL
ANADEX	DP-8000	$849	DP-9500/01	$1389

OKIDATA

Microline 80	Friction & pin feed	$CALL
Microline 82A	Friction & pin feed	$CALL
Microline 83A	120 cps, uses up to 15" paper	$CALL

Call for new Microline series!

CENTRONICS	739, new model with graphics	$ 739
C. ITOH		
Starwriter I	25 cps, parallel interface	$1525
Starwriter I	25 cps, serial interface	$1620
Starwriter II	45 cps, parallel interface	$1950
Starwriter II	45 cps, serial interface	$2075
AXIOM	GP-80M	$ 319
DATA SOUTH	180 cps	$CALL
OLIVETTI	DY 211 Daisy Wheel	$CALL

MONITORS

BELL & HOWELL	9" B & W BHD911			$125
LEEDEX	12" B & W	$129	12" Green Screen	$155
	13" Color	$329		
SANYO	9" B & W	$149	12" Green Screen	$238
	12" B & W	$219	13" Color	$399
ZENITH	13" Color	$349	12" Green Screen	$129

TELECOMMUNICATIONS

PRENTICE STAR MODEM	1-year guarantee			$125
UNIVERSAL DATA SYSTEMS	UDS103LP	$149	UDS103JP	$215
NOVATION	CAT	$139	D-CAT	$149
	AUTO-CAT	$199	APPLE CAT II	$339
D.C. HAYES	SMART/STACK MODEM			$249
	MICRO-MODEM II			$295
CCI Telnet Communications Package				$135

APPLE ACCESSORIES AND SOFTWARE

Mfr. by Microsoft - Mountain Computers - Videx - CCS - Personal Software

VISICALC	$159.00	VISIDEX	$159.00
VISITERM	$119.00	VISIPLOT	$139.00
Z-80 SOFTCARD	$259.00	VIDEX BOARD	$249.00
KEYBOARD ENHANCER	$110.00	16K CARD	$159.00
APPLE JOYSTICK	$ 49.00	SUP-R FAN	$ 39.00
SUP-R MOD	$ 25.00	CCS CARDS	$ CALL
APPLE CARDS	$ CALL	ASCII EXPRESS	$ 59.00
SUPERCALC	$199.00	ALF9 VOICE BOARD	$149.00
CPS MULTIFUNCTION CARD			$199.00
METACARD	8088 MICROPROCESSOR FOR APPLE		$CALL

ENTERTAINMENT

Mfr. by:On Line - Broderbund - Sirius - California Pacific

FLIGHT SIMULATOR	$29.00	SARGON II	$29.00
WIZARD & PRINCESS	$28.00	ABM	$21.95
MYSTERY HOUSE	$24.00	GORGON	$34.95
HI-RES FOOTBALL	$35.00	MICROPAINTER	$29.00
RASTER BLASTER	$25.95	APPLE PANIC	$27.95
SPACE EGGS	$17.95	POOL 1.5	$25.95

For fast delivery, send certified checks, money orders or call to arrange direct bank wire transfers. Personal or company checks require two to three weeks to clear. All prices are **mail order only** and are subject to change without notice. **Call for shipping charges.**

DEALER (NATIONAL/INTERNATIONAL) INQUIRIES INVITED — Send for FREE Catalogue

The CPU SHOP

TO ORDER CALL TOLL FREE 1-800-343-6522

TWX: 710-348-1796 Massachusetts Residents call 617/242-3361

CC1M

420-438 Rutherford Ave., Dept. KOIM
Charlestown, Massachusetts 02129
Hours 10AM-6PM (EST) Mon.-Fri. (Sat. till 5)

Technical Information call 617/242-3361
Massachusetts Residents add 5% Sales Tax
Tandy Corporation Trademark/®Digital Research

master charge THE INTERBANK CARD — VISA

CIRCLE 171 ON READER SERVICE CARD

Rotations

Rotations, like scaling, require a center. When we talk of direction, we'll use that of the part of the object closest to you (when the front rotates to the left, for example, the back goes to the right—we'll call this a left rotation). Rotations can be on any of three axes. Going around the x-axis rotates the object left or right, like a revolving door. Rotating around the z-axis moves the object clockwise or counterclockwise, like (gasp!) the hands of a clock.

Anyway, if a rotation on the z-axis is used as an example, the z-coordinates all stay the same. (Clockwise/counterclockwise doesn't affect the depth of any point.) Pretend your object is a two-dimensional figure, since the z-coordinate is never involved. The X and Y coordinates change according to some old formulas from trigonometry. The formulas have to do with the sine and cosine of the angle of rotation; for short we'll say S=sin(a) and C=cos(a), where "a" is the angle:

new X = C * X - S * Y
new Y = C * Y + S * X
(new Z = Z)

Since this rotation is on the z-axis, the figure will move clockwise or counterclockwise on the screen, depending on the angle of rotation. A small, positive angle causes counterclockwise movement.

Similarly, rotations around the y-axis (left/right) have no effect on the y-coordinate (height of the object on the screen). Again using S and C for the sine and cosine of the angle of rotation, the formulas would be:

new X = C * X - S * Z
new Z = C * Z + S * X

The other possibility, a rotation around the x-axis, gives an up/down movement of the object. In this case the x-coordinate is unaffected. The formulas are:

new Y = C * Y - S * Z
new Z = C * Z + S * Y

If you're studying these equations, note that the plusses and minuses in the equations depend on the direction to which you assign positive angles. This is because the opposite of an angle has the same cosine (cos(-a)=cos(a)), but the opposite sine (sin(-a)=-sin(a)). In this program, down, left, and clockwise are assigned negative angles, and up, right, and counterclockwise are assigned positive angles. This is all handled internally; the program user simply specifies the direction (see lines 6075-6110).

Before a rotation is done, however, we have to do the same operation with the center. Otherwise, rotations will move around the axes, rather than turning the object in its location. The first step is to subtract the center coordinates from all the coordinates of the object. The appropriate rotation formulas are then used, rotating the translated object around one of the axes. The final step is to add the center coordinates onto the new coordinates of the object, putting it back in its original location, but now rotated.

Distortions

There is one added operation in this program, called a distortion. A distortion is scaling an object in one dimension: width, height, or depth (the X, Y, or Z coordinate, respectively). This has the effect of stretching or compacting the object in that dimension. Starting with a cube, for example, you could distort each dimension, giving a rectangular box with any width, height, and depth. Thus, with a few basic shapes, you can create a multitude of variations without having to define new figures.

Designing the Program

The basic options necessary in this program will be creating and editing figures, viewing and manipulating them, saving them for later use, and loading previous figures. Other options included in this program are the ability to clear all figures from memory, for starting over, and saving two-dimensional screen images to disk.

A feature is also included to allow more than one figure to be in memory at a time. It is arranged so that several small figures can be created or loaded from disk and each one manipulated, assembling a larger figure consisting of all small figures in memory. This large figure can be saved, with all the small figures as its parts. The information from all the small figures is kept intact, so when the large figure is re-loaded, the small figures may still be manipulated individually.

To allow this capability, two extra arrays are needed: one to hold the names of the figures in memory, and one to hold the information for first and last point number, and first and last line number. The name array is FT$ in the program, and allows up to 100 names (0-99). The information array is dimensioned FG% (99,3). The '99' allows information for up to 100 figures. If 'I' is the number of the figure, (FG%(I,0) is the starting point of the figure, FG%(I,1) is the ending point, FG%(I,2) is the starting line, and FG% (I,3) is the ending line. An example of using these would be if Figure A had 8 points (0-7) and 12 lines (0-11), and Figure B had 4 points (8-11) and 4 lines (12-15). The starting point for Figure B is 8, the ending point 11, the starting line 12, and the ending line 15.

In the program, lines 5-86 initialize storage and give the main options to the user. LOMEM is set to 16384 so that the variables will not conflict with the high-resolution graphics page. In the array dimensions, T, X, and Y are used as temporary variables, and TR, the only other array not yet mentioned, will hold the values of the three-dimensional coordinates translated to two-dimensions.

All the subroutines dealing with creating, editing, loading, and saving would be considered housekeeping subroutines, separate from the part of the program that actually lets you view and manipulate figures. Those subroutines appear in lines 170-2020. Creating a new figure is done in lines 1000-2020, with the user first entering the points, then the lines. When done entering points (in X,Y,Z coordinates), the user types 'D' for "done." The point numbers for lines are then entered, again followed by "D" when finished.

CIRCLE 187 ON READER SERVICE CARD

The edit subroutine is in lines 170-239. This allows the user to display the points or lines for a figure, and change any of the values assigned to them. When first creating a figure, you may find it advantageous to enter a few "dummy" points to which you won't attach lines, in case you want to use them later. Likewise, you can enter a few dummy lines (connecting point 1 to point 1, for example) for possible later use.

Other subroutines in this section are: saving a figure (lines 250-288), loading a figure (lines 300-336), re-initializing the variables (line 350), and saving a screen image (lines 400-420).

There are a couple of other subroutines following these that let you choose figures for editing and manipulating, and compute information necessary for viewing. Lines 2830 to 2875 allow you to enter a figure name for editing and manipulation. Lines 2900-2930 allow you to specify manipulating everything on the screen, or an individual figure, setting the appropriate variables based on your replies. NP, NL, and NF are the number of points, lines, and figures. SP and EP are the numbers of the starting and ending points for the current figure, and SL and EL are the numbers of the starting and ending lines.

Viewing Figures

There are a few subroutines devoted exclusively to the process of viewing figures. Lines 120-165 control this process. First, the center and the viewer's distance must be computed. This is done in the subroutine in lines 2900-3140, as earlier explained. Then, in a loop, the following occur: the points are computed and translated, lines are drawn on the screen, the user selects an option for manipulating the figure, lines are erased, and the cycle starts over with the new points being computed, lines again drawn, etc. Each process is in its own subroutine. The points are computed and translated in lines 4000-4400. The loop in that subroutine goes from the starting point of the figure to the ending point, performs the selected operation on that point (C holds the operation code), then translates that point to its two-dimensional coordinate and stores that in the TR array. After every point has been done, the subroutine returns.

Lines 5000 to 5290 draw or erase the lines on the screen. SW and FS are switches that tell it which to do. If SW is set to zero, the subroutine erases each line. If FS is set to zero, the subroutine erases the entire screen and draws the new lines. If both SW and FS are equal to 1, then the subroutine only draws the new lines. (FS is 1 when only one figure of many is being moved; that way the other figures are not erased during movement.) This subroutine loops from the starting line to the ending line, determines the endpoints by checking array TR, then checks whether the line fits on the screen. The entire section from line 5070 to 5270 checks each endpoint for being on the screen, and attempts to find a segment of the line that will fit on the screen, if possible. This prevents trouble from parts of the figure that may be above, below, or to the side of the screen.

The last subroutine, where all the decisions are made, is in lines 6000 to 6300. Choices of operation are displayed here, and other decisions are made and constants gotten within this routine. For the sake of using this program, here's a breakdown of choices:

Rotate—allows rotation of the figure. You follow by giving a direction and an angle.

Shift—moves a figure. Again, you give a direction, then the number of units the figure should be moved.

Scale—changes the size of figure. You follow by giving a constant by which the dimensions will be multiplied. The constant may be a whole number or a decimal.

Distort—scales one dimension. You choose the dimension (width, height, or depth) and the constant by which to multiply.

Move Everything/One Figure—lets you choose to have further operations affect all figures in memory or just one. Choices are given to specify all, or a single figure name.

Choose Center—allows you to select your own center for rotations and scaling. Sometimes its advantageous to keep a specific point stationary, which happens with the center in rotate/scale operations. With this option you choose the point number of the center.

Edit, Save, or Quit—returns you to main options.

Full Screen—allows you to view full screen graphics until the next keypress.

Scale View on Screen—allows you to change the size of what you see without affecting the actual coordinates. It's like using binoculars instead of increasing the size of the object. This is also helpful for increasing or decreasing the illusion of perspective; similar to viewing an object closely (more apparent perspective) or from a distance (less apparent perspective). To get more "perspective," move the object very close and scale down the view on the screen. To get less 'perspective', move the object farther away and magnify it with this option.

This program should give you a good idea of how 3-D graphics are simulated by computers, the possible operations on them, and how those operations are performed. Questions regarding the program and the techniques are welcome, and I hope you enjoy it. □

```
1  REM 3-D GRAPHICS
      COPYRIGHT 1980
      MARK PELCZAPSKI
5  LOMEM: 16384: HOME :D$ =  CHR$
    (4): HGR
50  DIM CR(2),T(2),X(1),Y(1),P(49
    9,2),L%(749,1),TR(499,1),FG%
    (99,3),FT$(99)
65  GOSUB 350
70  HOME : VTAB 21: PRINT "1-CREA
    TE FIGURE, 2-EDIT FIGURE": PRINT
    "3-VIEW, 4-START OVER": PRINT
    "5-SAVE ON DISK, 6-GET FROM
    DISK": PRINT "7-SAVE 2 DIMEN
    SIONAL IMAGE, 8-QUIT";
80  INPUT C: IF C   1 OR C > 8 THEN
    70
81  IF C = 1 THEN 1000
82  IF C = 8 THEN  TEXT : STOP
83  IF NF   0 THEN 85
84  IF C   1 AND C < 6 THEN  PRINT
    : PRINT "THERE ARE NO FIGURE
    S IN MEMORY.": PRINT "<PRESS
     ANY KEY ";: GET A$: GOTO 70

85  ON C GOSUB 5,170,120,350,250,
    300,400
86  GOTO 70
120  HGR :C = 1: GOSUB 2910
130  GOSUB 4000:SW = 1: GOSUB 500
    0: GOSUB 6000
155  IF FS = 1 THEN SW = 0: GOSUB
    5000
165  GOTO 130
170  GOSUB 2830:C1 = FG%(CF,0)
175  TEXT : HOME : PRINT FT$(CF)
180  PRINT "1-POINTS,2-LINES,3-CH
    ANGE,4-DONE EDITING";: INPUT
    C: IF C   1 OR C > 4 THEN 18
    0
185  ON C GOTO 190,205,220,239
190  PRINT "#,X,Y,Z:":SW = 1:S1 =
    0: FOR I = C1 TO FG%(CF,1)
194  PRINT I - C1 + 1;: FOR I1 =
    0 TO 2: HTAB 8 + I1 * 8: PRINT
     LEFT$ ( STR$ (P(I,I1)),6);:
     NEXT : PRINT :S1 = S1 + 1: IF
    S1 = 20 THEN  PRINT "<PRESS
    A KEY ";: GET A$:S1 = 0: PRINT

196  NEXT : GOTO 180
205 C = FG%(CF,2): PRINT "#,FROM,
    TO":SW = 2:S1 = 0: FOR I = C
     TO FG%(CF,3)
212  PRINT I - C + 1,L%(I,0) - C1
     + 1,L%(I,1) - C1 + 1:S1 = S
    1 + 1: IF S1 = 20 THEN  PRINT
    " PRESS A KEY ";: GET A$:S1 =
    0: PRINT
214  NEXT : GOTO 180

220  IF SW = 2 THEN 230
222  INPUT "POINT #";I:I = I + C1
     - 1: IF I   C1 OR I > FG%(C
    F,1) THEN 180
224  INPUT "X:";P(I,0): INPUT "Y:
    ";P(I,1): INPUT "Z:";P(I,2):
     GOTO 180
230 C = FG%(CF,2): INPUT "LINE #"
    ;I:I = I + C - 1: IF I   C OR
    I   FG%(CF,3  THEN 180
232  INPUT "FROM #";L%(I,0): INPUT
    "TO #";L%(I,1): FOR I1 = 0 TO
    1:L%(I,I1) = L%(I,I1) + C1 -
    1: NEXT : GOTO 180
239  RETURN
250  INPUT "UNDER WHAT NAME? ";A$

255  PRINT D$;"OPEN";A$
260  PRINT D$;"WRITE";A$
261  PRINT NP: PRINT NL: PRINT NF
    : IF NF   2 THEN 270
262  FOR I = 0 TO NF - 1: PRINT F
    T$(I): FOR I1 = 0 TO 3: PRINT
    FG%(I,I1): NEXT I1,I
270  FOR I = 0 TO NP - 1: FOR I1 =
    0 TO 2: PRINT P(I,I1): NEXT
    I1,I
```

DISCOUNT DATA PRODUCTS

presents

APPLE SOFTWARE

*** GAMES *** UTILITIES *** BUSINESS ***

30% OFF

‡ SPECIAL ITEMS DISCOUNT

CHRISTMAS BONUS: Free Shipping on Orders of $65 or More.

APPLE

	LIST PRICE	OUR PRICE
ADVENTURE INTERNATIONAL		
Adventure Hint Book	7 95	8 35
Adventures #1, #2, #3 .	D 39 95	27 95 ‡
Adventures #4, #5, #6	D 39 95	27 95 ‡
Adventures #7, #8, #9	D 39 95	27 95 ‡
Adventure #10 Savage Island	D 20 95	16 75
Planetoids	D 19 95	15 95
Adventures #10, #11, #12	D 39 95	27 95
Adventures 0 - 10 each	T 19 95	15 95
Asteroids/Planetoids	T 14 95	11 95
ARISCI		
Magic Window	D 99 95	79 95
Magic Mailer	D 89 96	55 95
Magic Speller ...	.. D 59 95	47 95
AUTOMATED SIMULATIONS		
Introductory 3 Pack (Rescue, Morloc's, and Datestones)	D 49 95	39 95
Temple of Apshai	D 39 95	31 95
Hellfire Warrier	D 39 95	27 95‡
Star Warrior	D 39 95	31 95
Crush, Crumble & Crunch	D 29 95	23 95
Dragon's Eye	D 24 95	19 95
Upper Reaches Apshai	D 19 95	15 95
Keys of Acheron	D 19 95	15 95
Datestones of Ryn	D 19 95	15 95
Tues Morn Ortrback	D 29 95	23 95
AVALON HILL GAME COMPANY		
Empire Overmind	D 35 00	27 95
Mjr Leag Basebsll	D 30 00	23 95
Tanktics	D 29 00	22 95
Mjr Leag Baseball	T 25 00	19 95
B-1 Nuclear Bomber	T 15 00	11 95
Midway Campaign	T 15 00	11 95
Nukewar	T 15 00	11 95
Conflict 2500	T 15 00	11 95
Planet Miners	T 15 00	11 95
Computer Acquire	T 20 00	15 95
Lords of Karma	T 20 00	15 95
Empire Overmind	T 30 00	23 95
Tanktics	T 24 00	19 95
BRODERBUND SOFTWARE		
Galactic Empire	D 24 95	19 95
Space Quarks ..	. D 29 95	23 95
Genetic Drift	... D 29 95	23 95
Snoggle	D 24 95	19 95
Alien Typhoon	D 24 95	19 95
Tawala s Lst Redoubt	D 29 95	23 95
Alien Rain	D 24 95	19 95
Demon Derby	D 24 95	19 95
Golden Mountain	D 19 95	15 95
Payroll	D395 00	319 95
Space Warrior	D 24 95	19 95
General Ledger	D395 00	319 95
Apple Panic	D 29 95	23 95
BUDGECO		
Raster Blaster	D 29 95	23 95
CAVALIER		
Asteroid Field	D 24 95	19 95
Star Thief	... D 29 95	20 95
Bug Attack	. D 29 95	23 95
CONTINENTAL SOFTWARE ★ **CAVALIER**		
Hyperspace Wars	D 29 95	23 95
L A Land Monopoly	D 29 95	23 95
Home Money Minder	D 34 95	27 95
3-D Skiing	D 24 95	19 95
CPA General Ledger	D250 00	199 95
CPA Acc Rec	D250 00	199 95
CPA Acc Pay	D250 00	199 95
CPA Payroll	D250 00	199 95

	LIST PRICE	OUR PRICE
CPA Prop Mgt	D175 00	139 95
DAKIN 5		
3 3 Programming Aids	. D 90 00	71 95
★ **DATAMOST**		
DATA SOFT		
Micro Painter	D 34 95	24 50 ‡
Mychess W/Z 80	D 34 95	27 95
Micro Painter alb 1	D 19 95	15 95
Micro Painter alb 2	D 19 95	15 95
Chart Wizard	D 99 95	79 95
Lisp inter	D124 95	99 95
★ **DELTA SOFTWARE** ★ **DENVER SOFTWARE**		
★ **EDU-WARE**		
HAYDEN SOFTWARE		
Sargon II	D 34 95	24 50 ‡
Reversal	. D 34 95	27 95
Data-Graph	D 49 95	39 95
Histo-Graph	D 29 95	23 95
Assembly Lang Dev	D 39 95	31 95
Applesoft Compiler	D200 00	159 95
HIGHLANDS COMPUTING		
Crae 2 0	D 24 95	19 95
Mcat 2 0	D 19 95	15 95
Oldars Revenge Wiz	D 19 95	15 95
Gobblins	D 27 50	21 95
Creature Venture	D 24 95	19 95
INNOVATIVE DESIGN SOFTWARE		
Pool 1 5	D 34 95	27 95
★ **ISA** ★ **IUS** ★ **LAZER SYSTEM**		
★ **MICRO LAB**		
MICROSOFT		
Typing Tutor	D 19 95	15 95
Olympic Decathlon	D 29 95	23 95
Adventure	D 29 95	23 95
A L D S	D125 00	99 95
WordStar	D375 00	299 95
★ **MICRO SOFT** ★ **MICRO PRODUCTS**		
★ **MUSE**		
ON-LINE SYSTEMS		
Mission Asteroid	D 19 95	15 95
Mystery House	D 24 95	19 95
Wiz & Princess	D 32 95	25 95
Cranston Manor	D 34 95	27 95
Ulysess	D 34 95	27 95
Time Zone	D 89 95	71 95
Threshold	D 39 95	33 95
Football	D 39 96	27 95 ‡
Missile Defense	D 29 95	20 95 ‡
Soccer	D 29 95	23 95
Sabotage	D 24 95	19 95
Superscribe Word Pr	D 89 95	71 95
Gobbler	D 24 95	19 95
Expediter II		
AppleSft Compiler	D 99 95	79 95
Dev Sys	D 79 95	64 95
Speed-asm	D 39 95	31 95
★ **PICCADILLY** ★ **PHOENIX SOFTWARE**		
PERSONAL SOFTWARE		
Checker King	D 24 95	20 95
Gammon Gambler	D 24 95	20 95
Monty Plays Monopoly	D 34 95	28 95
Zork	D 39 95	32 95
Microchess	D 24 95	20 95
Desktop Plan II	D199 95	159 95
Visiplot	D179 95	148 00

	LIST PRICE	OUR PRICE
Visicalc 3 3	D199 95	159 95
Visitrend	D259 95	207 95
Visiterm	D149 95	119 95
CCA Data Mgnt Sys	D 99 95	85 95
★ **QUALITY** ★ **RIVERBANK SOFTWARE**		
SENSIBLE SOFTWARE		
Applesoft-Plus Str Basic	D 25 00	19 95
Applesoft Optimizer	D 20 00	15 95
DOS Plus	D 25 00	19 95
Disk Organizer	D 25 00	19 95
Disk Recovery ..	D 20 00	23 95
MultiDisk Ctlog III	.. D 25 00	19 95
Super Disk Copy III	D 30 00	23 95
SENTIENT SOFTWARE		
00-Topos	D 32 95	25 95
SIRIUS SOFTWARE ★ **SIERRA SOFTWARE**		
E-Z Draw 3 0	D 49 95	34 95‡
Phantoms 5	D 29 95	23 95
Space Eggs	D 29 95	23 95
Pulsar II	D 29 95	20 95 ‡
Autobahn	D 29 95	23 95
Orbitron	D 29 95	23 95
Gamma Goblins	D 29 95	23 95
Gorgon	D 39 95	31 95
Sneakers	D 29 95	23 95
Epoch	D 34 95	27 95
Cops & Robbers ...	... D 34.95	24.45
Out Post	. ... D 29 95	23 95
Beer Run .	.. D 34 95	27 95
★ **SIR-TECH SOFTWARE** ★ **SOFTAPE**		
SOFTWARE PUBLISHING CO.		
PFS Per Filing Sys	D 95 00	75 95
PFS Report	D 95 00	75 95
SOUTHWESTERN DATA SYSTEMS		
Apple Doc 3 3	D 44 95	35 96
The Correspondent	D 59 95	47 95
Ace 3 3	D 29 95	23 95
Ascii Express 3 3	D 64 95	51 95
Z-Term	D 99 95	79 95
Online	D 89 95	71 95
Speed Star	D135 00	108 95
STONEWARE		
DB Master	D225 00	179 95
STRATEGIC SIMULATIONS		
Computer Quarterback	D 39 95	31 95
Topedo Fire	D 59 95	41 95‡
Cartels & Cutthroats	D 39 95	31 95
Computer Baseball	D 39 95	31 95
The Warp Factor	D 39 95	31 95
Shattered Alliance	D 59 95	41 95‡
SYNERGISTIC SOFTWARE		
DoomCavern/Sorcerers	D 20 00	15 95
Higher Graphics II	D 35 00	24 50 ‡
Higher Text	D 40 00	31 95
Odyssey	D 30 00	23 95
Wilderness/Dungeon ..	D 32 50	27 95
Modifiable Data Reporter	D150 00	119 95
UNITED SOFTWARE OF AMERICA		
Appleworld	D 59 95	47 95
Super Kram	D175 00	139 95
Request	D225 00	179 95
Space Raiders .	D 29 95	23 95
VERSA COMPUTING		
Versawriter .	289 00	239 95
Versawriter Expansion Pak I .	D 39 95	31 95
E Z Port	.... D 24 95	19 95

★TRS-80 ★ATARI ★COMMODORE

★ SEND FOR OUR PRICE SHEET FOR SPECIFIC PROGRAMS AND PRICES

PLEASE CHECK FOR SYSTEM REQUIREMENTS BEFORE ORDERING
INCLUDE PUBLISHER AND PRODUCT NAME
FOREIGN INQUIRIES INVITED — ADD 10% SHIPPING

All Orders Prepaid by Personal Check Money Order Cashier Check
For Faster Delivery Service COD — Cash Only/Master Charge — Visa
Mastercharge — Visa add 3%, and include expiration date on card
Please Allow Sufficient Time for Checks to Clear
Please Add $2 50 for Shipping

California Residents Add 6% Sales Tax
Prices Valid Through This Month s Issue
Prices Subject to Change Without Notice
Please Specify Tape or Disk

DIRECT ORDER INQUIRIES TO:
DISCOUNT DATA PRODUCTS
P.O. BOX 19674-CB
SAN DIEGO, CA 92119
PHONE 714-287-0190

CIRCLE 158 ON READER SERVICE CARD

3-D Graphics, continued...

```
280 FOR I = 0 TO NL - 1: PRINT L%(I,0): PRINT L%(I,1): NEXT
286 PRINT D$;"CLOSE";A$
288 RETURN
300 ONERR GOTO 302
301 INPUT "UNDER WHAT NAME?";A$: GOTO 304
302 PRINT A$;" WAS NOT FOUND ON DISK.": PRINT "PRESS ANY KEY ";: GET A$: POKE 216,0: GOTO 70
304 PRINT "DO YOU WANT TO KEEP ";A$;" AS THE NAME";: INPUT FT$(NF)
305 IF LEFT$ (FT$(NF),1) = "Y" THEN FT$(NF) = A$: GOTO 308
306 IF LEFT$ (FT$(NF),1) < > "N" THEN 304
307 INPUT "NEW NAME?";FT$(NF)
308 PRINT : PRINT D$;"OPEN";A$
309 PRINT D$;"READ";A$
310 INPUT T(0): INPUT T(1): INPUT T(2)
311 IF T(2) < 2 THEN 321
312 FOR I = NF + 1 TO NF + T(2)
313 INPUT FT$(I)
314 FOR I1 = 0 TO 1: INPUT FG%(I,I1):FG%(I,I1) = FG%(I,I1) + NP: NEXT
317 FOR I1 = 2 TO 3: INPUT FG%(I,I1):FG%(I,I1) = FG%(I,I1) + NL: NEXT I1,I
321 FOR I = NP TO NP + T(0) - 1: FOR I1 = 0 TO 2: INPUT P(I,I1): NEXT I1,I
325 FOR I = NL TO NL + T(1) - 1: FOR I1 = 0 TO 1: INPUT L%(I,I1):L%(I,I1) = L%(I,I1) + NP: NEXT I1,I
331 FG%(NF,0) = NP:FG%(NF,1) = NP + T(0) - 1:NP = NP + T(0):FG%(NF,2) = NL:FG%(NF,3) = NL + T(1) - 1:NL = NL + T(1):CF = NF:NF = NF + T(2) + 1: IF T(2) = 1 THEN NF = NF - 1
334 PRINT D$;"CLOSE";A$
336 POKE 216,0: RETURN
350 NL = 0:NP = 0:NF = 0:VS = 0:CT = 3: RETURN
400 INPUT "UNDER WHAT NAME? ";A$
410 PRINT D$;"BSAVE";A$;",A8192,L8192"
420 RETURN
1000 HOME : TEXT :CF = NF:NF = NF + 1: INPUT "FIGURE NAME? ";FT$(CF):FG%(CF,0) = NP:FG%(CF,2) = NL: PRINT "TYPE 'D' OR 'DONE' WHEN NO MORE POINTS.": ONERR GOTO 1010
1010 PRINT "POINT #";NP - FG%(CF,0) + 1: INPUT "X:";A$: IF LEFT$ (A$,1) = "D" THEN FG%(CF,1) = NP - 1: GOTO 2000
1015 IF ASC (A$) > 57 THEN 1010
1020 P(NP,0) = VAL (A$): INPUT "Y:";P(NP,1): INPUT "Z:";P(NP,2):NP = NP + 1: GOTO 1010
2000 PRINT "TYPE 'D' OR 'DONE' WHEN NO MORE LINES.": ONERR GOTO 2010
2010 PRINT "LINE #";NL - FG%(CF,2) + 1: INPUT "FROM POINT #";A$: IF LEFT$ (A$,1) = "D" THEN FG%(CF,3) = NL - 1: POKE 216,0: GOTO 70
2015 IF ASC (A$) > 57 THEN 2010
2020 L%(NL,0) = VAL (A$): INPUT "TO POINT #";L%(NL,1): FOR I = 0 TO 1:L%(NL,I) = L%(NL,I) + FG%(CF,0) - 1: NEXT :NL = NL + 1: GOTO 2010
2830 IF NF = 1 THEN CF = 0: RETURN
2845 INPUT "WHICH FIGURE? ";A$:I = 0
2855 IF FT$(I) = A$ THEN 2870
2860 I = I + 1: IF I < NF THEN 2855
2862 PRINT "YOU DON'T HAVE ONE HERE NAMED ";A$: PRINT "PRESS A KEY ";: GET A$: POP : RETURN
2870 CF = I
2875 RETURN
2900 IF NF < 2 THEN C = 1: GOTO 2910
2905 INPUT "1-EVERYTHING, OR 2-INDIVIDUAL FIGURE? ";C
2910 IF C = 1 THEN FS = 0:SP = 0:EP = NP - 1:SL = 0:EL = NL - 1: GOTO 3032
2920 IF C < > 2 THEN 2900
2930 GOSUB 2830:FS = 1:SP = FG%(CF,0):EP = FG%(CF,1):SL = FG%(CF,2):EL = FG%(CF,3)
3032 FOR I = 0 TO 2:CR(I) = 999:T(I) = - 999: NEXT
3033 FOR I = SP TO EP
3034 FOR I1 = 0 TO 2
3035 IF P(I,I1) < CR(I1) THEN CR(I1) = P(I,I1)
3036 IF P(I,I1) > T(I1) THEN T(I1) = P(I,I1)
3037 NEXT I1,I
3038 FOR I = 0 TO 2:CR(I) = (CR(I) + T(I)) / 2: NEXT
3048 IF VS = 1 THEN 3140
3049 VS = 1:D1 = 0
3050 FOR I = SP TO EP
3060 VZ = 0: FOR I1 = 0 TO 2:VZ = VZ + (CR(I1) - P(I,I1)) ^ 2: NEXT :VZ = SQR (VZ)
3110 IF VZ > D1 THEN D1 = VZ
3120 NEXT
3130 VZ = - 20 * D1
3140 C = 4: RETURN
4000 FOR I = SP TO EP
4101 IF C = 4 THEN 4380
4102 FOR I1 = 0 TO 2:P(I,I1) = P(I,I1) - CR(I1):T(I1) = P(I,I1): NEXT
4110 ON C GOTO 4130,4200,4280,4380,4300
4130 T(1) = C1 * P(I,1) - S1 * P(I,2):T(2) = C1 * P(I,2) + S1 * P(I,1): GOTO 4350
4200 T(0) = C1 * P(I,0) - S1 * P(I,2):T(2) = C1 * P(I,2) + S1 * P(I,0): GOTO 4350
4280 T(0) = C1 * P(I,0) - S1 * P(I,1):T(1) = C1 * P(I,1) + S1 * P(I,0): GOTO 4350
4300 IF S1 < > 0 THEN T(S1 - 1) = P(I,S1 - 1) * M: GOTO 4350
4305 FOR I1 = 0 TO 2:T(I1) = P(I,I1) * M: NEXT
4350 FOR I1 = 0 TO 2:P(I,I1) = T(I1) + CR(I1): NEXT
4380 IF VZ - P(I,2) > - .001 THEN K = 10000 * D1: GOTO 4390
4385 K = VZ / (VZ - P(I,2))
4390 TR(I,0) = K * P(I,0):TR(I,1) = K * P(I,1)
4400 NEXT : RETURN
5000 IF SW = 0 THEN HCOLOR= 0: GOTO 5010
5005 IF FS = 0 THEN HGR
5006 HCOLOR= 7
5010 FOR I = SL TO EL
5020 SW = 0
5030 FOR I1 = 0 TO 1
5035 IF L%(I,I1) < 0 OR L%(I,I1) > = NP THEN SW = 1: GOTO 5060
5040 X(I1) = TR(L%(I,I1),0) * CT:Y(I1) = TR(L%(I,I1),1) * CT
5060 NEXT
5070 FOR I1 = 0 TO 1
5090 IF SW = 1 THEN 5270
5100 IF ABS (X(I1)) < = 139 THEN 5190
5110 IF ABS (Y(I1)) < = 95 THEN 5150
5120 IF Y(0) = Y(1) THEN 5230
5125 YC = SGN (Y(I1)) * 95:XC = (YC - Y(1)) * (X(0) - X(1)) / (Y(0) - Y(1)) + X(1): IF ABS (XC) < = 139 THEN 5250
5150 IF X(0) = X(1) THEN 5230
5155 XC = SGN (X(I1)) * 139:YC = (XC - X(1)) * (Y(0) - Y(1)) / (X(0) - X(1)) + Y(1): IF ABS (YC) < = 95 THEN 5250
5180 GOTO 5230
5190 IF ABS (Y(I1)) < = 95 THEN 5270
5200 IF Y(0) = Y(1) THEN 5230
5205 YC = SGN (Y(I1)) * 95:XC = (YC - Y(1)) * (X(0) - X(1)) / (Y(0) - Y(1)) + X(1): IF ABS (XC) < = 139 THEN 5250
5230 SW = 1: GOTO 5270
5250 X(I1) = XC:Y(I1) = YC
5270 NEXT
5280 IF SW = 0 THEN HPLOT 140 + X(0),96 - Y(0) TO 140 + X(1),96 - Y(1)
5290 NEXT : RETURN
6000 HOME : VTAB 21: PRINT "1-ROTATE, 2-SHIFT, 3-SCALE OBJECT(S),": PRINT "4-DISTORT, 5-MOVE EVERYTHING/ONE FIGURE": PRINT "6-CHOOSE CENTER, 7-EDIT, SAVE, OR QUIT": PRINT "8-FULL SCREEN ";
6038 IF FS = 0 THEN PRINT "9-SCALE VIEW ON SCREEN ";
6040 INPUT C: IF FS = 0 AND C = 9 THEN 6300
6050 ON C GOTO 6075,6142,6073,6071,6065,6200,6070,6250
6060 GOTO 6000
6065 GOSUB 2900: GOTO 6000
6070 POP : RETURN
6071 PRINT : INPUT "1-WIDTH, 2-HEIGHT, OR 3-DEPTH?";S1: IF S1 < 1 OR S1 > 3 THEN 6071
6073 IF C = 3 THEN S1 = 0
6074 INPUT "MULTIPLY BY? ";M:C = 5: RETURN
6075 HOME : VTAB 21: PRINT "ROTATE 1-DOWN, 2-UP, 3-LEFT, 4-RIGHT,": PRINT "5-CLOCKWISE, 6-COUNTERCLOCKWISE ";: INPUT C: IF C < 1 OR C > 6 THEN 6075
6090 INPUT "ANGLE (0 - 180) ? ";AN: IF AN < 0 OR AN > 180 THEN 6090
6110 AN = 3.14 * AN / 180: IF INT (C / 2) * 2 < > C THEN AN = - AN
6130 S1 = SIN (AN):C1 = COS (AN):C = INT ((C + 1) / 2): RETURN
6142 HOME : VTAB 21: PRINT "SHIFT 1-LEFT, 2-RIGHT, 3-DOWN, 4-UP,": PRINT "5-CLOSER, 6-FARTHER ";: INPUT C: IF C < 1 OR C > 6 THEN 6142
6150 INPUT "HOW MANY UNITS? ";AN: IF INT (C / 2) * 2 < > C THEN AN = - AN
6170 C = INT ((C - 1) / 2):CR(C) = CR(C) + AN: FOR I = SP TO EP:P(I,C) = P(I,C) + AN: NEXT :C = 4: RETURN
6200 PRINT "POINT # (1-";EP - SP + 1;") ";: INPUT C: IF C < 1 OR C > EP - SP + 1 THEN 6200
6210 C = C + SP - 1: FOR I = 0 TO 2:CR(I) = P(C,I): NEXT : GOTO 6000
6250 POKE - 16302,0: GET A$: POKE - 16301,0: GOTO 6000
6300 INPUT "MULTIPLY BY? ";M:CT = CT * M:C = 4: RETURN
```

Graphics Conversion for the TRS-80, Apple, and PET

Richard Kaplan

He sat in the basement hunched over his computer for hours, ambitiously entering a listing of his favorite game. "Converting this program to my machine should be a snap," he thought. "After all, I'm already an old pro at Apple programming. How much different can a TRS-80 be?" Months of fruitless programming later, he surrendered to his computer. He had discovered the hard way just how bewildering program conversion can be to someone with a knowledge of only his own computer.

Graphics conversion is perhaps one of the most frustrating problems with which a microcomputer owner must deal. To an Apple owner, the command "PRINT @ 1000, A + B" might seem like a way of instructing his computer to wait until ten o'clock before printing A + B. By the same token, a TRS-80 owner is just as likely to be able to decipher the meaning of the command "HGR" as he is likely to know offhand the Hungarian word for "disk drive."

But nowhere in the Apple owner's manual can he discover the meaning of PRINT @. Thus, very often, extremely competent programmers find themselves totally out of luck when translating programs for their machines.

This article will deal with the Apple II, the TRS-80 Models I and III, and the PET. In many cases it is possible to translate graphics for one machine directly to another, just as one translates foreign languages. However, there are many situations in which it is quite unrealistic to attempt direct conversion.

At those times, the best approach is to begin by finding out exactly what each graphics function in the program from which you are translating actually does. If you can plot each point on paper, then often it will be possible to modify the screen or devise an algorithm better suited to your computer. So, let's first take a look at the graphics capabilities of each computer.

APPLE

The Apple produces graphics in three ways: standard PRINT statements and two special graphics modes.

Any computer can produce graphics by printing characters on the screen. A simple bar graph, for instance, can easily be generated by drawing asterisks in the appropriate positions on the screen. The Apple provides two commands which greatly aid in developing programs of this nature and which will be very helpful in translating TRS-80 programs to the Apple.

The first step with "printed" graphics is to clear the screen. Typing HOME (or executing this statement from within a program in Applesoft) will accomplish this. If you have Integer Basic, the correct statement is CALL -936.

Any computer can produce graphics by printing characters on the screen.

VTAB and HTAB

The VTAB statement controls the location of the cursor along the Y axis. There are 24 lines on which the Apple can print in Text mode. Typing VTAB XX, where XX is any number from 1 to 24, will move the cursor to that location without erasing any previous characters. As an example, suppose we had executed the following: FOR I=1 to 12:PRINT"HELLO":NEXT. Executing the statement VTAB5:PRINT "GOODBYE" would cause the "HELLO" on the fifth line to be replaced with "GOODBYE."

This same principle can be used with horizontal tabbing. Typing HTAB XX, where XX is any number from 1 to 40, will move the cursor to the appropriate horizontal position.

HTAB and VTAB can be very useful when converting other programs to the Apple, especially when used in conjunction with the other special functions.

PEEK (37) contains a number, which can range from 0 to 23, holding the value of the vertical position of the cursor. This number is one *less* than the value for the same line if used in a VTAB statement. If the cursor is on line 10 and you wish to move the cursor up one position, the command VTAB PEEK(37) will do just that. HTAB PEEK(36) or HTAB POS(0) will do the same horizontally, i.e. move the cursor back one position. Caution should be exercised, however, not to HTAB to a position less than 1 or greater than 40, or to VTAB to a position less than 1 or greater than 24.

Although using ordinary PRINT statements is a very primitive means of programming graphics, in some cases it may be the best and most direct method to use in converting a program. In situations involving more intricate graphics, however, you may wish to use one of the Apple graphics modes.

The Apple has two graphics modes. These modes allow the use of as many as sixteen colo s, as well as some very powerful plotting statements. The only disadvantage to using the Apple graphics modes is that text and graphics cannot be mixed on the same area of the screen without tremendous programming effort. For most purposes the programmer is restricted to four lines of text at the bottom of the screen.

Lo-Res Graphics

Apple low-resolution graphics are very convenient for simple graphics programs. An array of graphics blocks 40 x 40 may be used, with four lines of text at the bottom. A 40 x 48 array is possible without text. Sixteen colors are available with lo-res graphics.

Typing GR (or using this from within a program) enters the lo-res mode (mixed text-graphics.) The screen is cleared to black and PRINT statements produce output only on the bottom four lines of text.

If you want the larger (40 x 48) graphics area, simply type POKE -16302,0. The four lines of text at the bottom disappear and you have an additional eight lines of graphics to work with on the bottom of the screen.

Before plotting any points, the Apple must be assigned a specific color. Sixteen colors are available. To assign a color to graphics, type COLOR=X. where X is

Richard Kaplan, 53 Capral Lane, New City, NY 10956.

any of the following: 0 black, 1 magenta, 2 dark blue, 3 purple, 4 dark green, 5 grey, 6 medium blue, 7 light blue, 8 brown, 9 orange, 10 grey, 11 pink, 12 green, 13 yellow, 14 aqua, 15 white.

Assigning a color has no effect on graphics already on the screen. Only graphics statements executed after this will be of that color. Therefore, executing several color statements allows multiple colors to be used on the same screen.

Apple Low-Resolution Graphics are very convenient for simple graphics programs.

Now for a very basic question: How do you plot a point? Basically, the Apple screen operates similarly to a mathematical coordinate system. The X axis can be pictured as running along the top of the screen, numbered with coordinates from 0 to 39. The Y axis runs parallel to the left side of the screen, with 0 at the top and 39 or 47 at the bottom, depending on whether you have chosen to use the extra eight lines or not. Thus the point 0,0 is at the top left of the screen and the point 39,39 is at the bottom right of the screen (in mixed text-graphics mode).

The PLOT statement actually plots a specific point. Its format is PLOT X,Y. Thus PLOT 20,20 would place a graphics square at a location 20 points away from the left of the screen and twenty points down from the top. To erase this point, set the color to 0 (black) or whatever the background color is and re-plot the point.

It is also possible with the Apple to draw a line between two points on the screen. The command HLIN X,Y AT Z would plot a horizontal line between horizontal coordinates X and Y at vertical location Z. Thus the statement HLIN 1,20 AT 10 would connect the points 1,10 and 20,10. VLIN X,Y at Z does the same thing for a vertical line. Thus, the command VLIN 1,20 AT 10 would connect the points 10,1 and 10,20.

For an example of lo-res graphics see the program in Figure 1 which shows a border around the lo-res screen.

As a last note to using lo-res graphics, the user should know how to exit this mode. Simply type TEXT and the screen will revert to its usual 24 lines of text and 40 characters per line.

Hi-Res Graphics

The Apple high-resolution graphics mode offers some of the best graphics capabilities available on any microcomputer. Although only eight colors can be used, resolution of 280 x 192 pixels may be obtained, allowing highly detailed objects and extremely impressive graphics to be programmed.

To enter hi-res graphics, simply type HGR. This gives you a 280 x 160 grid with four lines of text at the bottom. Typing HGR2 instead of HGR, or typing POKE -16302,0 after entering HGR, will place

Figure 1.

```
10 GR                  Enter lo-res graphics mode
20 COLOR = 3           Set color to be purple
30 HLIN 0,39 AT 0      Draw line at top of screen
40 VLIN 0,39 AT 39     Draw line at right of screen
50 HLIN 0,39 at 39     Draw line at bottom of screen
60 VLIN 0,39 AT 0      Draw line at left of screen
```

Figure 2.

10 HGR	Enter hi-res graphics mode
20 COLOR = 1	Set color to green
30 HPLOT 0,0 TO 0,159 TO 279,159 TO 279,0 TO 0,0	Connect the four corners of the screen

you in the full-screen graphics mode, with a resolution of 280 x 192.

The high-resolution colors are set very similarly to low-resolution colors. HCOLOR= is the equivalent of the lo-res statement COLOR=. The eight colors available in high resolution graphics are: 0 black, 1 green, 2 blue, 3 white 1, 4 black, 5 depends on TV, 6 depends on TV, 7 white 2.

The hi-res coordinate system is numbered from 0 to 279 along the X axis (top of the screen) and from 0 to 159 (HGR) or 0 to 191 (HGR2) along the Y axis.

The hi-res equivalent of PLOT is HPLOT. HPLOT X,Y plots a point at location X on the X axis and location Y on the Y axis.

In high-resolution graphics, it is possible to plot from any location to any other location, even if it necessitates the drawing

TRS-80 graphics are much simpler than Apple graphics, although not quite as versatile.

of a diagonal line. The statement HPLOT X,Y TO X,Y or HPLOT X,Y TO X,Y TO X,Y TO X,Y connects the points between the "TO." This is a very powerful statement, and it is not available in lo-res mode.

For an example of Apple hi-res graphics, see the program in Figure 2 which draws a border around the screen, as in the last example.

As with lo-res graphics, TEXT will cause the computer to revert to normal text mode.

TRS-80

TRS-80 graphics are much simpler than Apple graphics, although not quite as versatile. No special graphics modes are required. Text may be printed at a specific location on the screen (as with the Apple VTAB and HTAB statements), and graphics may be used on the same screen. The resolution of the TRS-80 may be compared to the Apple lo-res mode.

The Model I and the Model III are almost identical machines; 95% of TRS-80 statements can be used on both machines. For this reason, I will use "TRS-80" to refer to both models. When a specific feature is available on only one model, I will specify that model.

PRINT Statements

The TRS-80, like the Apple, can produce graphics through PRINT statements. However, the TRS-80 has a special statement, PRINT @, which makes it possible to refer

The Model III TRS-80 has a set of 96 additional special characters.

to any screen location specifically by number. This can be a very powerful statement if used efficiently.

The TRS-80 screen is composed of 16 lines of 64 characters each, for a total of 1024 possible character positions. These positions are numbered from 0 to 1023, with 0 in the upper left of the screen, 63 at the end of the first line, 64 at the beginning of the second line, etc., and 1023 as the last position in the last line of the screen. The correct syntax for this statement is PRINT @ XXXX,... where XXXX is a number from 0 to 1023 and ... is any expression valid in a standard PRINT statement.

Let's go back to the example we used with the Apple. First type FOR I = 1 to 12:PRINT"HELLO":NEXT. In order to replace the fifth "HELLO" on the Apple with "GOODBYE" we typed VTAB 5: PRINT"GOODBYE". On the TRS-80, however, the best way to accomplish the same thing is to identify the numerical value of the first location on the fifth line of the screen.

The formula (X-1)*64 is used to locate the point at which to print if you wish to begin printing at the first position on the Xth line of the screen. Therefore, in order to print "HELLO" twelve times and replace the fifth with "GOODBYE," we would type: FORI=1to12:PRINT"HELLO": NEXT:PRINT@(5-1)*64,"GOODBYE". Note, though, that the cursor location has been moved to the fifth line of the screen, so that the word "READY" will now print where a "HELLO" formerly was. If you did not wish this to happen, you could add PRINT@(13-1)*64,"; which would move the cursor location back down to the thirteenth line.

Very often in converting graphics, you will want to move the cursor up or down one column without using a PRINT @ statement. Maybe you do not know the current cursor position, or perhaps you are converting a PET program which uses a special PET feature to relocate the cursor. To do this on the TRS-80 you would use the CHR$ function. Typing PRINT CHR$(X); where X is one of several special cursor movement codes, will perform the desired action. The codes are listed in Table 1.

Table 1.

CHR$(X) X-Value	Action
24	Move cursor one space left
25	Move cursor one space right
26	Move cursor one line down
27	Move cursor one line up
28	Move cursor to upper-left corner

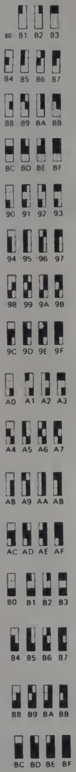
Graphics Characters

The TRS-80 can also create graphics by printing special graphics characters. These characters (see Figure 3) consist of all 64 possible on/off permutations of a 2 x 3 matrix ($2^{2^3}=2^6=64$). These graphics characters may be printed by using the CHR$ function. Typing PRINT CHR$(X), where X is the numerical code for the special graphics character desired, prints that character. This function can also be used in conjunction with the PRINT @ statement. In addition, the statement PRINT STRING$ (X,Y) will print a string composed of graphics character Y concatenated with itself X times. Thus, the statement PRINT @0,STRING$(64,191) will print a horizontal line across the top of the screen.

The Model III TRS-80 has a set of 96 additional special characters. Sixty-four

Figure 3. TRS-80 graphics characters (codes 128-191).

DEC	HEX	Z-80 OP CODE	GRAPHIC	TRS-80 BASIC
128	80	ADD A,B		END
129	81	ADD A,C		FOR
130	82	ADD A,D		RESET
131	83	ADD A,E		SET
132	84	ADD A,H		CLS
133	85	ADD A,L		CMD
134	86	ADD A,(HL)		RANDOM
135	87	ADD A,A		NEXT
136	88	ADC A,B		DATA
137	89	ADC A,C		INPUT
138	8A	ADC A,D		DIM
139	8B	ADC A,E		READ
140	8C	ADC A,H		LET
141	8D	ADC A,L		GOTO
142	8E	ADC A,(HL)		RUN
143	8F	ADC A,A		IF
144	90	SUB B		RESTORE
145	91	SUB C		GOSUB
146	92	SUB D		RETURN
147	93	SUB E		REM
148	94	SUB H		STOP
149	95	SUB L		ELSE
150	96	SUB (HL)		TRON
151	97	SUB A		TROFF
152	98	SBC A,B		DEFSTR
153	99	SBC A,C		DEFINT
154	9A	SBC A,D		DEFSNG
155	9B	SBC A,E		DEFDBL
156	9C	SBC A,H		LINE
157	9D	SBC A,L		EDIT
158	9E	SBC A,(HL)		ERROR
159	9F	SBC A,A		RESUME
160	A0	AND B		OUT
161	A1	AND C		ON
162	A2	AND D		OPEN
163	A3	AND E		FIELD
164	A4	AND H		GET
165	A5	AND L		PUT
166	A6	AND (HL)		CLOSE
167	A7	AND A		LOAD
168	A8	XOR B		MERGE
169	A9	XOR C		NAME
170	AA	XOR D		KILL
171	AB	XOR E		LSET
172	AC	XOR H		RSET
173	AD	XOR L		SAVE
174	AE	XOR (HL)		SYSTEM
175	AF	XOR A		LPRINT
176	B0	OR B		DEF
177	B1	OR C		POKE
178	B2	OR D		PRINT
179	B3	OR E		CONT
180	B4	OR H		LIST
181	B5	OR L		LLIST
182	B6	OR (HL)		DELETE
183	B7	OR A		AUTO
184	B8	CP B		CLEAR
185	B9	CP C		CLOAD
186	BA	CP D		CSAVE
187	BB	CP E		NEW
188	BC	CP H		TAB(
189	BD	CP L		TO
190	BE	CP (HL)		FN
191	BF	CP A		USING

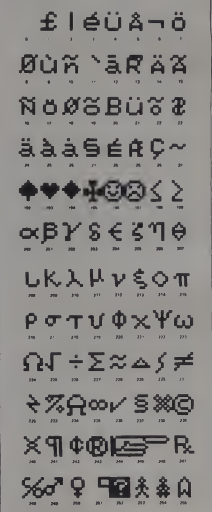


of these can be printed exactly as the 64 described above. They are codes 192-255 (see Figure 4). However, there is one short statement which must be executed prior to printing these characters.

When the Model III is powered up, these 64 codes represent "space compression" characters. PRINT CHR$(192) prints no spaces, PRINT CHR$(193) prints one space, etc., until PRINT CHR$(255), which would print 63 spaces. In order to replace these space compression characters with the special graphics characters, type PRINT CHR$(21). This statement functions as a toggle switch between space compression characters and special graphics characters.

In addition to the 64 special graphics characters available to the Model III owner, there exists a special set of Japanese characters. These characters are CHR$ numbers 192-255, as are the special graphics characters. They are selected by executing the statement PRINT CHR$(22) after

Figure 4. TRS-80 Model III special characters (codes 0-31, 192-255).



selecting the special character set (PRINT CHR$(21)).

If you are amazed at the number of characters available on the Model III, you are in for still another surprise. There is yet another set of special graphics characters available to the Model III user. These characters are codes 0-31 (see Figure 4). However, they are only accessible by means of a POKE statement.

In order to print a graphics character from 0 to 31, the value of that character must be poked into the appropriate memory location, or what Radio Shack refers to as VIDRAM. These video addresses start at 15360 and end at 16383, and are equivalent to a PRINT @ address plus 15360. Thus, in order to print special character 10 at the beginning of the screen, you would type "POKE 15360,10."

We are not done yet with the TRS-80 graphics capabilities. Both models can also plot specific points on the screen. These plotted points can appear on the screen in conjunction with any other graphics features on the TRS-80, as well as text.

The TRS-80 screen is divided into a 128 x 48 array, any block of which may simply be turned on or off. Color is not supported by either TRS-80.

The statement SET (X,Y) turns on the graphics block at horizontal location X (X axis) and vertical location Y (Y axis). The X value can be between 0 and 127, while the Y value can range from 0 to 47. An important difference between turning on a graphics block and printing a graphics character is that a graphics block will not scroll off the screen. The only way to eliminate it is through the RESET statement or clearing the screen, which is done with CLS.

The RESET statement, as previously stated, turns off the specified graphics block. The syntax of the statement is RESET (X,Y), and it has exactly the same parameters as does the SET statement.

See Figure 5 for an example demonstrating some basic characteristics of TRS-80 graphics.

PET

PET graphics are very different from TRS-80 graphics. There are no special graphics modes on the PET, nor can a specific point on the screen be referred to by means of a coordinate system. Essentially PET graphics consist of standard PRINT statements combined with special cursor movement characters. (The graphics characters which may be printed are accessed by pressing the Shift key and the appropriate keyboard key. The cursor movement keys are specifically marked, and sometimes must be pressed in conjunction with the Shift key.)

The PET has six cursor movement characters. These characters are treated just like any other character on the keyboard, as they may be assigned to a string variable and printed. When they are printed, they appear as special symbols, quite unique from any character on any other computer.

The Home Cursor key returns the cursor to the upper lefthand corner of the screen. It is printed as an "S" in reverse video.

The shifted Home Cursor key returns the cursor to the upper lefthand corner of the screen and also clears the screen. It appears on the screen as a heart in reverse video.

The Cursor Down/Up key moves the cursor down one line. It appears as a "Q" in reverse video.

The shifted Cursor Down/Up key moves the cursor up one line. It appears as an empty circle with a black border.

The Cursor Right/Left key moves the cursor one position to the right. It appears as a right bracket in reverse video.

The shifted Cursor Right/Left key moves the cursor one position to the left. It appears as a black rectangle with a vertical white line through it.

These six cursor control characters can be treated just like any other character in the PET character set. For example, the sequence PRINT "(Shifted Home Cursor) (Cursor Down) (Cursor Down) (Cursor Down) HELLO" would clear the screen and place the word "HELLO" on the fourth line.

There are no special graphics modes on the PET.

The PET also has an alternate set of characters, which can be selected by typing POKE 59468,14. The keyboard will then function with the alternate character set (see Figure 6). To return to the standard character set, execute the statement POKE 59468,12.

The program in Figure 7, though quite simple, illustrates the basic method of incorporating graphics into a PET program. The program clears the screen, moves the cursor to the fourth line, and draws a square.

CONVERSION TO APPLE

From TRS-80

When converting a program from the TRS-80 to the Apple, you may use the text mode, low-resolution graphics, or high-resolution graphics.

TEXT mode should be used when the original program involves PRINT @ statements, or simply PRINT statements, and the text or graphics on the screen can be condensed to 40 columns wide. Aside from the smaller screen, the only disadvantage to using the Apple will be that graphics characters cannot be generated in text mode.

The statement causing the most confusion in conversion is probably PRINT @. However, this is really the easiest statement to convert. The TRS-80 statement PRINT @ X, "THIS IS A TEST" can be changed into three Apple statements:

```
VTAB INT(X/64) + 1
HTAB X + 1 - INT(X/64) * 64
PRINT "THIS IS A TEST"
```

When using this conversion procedure, however, the user must be very cautious not to HTAB past column 40. The TRS-80 screen is 64 columns wide, in contrast to the 40-column screen of the Apple. If only 40 columns are needed, then this procedure

Figure 5.

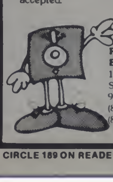
```
10  CLS                                  Clear screen
20  FOR X = 0 to 127:SET (X,47):         Draw a border around the screen
    SET (X,0):NEXT
    FOR X=0 to 47:SET (0,X):SET(127,
    X):NEXT
30  PRINT @512,"Press ENTER to see       Print message at center of screen
    special characters";
40  INPUT"";X$                           Wait for Enter key
50  CLS                                  Clear screen
60  PRINT CHR$(21)                       Select graphics characters
70  FOR I=192 to 255:                    Print characters
    PRINT CHR$(I);" ";:NEXT
80  INPUT"PRESS ENTER TO SEE             Wait for Enter
    Japanese characters";X$
90  PRINT CHR$(22)                       Select Japanese characters
100 INPUT "PRESS ENTER TO                Wait for Enter
    END@:X$
110 PRINT CHR$(22);CHR(21);:             Select standard character sets
    CLS:END                              Clear screen
```

CIRCLE 145 ON READER SERVICE CARD

MEMOREX
FLEXIBLE DISCS

WE WILL NOT BE UNDER-SOLD!! Call Free **(800)235-4137** for prices and information. Dealer inquiries invited and C.O.D.'s accepted.

VISA



PACIFIC EXCHANGES
100 Foothill Blvd.
San Luis Obispo, CA 93401 In Cal. call (800)592-5935 or (805)543-1037

CIRCLE 189 ON READER SERVICE CARD

You can pay more — But you can't get more!

Model III 16K
$839
Model III 48K
2 disc & RS232C
$2100

Color Computer 4K
$310
w/16K Ext. Basic
$459

BUY DIRECT. These are just a few of our great offers which include Printers, Modems, Computers, Peripherals, Disc Drives, Software and more. call TOLL FREE 1-800-343-8124

We have the lowest possible fully warranteed prices and a full complement of Radio Shack Software.

computer plus
Write for your free catalog
245A Great Road
Littleton, MA 01460
617 • 486 • 3193

CIRCLE 124 ON READER SERVICE CARD

Make Your Dreams Come True With Computer Shopper

Now you can expand your system or get a new one at prices you had never dreamed possible by taking advantage of the thousands of bargains each month in COMPUTER SHOPPER.

COMPUTER SHOPPER is *THE* publication for buying, selling and trading new and used micro and mini-computer equipment, accessories and software.

- Buy, Sell or Trade
- Over 60 **Big** (11" x 14") pages
- Over 20,000 readers nationwide
- Classified ad only 12¢ a word
- Hundreds of ads from individuals
- Money back guarantee

New subscribers are entitled to a *FREE* 50 word classified ad to use for software or used equipment plus a *FREE ISSUE* all for the low subscription price of ONLY $10.00.

SAVE OVER 50% OFF the single copy price of $1.50, Add it up:

12 issues @ $1.50......$18.00
One free issue..........$1.50
Free 50 word classified ad$5.00

TOTAL VALUE..........$24.50
NOW ONLY $10.00. You save $14.50.

MasterCard or VISA subscription orders only Call TOLL FREE 1-800-327-9920

COMPUTER SHOPPER
P.O. Box F14 • Titusville, FL 32780
305-269-3211

Yes, I want to save money with Computer Shopper. If I'm not 100% satisfied with my first issue my money will be refunded in full and I get to keep the first issue FREE

1 yr (3rd class) $10.00

I am a new subscriber send me a certificate for a free classified ad

NAME ______

ADDRESS ______

CITY ______ ST ______ ZIP ______

OFFER EXPIRES 4 ...

CIRCLE 128 ON READER SERVICE CARD

Figure 6. PET standard and alternate character sets.

PRINTS	CHR$	PRINTS	CHR$	PRINTS	CHR$	PRINTS	CHR$
	0		16	SPACE	32	Ø	48
	1	CRSR ↓	17	!	33	1	49
	2	RVS ON	18	"	34	2	50
	3	CLR HOME	19	#	35	3	51
	4	INST DEL	20	$	36	4	52
WHT	5		21	%	37	5	53
	6		22	&	38	6	54
	7		23	'	39	7	55
	8		24	(	40	8	56
	9		25	)	41	9	57
	10		26	*	42	:	58
	11		27	+	43	;	59
	12	RED	28	,	44	<	60
RETURN	13	CRSR →	29	—	45	=	61
SWITCH TO LOWER CASE	14	GRN	30		46	>	62
	15	BLU	31	/	47	?	63

PRINTS	CHR$	PRINTS	CHR$	PRINTS	CHR$	PRINTS	CHR$
@	64	U	85		106		127
A	65	V	86		107		128
B	66	W	87		108		129
C	67	X	88		109		130
D	68	Y	89		110		131
E	69	Z	90		111		132
F	70	[	91		112	f1	133
G	71	£	92		113	f3	134

PRINTS	CHR$	PRINTS	CHR$	PRINTS	CHR$	PRINTS	CHR$
H	72	]	93		114	f5	135
I	73	↑	94	♥	115	f7	136
J	74	←	95		111	f2	137
K	75		96		117	f4	138
L	76	♠	97		118	f6	139
M	77		98		119	f8	140
N	78		99	♣	120	SHIFT RETURN	141
O	79		100		121	SWITCH TO UPPER CASE	142
P	80		101	♦	122		143
Q	81		102		123	BLK	144
R	82		103		124	CRSR ↑	145
S	83		104		125	RVS OFF	146
T	84		105	π	126	CLR HOME	147

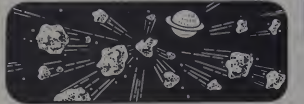
PRINTS	CHR$	PRINTS	CHR$	PRINTS	CHR$	PRINTS	CHR$
INST DEL	148	CYN	159		170		181
	149	SPACE	160		171		182
	150		161		172		183
	151		162		173		184
	152		163		174		185
	153		164		175		186
	154		165		176		187
	155		166		177		188
PUR	156		167		178		189
CRSR ←	157		168		179		190
YEL	158		169		180		191

Figure 7.

```
10 PRINT"(CLEAR SCREEN)            Clear screen and move cursor
   (CURSOR DOWN) (CURSOR            down to fourth line
   DOWN) (CURSOR DOWN)";
20 PRINT"——"                       Draw top of square
30 FOR I = 1 TO 7:                 Draw sides of square
   PRINT"       ":NEXT
40 PRINT"——"                       Draw bottom of square
```

AMBER SOFTWARE

Software for Apple and Apple II plus



Galaxy Rocks™ by Jay Crafferty

With Galaxy Rocks you explore space while trying to avoid the menancing 3-D asteroids that are capable of destroying your ship on contact. Paddles control your position in space and your phaser cannon. A fast machine language approach to this classic space game. Runs on any Apple with Applesoft and at least 48K of RAM. Diskette $29.95

AMBER

Amber Software
170 Parsippany Rd., Parsippany NJ
(201) 887-6474

CIRCLE 113 ON READER SERVICE CARD

OMNISCAN™

The interface that provides the most revolutionary means of information retrieval since the printing press by combining these important technologies:

1. *the Apple II computer,*
2. *the Pioneer VP-1000 Laser Video Disc,*
3. *and the Color Television.*

The **OMNISCAN** *interface is used to control the Pioneer LaserDisc player in an interactive way, with software running on the Apple II computer. The system can display information with color, motion, and stereo or bilingual sound* ***under program control.*** *It can teach, review, test, and grade material while allowing for individual learning rates. The branching capability of the computer gives unlimited flexibility in programing a learning sequence.*

Documentation on the hardware and a tutorial on the software is provided.

Price: $ 250 *Dealer inquiries invited*

aurora systems, inc.
2040 E. Washington Ave.
Madison, WI 53704
608 - 249 - 5875

OMNISCAN is a trademark of Aurora Systems, Inc.
Apple II is a trademark of Apple Computers, Inc VP-1000 is a trademark of Pioneer USA, Inc

CIRCLE 107 ON READER SERVICE CARD

computer tutor

FEBRUARY SPECIAL
VISICALC 3.3
149.95
OLYMPIC DECATHLON
21.95

SELLS SOFTWARE FOR APPLE* & TRS-80†

ACORN, VERSA, NIBBLE, ADVENTURE INT'L, MICROSOFT, USA, SYNERGISTIC, ON-LINE, QUALITY, SENTIENT, BEDGECO, IDSI, MICRO CO-OP, SIRIUS, HAYDEN, EDU-WARE, SUB-LOGIC, CONTINENTAL, BIG-FIVE, EPYX, APPARAT, CENTRAL POINT, STRATEGIC, PERSONAL, MUSE, TG PRODUCTS, CAVALIER, BRODERBUND, MICRO LAB, SENSIBLE, IJG, CORNSOFT, LAZER, RIVERBANK, SOFTWARE PUBLISHING, BEAGLE BROS., PDI, SIR-TECH

—SAMPLE DISCOUNTS—

COMPLETE GRAPHICS (Penguin)	59.95	*now*	**50.95**
ROBOT ATTACK	19.95	*now*	**16.95**
SPACE QUARKS	29.95	*now*	**24.95**
ENHBAS	59.95	*now*	**50.95**
GORGON	39.95	*now*	**33.95**
MAXI MANAGER	79.95	*now*	**67.95**
CCA DATA MANAGEMENT	99.95	*now*	**84.95**
PFS	95.00	*now*	**79.95**
ZORK	39.95	*now*	**34.95**
EXPEDITER II	99.95	*now*	**84.95**
BEER RUN (Sirius)	34.95	*now*	**26.95**
ATTACK FORCE	19.95	*now*	**16.95**
SPACE EGGS	29.95	*now*	**24.95**
MAGIC WINDOW	99.95	*now*	**83.95**
FORTRAN 80	100.00	*now*	**84.95**
CYBORG (Sentient)	32.95	*now*	**26.95**

We Pay Shipping — Big Discounts
Visa/Mastercharge/C.O.D.
All Programs Shipped From Stock

Call or Write for Free Catalog:

(503) 895-3388

COMPUTERTUTOR
83242N PAC HWY
CRESWELL, OR 97426

*Reg. TM Apple Computers
†Reg. TM Tandy Corp.

is probably the easiest to use. It might be advisable, however, to plot out on graph paper the results of the PRINT @ statements to obtain more aesthetically pleasing results.

The easiest conversion between TRS-80 and Apple (in TEXT mode) is clearing the screen. Essentially all that must be done is to replace every occurrence of CLS in a TRS-80 program with HOME.

The TRS-80 graphics should be simulated in either lo-res or hi-res graphics. These methods will provide the most graphically pleasing results. However, if text and graphics must be placed on the same screen, then TEXT mode must be used. In this case, you should follow the instructions under lo-res graphics, but substituting HOME for GR (in order to clear the screen but not enter the graphics mode).

PLOT statements, when used from TEXT mode, will not place graphics blocks at the appropriate coordinates, but will instead place standard text characters on the screen. The actual character which will be printed can be predetermined, but that is beyond the scope of this article.

The TRS-80 statement PRINT CHR$(31) will clear the screen from the current cursor position on. This can be emulated on the Apple by executing the statement CALL -958.

The TRS-80 special graphics characters (including the alternate character sets of the Model III) cannot be easily duplicated on the Apple. If you have a program which mixes text and special graphics characters, the only options available are to substitute characters from the Apple standard character set or use hi-res graphics and create a character generator, which is a most formidable task for an inexperienced programmer.

Apple lo-res graphics can be used when only graphics are used on the TRS-80 (SET statements), as opposed to text and graphics. But remember, lo-res offers at best a 40 x 48 array (with no text), while the TRS-80 has a 128 x 48 array of graphics. However, if it is possible to program a particular application within these constraints then lo-res graphics are preferable. Lo-res is easier to use than hi-res and provides twice as many colors from which to choose.

Using lo-res again requires condensing the TRS-80 screen. In this case, the graphics must be condensed to either 40 x 48 or 40 x 40. Once this has been done, the conversion procedure is quite simple.

In the TRS-80 program, look to see where the graphics portion begins. Usually a CLS statement will appear at this point. Replace the CLS with GR to clear the screen and enter lo-res mode.

Subsequent PRINT statements in the program will have to be restricted to four lines of text. These lines of text must be contiguous at the bottom of the screen. No special conversion of PRINT statements is required unless PRINT @ is used. In that case, keep in mind that only lines 21-24 may be used for text in lo-res graphics.

If you wish to replace the bottom four lines of text with an additional eight rows of graphics, execute the statement POKE -16302,0. You will then have a 40 x 48 array available.

A color should be selected before any points are plotted. (This color may be changed at any point in the program without changing previously plotted graphics.) This is done through the COLOR= statement (see above).

All SET statements should be replaced with PLOT statements. Essentially, SET (X,Y) becomes PLOT X,Y. Not all acceptable values for X and Y in a SET statement are valid values in a PLOT statement. X in a PLOT statement cannot exceed 39, and Y cannot exceed either 39 or 47, depending upon whether full screen graphics or mixed text-graphics is chosen.

The final step is to convert the TRS-80 RESET statements. This is done exactly as a SET statement is converted, with one exception. The color should be set to whatever the background is (usually black). Then executing a PLOT statement will transform that graphics block back into its original state (off).

High-Resolution Graphics

Converting TRS-80 graphics to hi-res graphics is much more involved than converting to TEXT mode or lo-res graphics, but the results are well worth the effort. The entire 128 x 48 grid can be incorporated into the Apple screen, along with all 64 graphics characters (ASCII codes 128-191). The alternate character sets of the Model III can also be simulated, though this requires substantial programming effort in some cases.

Before discussing the actual conversion process, let's take a closer look at the graphics capabilities of the TRS-80. We have said that the screen is a 128 x 48 array. But is this really so? In actuality, each graphics block is, itself, an array two blocks wide and three blocks high. This means that the TRS-80 graphics screen can be represented as a screen of (128 * 2) * (48 * 3), or 256 * 144, blocks. The Apple high resolution mixed text-graphics mode can accommodate 280 * 160 blocks, so the entire TRS-80 screen can in fact, be represented on the Apple.

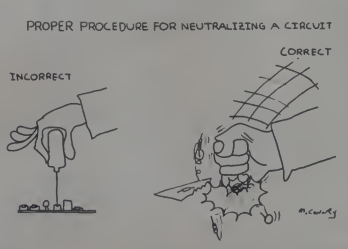
If you have been following along, you will probably have noticed that there is one small problem with this conversion procedure. The TRS-80 screen, you will recall, is composed of 6144 blocks. The portion of the Apple screen we will use, however, contains 256 * 144, or 36,864, blocks. This means we will have to plot 36864/6144, or 6, points on the Apple for every point on the TRS-80. The way to do this follows.

First, select the hi-res graphics mode appropriate for your application (HGR or HGR2). Usually HGR will be sufficient, because even with the extra lines of text at the bottom of the screen there is enough room to accommodate the full TRS-80 screen.

The next step is to select a color with the HCOLOR= statement. This can be done by simply choosing a color from the chart in this article.

Whenever you encounter a SET (X,Y) statement, it must be converted into the equivalent HPLOT statements. The X and Y coordinates of the SET statements can be related to the Apple screen. The coordinates X * 2, Y * 3 correspond to the upper left point of the Apple 2 * 3 grid for that point. See Table 2 for a list of the six points on the Apple which compose that one point.

If the entire block is to be filled in, you should execute the statements HPLOT X * 2,Y * 3 TO X * 2,Y * 3 + 2:HPLOT X * 2 + 1,Y * 3 TO X * 2 + 1, Y * 3 + 2. It is a



good idea to incorporate these statements into a subroutine. Then, any time a statement such as SET (2,3) appears in your source listing, you can simply substitute the statements X = 2:Y = 3:GOSUB 10000 (assuming you have used the above line of code as line 10000 and added a RETURN statement at the end).

Plotting one of the 64 TRS-80 graphics characters is very simple. First consult the chart to determine which of the six graphics blocks should be turned on or off. Then apply the formulas in the above chart and HPLOT the appropriate coordinates.

For example, let's say we wanted to print character 179. By examining the chart, we can see that this is composed of the top left, top right, bottom left, and bottom right portions of the 2 x 3 graphics grid. If we wanted to print this at TRS-80 coordinates (50,100), we would execute the following statements:

```
HPLOT 50 * 2+1,100 * 3 + 2
HPLOT 50 * 2,100 * 3 + 2
HPLOT 50 * 2+1,100 * 3
HPLOT 50 * 2,100 * 3
```

From PET

Converting PET graphics to the Apple can be exceedingly frustrating if the PET special graphics characters are used. Producing many of these on the Apple is comparable to producing the Model III special character sets. In many cases it is advisable to rewrite the entire programming algorithm so that it is more adaptable to use on the Apple.

Converting PET graphics to the Apple can be exceedingly frustrating.

If the graphics characters used on the PET are such that there is a comparable character in the Apple character set, then conversion is very easy. The PET screen is composed of 25 lines of 40 characters each, and the Apple screen contains 24 lines of 40 characters. The hardest part of the conversion is simply reducing the screen to 24 lines, which can usually be accomplished without much problem.

The main problem in converting between the PET and the Apple is substituting appropriate VTAB and HTAB statements for the cursor movement characters on the PET. This can usually be done directly using Table 3.

Now, let's say we have a PET program which clears the screen and draws a line on the fifth line of the screen. The program would have a statement which read PRINT" (Shifted Home Cursor) (Cursor Down/Up) (Cursor Down/Up) (Cursor Down/Up) (Cursor Down/Up) ..." The translated Apple program would read HOME:VTAB PEEK (37)+2:VTABPEEK(37)+2:VTAB PEEK (37)+2:VTAB PEEK(37)+2:PRINT"..." Note that the cursor location characters on the PET are actually part of the PET character set and thus are PRINTed as elements of a string literal (or even a string variable). The Apple, on the other hand, has cursor movement *statements* which *cannot* be used from within PRINT statements.

Both the PET and Apple support reverse video. On the PET, there are two special characters, which, again, can be used from within a string and PRINTed. On the Apple, there are separate statements to control this function. The appropriate commands are shown in Table 4.

The methods which the PET and the Apple incorporate to access reverse video are quite similar. Executing the appropriate statement causes all subsequent output to be printed in reverse video. There is one small difference, however. The Apple INVERSE statement can *only* be cancelled by a NORMAL statement. On the PET, either a carriage return *or* a Shifted Reverse on will do it.

Let's say the PET program you are translating has the statement PRINT "(Reverse On) THIS IS IN REVERSE FIELD (Shifted Reverse On) AND THIS IS NOT". The equivalent Apple statements would be INVERSE:PRINT"THIS IS IN REVERSE FIELD ";:NORMAL:PRINT "AND THIS IS NOT". Note the use of a semicolon after the first PRINT statement to cancel the carriage return.

CONVERSION TO TRS-80

From Apple

Conversion to TRS-80 from the Apple, when possible, is very easy. Most printed output from the Apple can be duplicated on the TRS-80, but since the TRS-80 screen only has 16 lines, whereas the Apple screen has 24 lines, in some cases the screen must be compressed or modified in some other way.

Only two of the three Apple "modes" can be emulated on the TRS-80. PRINTed output (VTAB, HTAB, etc.) can be easily converted, as can Apple lo-res graphics. The TRS-80 does not, however, have the ability to reproduce Apple high resolution graphics. If a hi-res graphics program must be converted to the TRS-80, the standard TRS-80 graphics must be used, and a substantial amount of resolution will be lost.

The only potential problem in converting an Apple program to the TRS-80 is in

Table 2.

Apple X Value	Apple Y Value	Position
X * 2	Y * 3	Upper Left
X * 2 + 1	Y * 3	Upper Right
X * 2	Y * 3 + 1	Middle Left
X * 2 + 1	Y * 3 + 1	Middle Right
X * 2	Y * 3 + 2	Lower Left
X * 2 + 1	Y * 3 + 2	Lower Right

Table 3.

PET Cursor Control Character	Apple Cursor Location Statement
Home Cursor	VTAB 1:HTAB 1
Shifted Home Cursor (Clear Screen)	HOME
Cursor Down/Up	VTAB PEEK (37) + 2
Shifted Cursor Down/Up	VTAB PEEK (37)
Cursor Right/Left	HTAB PEEK (36) + 2
Shifted Cursor Right/Left	HTAB PEEK (36)

Table 4.

PET Character	Apple Statement	Function
Reverse On	Inverse	Print all subsequent characters in reverse video
Shifted Reverse On	Normal	Cancel all reverse video statements previously executed

Yes! I want to make the most of my computer. Send me:

Quan.	Item	Price	Total
____	Basic Computer Games	$7.95	____
____	More Basic Computer Games	7.95	____
____	Computers For Kids—Apple	3.95	____
____	Computers For Kids—TRS-80	3.95	____
____	Computers For Kids—Atari	3.95	____
____	Computers in Mathematics	15.95	____
____	Blister Ball (48K) Apple Disk	29.95	____
____	Air Traffic Controller:		____
____	Apple Disk (16K)	19.95	____
____	Apple Cassette (16K)	11.95	____
____	Atari Disk (24K)	19.95	____
____	Atari Cassette (16K)	14.95	____
____	TRS-80 Disk (32K)	19.95	____
____	TRS-80 Cassette (16K)	11.95	____
____	Computer Music Record	6.00	____
____	48-page catalog	FREE	____
	SUBTOTAL		____

Order Toll Free in continental U.S.
800-631-8112
In NJ call 201-540-0445

creative computing

Magazine and Term	USA	Canada and Foreign Surface	Foreign Air
Creative Computing 1-year (12 issues)	☐ $20	☐ $29	☐ $50
Small Business Computers 1-year (6 issues)	☐ $12	☐ $18	☐ $26
Microsystems 1-year (6 issues)	☐ $10	☐ $15	☐ $25

Books, Records, Games ____
$3 USA, $6 Foreign Shipping Charge ____
NJ residents add 5% sales tax ____
Magazine subscriptions ____
TOTAL ____

☐ Check or Money order enclosed (U.S. funds only)
☐ VISA ☐ MasterCard ☐ American Express

Card number

Expiration Date Signature

Name ____

Address ____

City ____ State ____ Zip ____

Yes! I want to make the most of my computer. Send me:

Quan.	Item	Price	Total
____	Basic Computer Games	$7.95	____
____	More Basic Computer Games	7.95	____
____	Computers For Kids—Apple	3.95	____
____	Computers For Kids—TRS-80	3.95	____
____	Computers For Kids—Atari	3.95	____
____	Computers in Mathematics	15.95	____
____	Blister Ball (48K) Apple Disk	29.95	____
____	Air Traffic Controller:		____
____	Apple Disk (16K)	19.95	____
____	Apple Cassette (16K)	11.95	____
____	Atari Disk (24K)	19.95	____
____	Atari Cassette (16K)	14.95	____
____	TRS-80 Disk (32K)	19.95	____
____	TRS-80 Cassette (16K)	11.95	____
____	Computer Music Record	6.00	____
____	48-page catalog	FREE	____
	SUBTOTAL		____

Order Toll Free in continental U.S.
800-631-8112
In NJ call 201-540-0445

creative computing

Magazine and Term	USA	Canada and Foreign Surface	Foreign Air
Creative Computing 1-year (12 issues)	☐ $20	☐ $29	☐ $50
Small Business Computers 1-year (6 issues)	☐ $12	☐ $18	☐ $28
Microsystems 1-year (6 issues)	☐ $10	☐ $15	☐ $25

Books, Records, Games ____
$3 USA, $6 Foreign Shipping Charge ____
NJ residents add 5% sales tax ____
Magazine subscriptions ____
TOTAL ____

☐ Check or Money order enclosed (U.S. funds only)
☐ VISA ☐ MasterCard ☐ American Express

Card number

Expiration Date Signature

Name ____

Address ____

City ____ State ____ Zip ____

7654321

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 738 MORRISTOWN, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

creative computing

P.O. Box 789-M
Morristown, New Jersey 07960

7654321

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 738 MORRISTOWN, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

creative computing

P.O. Box 789-M
Morristown, New Jersey 07960

locating the equivalent PRINT @ location for a given set of VTAB and HTAB locations. For any given values X and Y, the Apple statement VTAB X:HTAB Y is equivalent to the TRS-80 expression PRINT @ (X * 64) + Y -65. One problem with using this method, however, is that since the TRS-80 screen only has 16 lines of text, this formula cannot be used in a situation where the X value is greater than 16. The only solution to this problem is to redesign the screen so that only 16 lines of text are used.

Another element in converting an Apple program to the TRS-80 is clearing the screen. Quite simply, replace each occurrence of HOME in the Apple program with a CLS in the TRS-80 version.

Apple lo-res graphics can be duplicated very easily on the TRS-80. Since the Apple lo-res screen contains at most a 40 x 48 matrix and the TRS-80 screen has a 128 x 48 matrix, this particular conversion is ideal.

When you encounter a GR statement, replace it with CLS. Then, simply replace each occurrence of PLOT X,Y with SET (X,Y). The actual values of X and Y will not change in this instance.

Color cannot be reproduced on the TRS-80, so COLOR= statements should be ignored, except where the COLOR is set to 0 or whatever the background color is at that moment. In that case, subsequent PLOT statements should be replaced with RESET statements in order to erase the graphics blocks at the appropriate coordinates.

From PET

Converting a PET program to run on the TRS-80 is similar to converting it to run on the Apple. However, the screen will have to be reduced not to 24 lines from the PET's 25, but to 16 lines. In addition, many of the PET special characters have no parallels on the TRS-80. If no acceptable character can be found on the TRS-80, the only solution is to plot out the individual points from the PET program and devise an algorithm to access TRS-80 SET statements or to PRINT TRS-80 special graphics characters.

When converting from the PET to the TRS-80, cursor control characters on the PET will probably cause the most confusion. These cursor control characters, however, have *direct* equivalents on the TRS-80, as shown in Table 5.

In order to access the TRS-80 codes, you should use the CHR$ function and PRINT the appropriate character. (Be sure to place a semicolon after the PRINT statement.) Thus, the equivalent of the PET statement PRINT"(Home Cursor) (Cursor Down/Up) (Cursor Right/Left) TEST" would be PRINT CHR$(28);CHR$(26);CHR$(25);"TEST".

With the PET there is no way to access a particular screen location directly with a set of coordinates.

One PET character does not have an ASCII counterpart on the TRS-80. The Shifted Home Cursor on the PET (which clears the screen) should be replaced with the CLS on the TRS-80.

CONVERSION TO PET

From Apple

Converting a program from Apple to PET is, in many cases, almost impossible. The graphics capabilities of the PET simply operate very differently from those of most other computers.

The main problem in converting graphics from the Apple to the PET is that with the PET there is no way to access a particular screen location directly with a set of coordinates, such as Apple VTAB and HTAB statements or the TRS-80 PRINT @ statement. The best advice to PET owners is to rewrite the graphics routines of their programs in order to reproduce graphics efficiently.

There is a way to create a subroutine to simulate VTAB and HTAB statements, but it is generally not advisable unless relatively simple graphics are being used. It can be used with PRINTed graphics only, lo-res and hi-res graphics cannot be directly translated.

Essentially, we must first home the cursor then print as many Cursor Downs as the value of the argument of the VTAB minus 1 and as many Cursor Rights as the value of the argument of the HTAB statement minus 1. Thus, the statement VTAB 4: HTAB4;PRINT"THIS IS A TEST" can be translated as PRINT "(Home Cursor) (Cursor Down/Up) (Cursor Down/Up) (Cursor Down/Up) (Cursor Right/Left) (Cursor Right/Left) (Cursor Right/Left) THIS IS A TEST". By incorporating a FOR-NEXT loop, this can be made into a subroutine. While it is a very primitive means of duplicating a VTAB statement, it is a possibility for relatively simple PET graphics programs.

The one other necessary conversion between the Apple and the PET is the clear screen code. On the PET, the equivalent statement would be PRINT"(Shifted Home Cursor)".

From TRS-80

Converting a program from the TRS-80 to the PET is basically the same as converting an Apple program to the PET. It is exceedingly difficult to do, and the resulting program will not usually operate very efficiently if the same algorithm is used with both programs.

The clear screen code on the TRS-80 is CLS. This means that every occurrence of CLS in the TRS-80 program should be replaced with PRINT"(Shifted Home Cursor)".

If it is absolutely necessary to convert a TRS-80 program to the PET directly, it can be done. However, as with the Apple, only TEXT can be directly translated. This means that a graphics program which uses SET statements can usually *not* be translated.

PRINT @ statements are the primary means of producing graphics on the TRS-80 without SET statements. The PRINT @ address must first be converted into an equivalent set of horizontal and vertical coordinates. For any given PRINT @ coordinate X, the corresponding vertical (Y axis) coordinate is INT (X/64) + 1 and the horizontal coordinate is X + 1 - INT (X/64) * 64. Once these coordinates have been computed, the procedure above for Apple to PET conversion can be followed to move the cursor.

The graphics conversion techniques described here do not exhaust all possible conversion methods, nor have I covered every graphics statement on every computer mentioned. What I have attempted to do is familiarize the reader with the basic graphics principles of each computer and provide some insight as to how to approach the conversion process.

Graphics conversion is by no means an objective endeavor; once he has an understanding of how each computer operates the programmer's own creativity will more than likely influence his conversion technique more than anything else. □

Table 5.

PET Cursor Control Character	TRS-80 ASCII Code
Home Cursor	28
Cursor Down/Up	26
Shifted Cursor Down/Up	27
Cursor Right/Left	25
Shifted Cursor Right/Left	24

APPLE. . . APPLE . . . APPLE . . . APPLE

STOP

if you didn't buy from CP! . . . you paid too much!

We'll meet any nationally advertised software prices
even 45 days after your order. (Just send a copy of the ad.)

STOP

LOWEST SOFTWARE PRICES-We won't be undersold.

Adventure Time

ADVENTURE INTERNATIONAL

Adventure #1, 2, 3	d	32.00
Adventure #4, 5, 6	d	32.00
Adventure #7, 8, 9	d	32.00
Adventure #10, 11, 12	d	32 00
Stone of Sisyphus	d	24 00
Kid Adventure #1	c	12.00
Adv Hint Book	d	6 50

EDU-WARE

The Prisoner	d	24 00
Terrorist	d	24.00

HIGHLANDS COMPUTER

Oldorf's Revenge	d	16.00
Tarturian	d	20.00
Creature Venture	d	20 00

ON-LINE SYSTEMS

Hi-Res Adv #0	d	16.00
Hi Res Adv #1	d	20.00
Hi Res Adv #2	d	26.50
Hi-Res Adv #3	d	28.00
Softporn Adv. (x rated)	d	24.00

PERSONAL SOFTWARE

Zork	d	34.00
Gammon Gambler	d	21.00
Monty Monopoly	d	29.00
Monty Scrabble	d	29.00
Micro Chess	d	21.00
Bridge Partner	d	21.00

Apples = BUSINESS

CONTINENTAL SOFTWARE

#1 General Ledger	d	200.00
#2 Accts. Rec	d	200 00
#3 Accts. Pay	d	200.00
#4 Payroll	d	200.00

DENVER SOFTWARE

Financial Partner	d	140.00

HOWARD SOFTWARE

Tax Preparer	d	80 00
Real Estate Analyzer	d	120.00
Creative Financing	d	120.00

PERSONAL SOFTWARE

Desk Top Plan II	d	166.00
Visicalc 3.3	d	166 00
Visiplot	d	151.00
Visitrend Visiplot	d	219 00
Visidex	d	166.00
Visiterm	d	127.00

SOFTWARE PUBLISHING

PFS (Filing Sys)	d	76.00
PFS: Report	d	76 00

MICRO PRO (CP/M)

Spell Sort I	d	195.00
Word Star	d	290 00
Data Star	d	290 00
Mail Merge	d	95.00

*Requires Z80-SOFTCARD.

Programmer Helpers

DENVER SOFTWARE

Pascal Programmer	d	100.00
Pascal Tutor	d	100 00

HAYDEN SOFTWARE

Assembly Dev Sys	d	32 00
Applesoft Compiler	d	160 00

IUS

FORTH Dev Sys	d	112.00

MICROSOFT

Fortran 80	d	156 00
A.L.D S	d	100 00
Basic Compiler	d	316 00
Cobol 80	d	600.00
SOFT Card	d	335.00
RAM Card	d	165.00
Olympic Decathlon	d	24 00

SYNERGISTIC SOFTWARE

Prog. Line Editor	d	32.00
Higher Fonts	d	12.00
Higher Text II	d	32 00
Higher Graphics	d	28.00
Prog. Line Editor (ROM)		48 00

STONEWARE

DB Master	d	184 00

SENSIBLE SOFTWARE

Super Disk Copy III	d	24 00
Multi-Disk Catalog	d	20 00

ARCADE in the Home

BRODERBUND SOFTWARE

Apple Panic	d	24 00
Space Warrior	d	20.00
Snoggle (Joystick)	d	26.50

BUDGECO

Raster Blaster	d	24.00

CAVALIER COMPUTER

Astroid Field	d	20.00
Star Thief	d	24.00

INNOVATIVE DESIGN

Pool 1.5	d	28.00
Shuffleboard	d	24.00

MUSE

3 Mile Island	d	32.00
A B M	d	20 00
Robot War	d	32.00

SENTIENT SOFTWARE

Oo-Topus	d	26.50

SIRIUS SOFTWARE

Space Eggs	d	24 00
Autobahn	d	24 00
Gamma Goblins	d	24 00
Gorgon	d	32 00
Sneakers	d	24 00

STRATEGIC SIMULATIONS

Warp Factor	d	32.00
Computer Baseball	d	32.00

Didn't find it? Send for a Catalog of over 800 items. (incl. ATARI, PET & TRS-80)

Prices subject to change without notice All products fully guaranteed

To insure correct shipment indicate computer make/model and if you desire disk or cassette Personal checks accepted please allow 14 days for processing For faster service make payment by Money Order Cashier Check C O D Master Charge or VISA Card For charge card indicate card type and date expiration date and phone number California residents add 6% sales tax Include $2.50 shipping charge per order

VISA

CPI

Computer Products International
P.O. Box 56
Arcadia, California 91006

MICRO PRO MICROSOFT MUSE ON-LINE PERSONAL PICCADILLY PHOENIX QUALITY

ADVENTURE INTERNATIONAL ASTAR ARTSCI AUTOMATED SIMULATIONS AVALON HILL BRODERBUND

CAVALIER CONTEXT CONTINENTAL DATAMOST DATASOFT DELTA DENVER EDU-WARE HAYDEN HIGHLANDS HOWARDSOFT

CIRCLE 222 ON READER SERVICE CARD

Riverbank Software Inc.

PROUDLY INTRODUCES

INTERNATIONAL GRAN PRIX

an arcade-like race car simulation
by RICHARD ORBAN
author of THREE MILE ISLAND*

REQUIRES
APPLE II** OR
APPLE II PLUS**
48K, 13 OR 16
SECTOR DISK,
PADDLE CONTROL

VISA/MASTERCHARGE
MONEY ORDERS/COD
DEALER/DISTRIBUTOR
INQUIRIES INVITED

$30.00 PER DISK
MD RESIDENTS ADD 5%
U.S. CURRENCY ONLY

See your local dealer

INQUIRIES AND
ORDERS 301-479-1312
SMITH S LANDING ROAD
POST OFFICE BOX 128
DENTON MD 21629

• SPECIAL FEATURES •

Five GRAND PRIX-style road circuits, including: Oulton Park, Warwick Farm, Karlskoga, and Monaco • Five speed manual or automatic transmission (with or without cruise control) • Eight levels of difficulty.

• ADDITIONAL FEATURES •

Speeds to 198 MPH • controlled skids • spinouts • spectacular crashes • hair pin turns • narrow corners • obstacles • identified circuit features • number of laps selection • flashing last lap indicator • 'Christmas tree' controlled start • switch for silent operation • blue post marks 300' intervals • best lap/best race times posted • fully instrumented control panel, lap timer • race timer • indicator lights • edge detectors • position indicator • steering indicator • moving speed tape • lap counter • gear and RPM indicators • operating fuel gauge

RIVERBANK WILL REPLACE DAMAGED DISKS WITHIN 1 YEAR OF PURCHASE RETURN DISK WITH PROOF OF PURCHASE PLUS FIVE DOLLARS POSTAGE AND HANDLING FOR IMMEDIATE REPLACEMENT
(TEN DOLLARS OVERSEAS)

*TRADEMARK MUSE CO BALT MD ** APPLE COMPUTER, INC CUPERTINO, CA

CIRCLE 303 ON READER SERVICE CARD

Natural Craft Stand

CHERRY, BLACK WALNUT, OAK, AND CEDAR

Our Guarantee:SOLID WOOD AND ELEGANT QUALITY

Stands For tne Apple II (ventilated)..$36.00
Stands For the MX-70&80, Okidata,MPI..$24.00
Stands For the MX-100 and more........$27.00

ORDER NOW: TENNESSEE COMPUCRAFT,P.O. BOX 146
OAK RIDGE TENNESSEE 37830-0146 (615)482-3339

ALL ORDERS MUST SPECIFY WOOD TYPE
Dealer Inquiries Invited. Tennessee
Residents Add 4.5% Sales Tax. U.S
Residents Add $3.00 /stand For Shipping

CIRCLE 216 ON READER SERVICE CARD

Player/Missile Design Aid

Tom Gurak

Player/Missile Design Aid (PMDA) is a program which aids you in designing your own player/missile graphics. Player/missile graphics are a powerful tool provided by Atari for designing games. However, designing and encoding each player/missile character can be a time-consuming process. Further, using the normal method of designing these players on graph paper, the designer is never sure exactly how the player/missile graphic will look when displayed on the screen.

Player/Missile Design Aid was written to facilitate this process and allow the designer to see the player/missile graphic he is designing while he is working on it.

Whenever PMDA is awaiting your direction, it shows a blinking cursor on the screen. To move the cursor, simply push the joystick in the direction you wish to move the cursor. The cursor will continue to move in that direction until you release the joystick or push it in a different direction.

To start, LOAD the PMDA program and type RUN. PMDA will then display a title screen and begin setting up. Once setup is complete, PMDA displays a screen containing an 8 x 24 bit map which will be used to design your player graphic.

Note that a bit which is off (0) is displayed as a plus sign (+) and a bit which is on (1) is displayed as a solid white block. To the immediate left of the bit map is a column of line numbers and to the right is the decimal POKE value for each line. Initially, this latter field is all zeroes. As bits are turned on, however, this will change to correspond to the new value of the line (byte).

Tom Gurak, 24 North St., West Albany, NY 12205.

On the right side of the screen is a list of commands, a status line, and a prompt line which indicates the action to be taken.

Some explanation of the status line is in order. The first item is the current player/missile mode (M=nn). The two digits are the actual decimal value which is POKEd at SDMCTL (559) to produce the desired mode. M=46 indicates that you are in double-line mode (the default); M=62 indicates that you are in single-line mode.

The second item is the player size or width (W=n). The digit following is the desired value to be POKEd in the player size register (in this case, SIZEP0 (53256)). W=0 indicates single width (the default); W=1 indicates double width; and W=3 indicates quadruple width. The last item is the color/luminance for the player/missile graphic (COLOR=). The digits following are the actual decimal POKE value in the player/missile color register (in this case, PCOLR0 (704)).

I would like to point out that I am not attempting to explain player/missile graphics as there has been much information published already on this subject. I am merely attempting to present enough information to enable you to understand the operation of the Player/Missile Design Aid.

Finally, we are ready to begin designing our player/missile graphic. Using the joystick, position the blinking cursor to the bit position in the map which is to be changed. Pushing the fire button on the joystick will cause the bit to be flipped from off to on, or vice-versa. As bits are turned on, the actual player/missile graphic will begin to take shape in the area between the bit map display and the command list.

It is also possible to "draw" a line in any direction. To accomplish this, position the cursor to the desired starting position of the line, press and *hold* the fire button, and push the joystick in the desired direction. Remember that if you pass over a bit position which is already on, it will be turned off.

To use the commands (each of which is described later), position the cursor to the first character of the desired command and press the fire button. The command list may be reached by moving the cursor to the left or right until it leaves the bit map display. To return the cursor to the bit map, simply move the joystick left or right.

When the player/missile graphic is completed and all options (mode, width, and color) are set correctly, you can either write down the status line settings and the decimal values for each line (byte) of the player/missile graphic or you can use the Save Data command to save this data. The data saved takes the form of a Basic language DATA statement which may be added to your own player/missile graphic program by using the Atari ENTER command. This eliminates the need for a runtime subroutine to load the data. The format of the DATA statement is explained later.

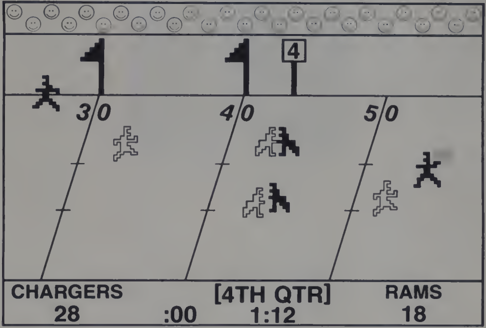
Commands

Shift All ↑: Shifts all 24 lines of the graphic up one line and leaves a blank (0) line at line 23.

Shift All ↓: Shifts all 24 lines of the graphic down one line and leaves a blank (0) line at line 0.

Shift All →: Shifts all 24 lines of the graphic right one bit position and leaves a

ARCADE PRO FOOTBALL™



An Armchair Quarterback's Dream Come True!

It's 4th down and 14 on your opponent's 44 yard line. You're out of time outs with just over a minute left in the game. You call it...sweep right, screen pass left or go for the bomb!

Arcade Pro Football™ puts you in the middle of 60 minutes of exciting gridiron play. You control the action *and* call all the shots. It's the most realistic computer sports game available and it's designed exclusively for the Atari 400/800™ personal computers by Arcade PLUS.

With features like these, Arcade Pro Football™ is in a league of its own!

- Play offense *and* defense head-to-head against the computer or against another player!
- Control two full-color, animated teams in 3-D perspective on a 100 yard, scrolling field!
- 4 game variations, including player handicapping!
- Over 25 offensive and defensive play possibilities...passing, *and* catching, running and kicking!
- All the fun and excitement of real Pro Football...penalties, interceptions, fumbles, bad snaps, 30 second clock—even 4-channel sound and a crowd to cheer you on!

Arcade Pro Football™ is available on cassette or disk for Atari® 400/800™ computers with 16K minimum memory from your local Atari computer dealer. Or send $29.95 (cassette)/$34.95 (disk) plus $2.50 postage and handling (California residents please add 6% sales tax).

arcade PLUS

5276 Hollister Avenue Suite 208 Santa Barbara, CA 93111 (805) 683-2305

CIRCLE 105 ON READER SERVICE CARD

blank (0) column of bit positions at the extreme left.

Shift All ←: Shifts all 24 lines of the graphic left one bit position and leaves a blank (0) column of bit positions at the extreme right.

Shift Line ↑ : Shifts all lines from the line you indicate to line 23 up one line and leaves a blank line (0) at line 23. Select the first line to be shifted by positioning the cursor on the desired line and pressing the fire button when prompted by the program.

Shift Line ↓ : Shifts all lines from the line you indicate to line 23 down one line and leaves a blank (0) line at the line selected. Line selection is the same as described for Shift Line ↑ above.

Shift Line →: The single line which you select is shifted right one bit position and a 0 bit is left at the extreme left of the line. Line selection is the same as for Shift Line ↑.

Shift Line ←: The single line which you select is shifted left one bit position and a 0 bit is left at the extreme right of the line. Line selection is the same as for Shift Line ↑.

Blank All: All bit positions are set to 0. Before proceeding, you will be asked to confirm your request by pressing the fire button. If you do not want the command to proceed, push the joystick in any direction.

Blank Line: The single line which you select will have all its bit positions set to 0. Line selection is as described for Shift Line ↑.

Blank Column: The bit position which you select will be set to 0 in all lines. Select the bit position by moving the cursor to the desired position and pressing the fire button when prompted by the program.

Change Mode: This changes the mode from double-line (M=46) to single-line (M=62) and vice-versa.

Change Width: This changes the player/missile graphic width from single (W=0) to double (W=1); double to quadruple (W=3); or quadruple to single.

POKE P/M: This allows the user to enter a previously-defined character when only the POKE values are known. Use the keyboard to enter the value for each line when prompted by the program. The Return key must be pressed after each value. Enter three nines (999) followed by Return to indicate that you are done.

Set Color: This sets the color of the player/missile graphic *only*. Using the keyboard, enter the Atari color value (0-15) followed by Return, then enter the luminance value (0-14, even numbers only) also followed by Return. These values will be converted to the corresponding color register value and POKEd into PCOLR0 to change the color of the player/missile graphic displayed.

POKE Color: This sets the color of the player/missile graphic *only*. Using the keyboard, enter the decimal value to be POKEd into the player/missile color register.

Tank.

Save Data: This saves the player/missile data as a Basic language DATA statement. The format on this statement is described later. Prior to beginning the operation, you are asked to confirm your intent by pushing the fire button. To cancel the operation, push the joystick in any direction. The data saved include the mode, width, and color settings followed by the POKE values for each line from 0 to the last non-zero line.

Load Data: This loads previously-saved player/missile data. Before beginning the operation, you are asked to confirm your intent by pressing the fire button. To cancel the operation, push the joystick in any direction. Upon confirmation, a Blank All operation will be performed. The player/missile graphic will be loaded and displayed with the same mode, width, and color as were in effect when it was saved.

Messages

Color?: Use the keyboard to enter the Atari color value and press the Return key.

Enter POKE Values: Use the keyboard to enter the POKE values for a play/missile graphic. Press Return after each one and use 999 followed by Return to indicate you are finished.

Luminance?: Use the keyboard to enter the Atari luminance value and press Return.

No P/M Data to Save: The Save Data command was selected but there are no non-zero bits in the bit map. No action is required.

POKE Color?: Use the keyboard to enter the POKE value for the player/missile color register and press the Return key.

Pos Cursor for Blank: Position the cursor to the line/column to be blanked and press the fire button to complete the Blank command.

Pos Cursor for Shift: Position the cursor to the appropriate line for the Shift operation and press the fire button to complete the Shift command.

Processing...: A long-running command is executing. No action is required.

Push FIRE to Change: The cursor is located within the bit map and pressing the fire button will cause the bit at the cursor position to be flipped.

Push FIRE to Confirm: A Blank All, Save Data, or Load Data command has been selected and pressing the fire button will cause the command to continue. The command may be cancelled by pushing the joystick in any direction.

Push FIRE to Select: The cursor is located within the command list and pressing the fire button will cause the command at which the cursor is positioned to be executed.

Ready Tape Recorder: Insert a cassette tape, press Play or Record and Play depending on the operation selected, and press the console Return key.

Save Data Format

The Save Data command produces a Basic language DATA statement which has the following format:

Lineno DATA mode, width, color, data0, data1,...datan,-1

Lineno is the line number. The first save will create a statement with a line number of 32000. For each subsequent save, the line number is incremented by 10.

DATA is written as shown to identify the Basic language statement type.

Mode is the POKE value for the player/missile mode (double-line or single-line).

Width is the POKE value for the player/missile size register.

Color is the POKE value for the player/missile color register.

Data0 is the POKE value needed to create line 0 of the player/missile graphic.

Data1 is the POKE value needed to create line 1 of the player/missile graphic.

Datan is the POKE value needed to create line n of the player/missile graphic. The last line saved is the last non-zero line found in the bit map. Leading zero lines and any zero lines within the body of the player/missile graphic *will* be saved.

-1 is written as shown to indicate the end of the player/missile data. □

```
5 TRAM=PEEK(106)-8:POKE 106,TRAM
10 GRAPHICS 2+16:SETCOLOR 4,9,4 ? #6:? #
6:? #6;"   PLAYER/MISSILE":? #6
20 ? #6;"      DESIGN AID":? #6:? #6:? #6
;"         -BY-":? #6.? #6;"      TOM  GUR
AK"
30 K0=0:K1=1:K2=2:K5=5:K7=7:K8=8:K10=10:
K12=12:K13=13:K15=15:K19=19:K22=22:K23=2
3:K27=27:K256=256:K512=512
40 ATRACT=77:SDMCTL=559 PCOLR0=704:CRSIN
H=752:HPOSP0=53248:SIZEP0=53256:GRACTL=5
3277:PMADR=54279
70 PMBASE=TRAM*K256+K512
```

Atari is hot
and so are we

EVERYONE IS TALKING ABOUT THE ATARI® 800™ COMPUTER. Color graphics and English characters with truly high resolution; high quality sound; expandable memory; and sleek, modular appearance have made the 800 a "must have" for many computer users. And when you add ATARI's full line of advanced peripheral components and comprehensive software library you get a really hot deal, whether your application is business, professional or personal.

SPECIAL OFFER — ASAP makes the **ATARI® 800™** the hottest deal in town by offering 16K bytes of additional RAM . . . **FREE!**

So don't get caught out in the cold. Call ASAP today.

OPTIONAL ACCESSORIES	PRICE
ATARI® 410™ Program Recorder	$ 60.00
ATARI® 810™ Disk Drive	$ 455.00
ATARI® 815™ Dual Disk Drive	$1195.00
ATARI® 820™ 40-column Dot Matrix Impact Printer	$ 279.00
ATARI® 822™ Thermal Printer	$ 349.00
ATARI® 825™ 80-column Dot Matrix Impact Printer	$ 625.00
ATARI® 830™ Acoustic Modem	$ 159.00
ATARI® 850™ Interface Module	Call
ATARI® Paddle (CX30-04) and Joystick (CX40-04)	$ 17.95
Light Pen (CX-70)	$ 64.95
ASAP 16K RAM Module	$ 75.00

COMPLETE SOFTWARE LIBRARY INCLUDES THESE POPULAR UNITS:

Basketball ROM	$ 28.00
Super Breakout ROM	$ 24.00
Educational System ROM	$ 19.95
Video Easel ROM	$ 24.00
Music Composer ROM	$ 42.00
Computer Chess ROM	$ 30.00
3D Tic Tac Toe ROM	$ 24.00
Star Raiders ROM	Call
Kingdom Cassette	$ 12.95
Blackjack Cassette	$ 12.95
Biorhythm Cassette	$ 12.95
Assembler/Editor ROM	$ 45.00
Mortgage Loan Analysis Tape	$ 12.95
Stock Analysis Disk	$ 19.95
Stock Charting	$ 19.95
Bond Analysis Disk	$ 19.95
Mailing List Tape	$ 17.95
Touch Typing (2 tapes)	$ 19.95
Graph It (2 tapes)	$ 17.95
Energy Czar Tape	$ 12.95
Telelink (Terminal ROM)	$ 19.95
Space Invaders Cassette	$ 14.95
*Scram	$ 16.95
*Word Processor	$129.95
*Asteroids	$ 30.00
*Missile Command	$ 30.00

*New item

ASAP offers a 120-day buyer protection policy: full money-back guarantee if not totally satisfied.

Ordering Information: name, address, phone, ship by: UPS or Mail. Shipping charge add $2.50 up to 1 lb. (UPS blue), U.S. Mail add $1.50 (U.S. only) ($25.00 minimum order).

Terms: We accept cash, check, money orders, Visa and Master Charge (U.S. funds only). Tax: 6% Calif. Res., COD's and terms available on approval (School PO's Accepted).

Toll free outside California: **(800) 421-7701** Inside California: **(213) 595-6431 (714) 891-2663**

asap computer products, inc.
1198 E. Willow St., Signal Hill, CA 90806

Design Aid, continued...

```
80 FOR Y=PMBASE TO PMBASE+768 POKE Y,K0
NEXT Y
90 POKE PMWDR,TRAM1 PMBASE=PMBASE+34
100 DIM B$(1),I$(1),S$(6),A$(4),L$(5),C$
(6):B$="+" I$="Inverse Video Blank" S$="
Shift ":A$="All " L$="Line " C$="Blank "
110 SN=31990 WD=0 MS=46
120 DIM P$(13),Q$(15),T$(7) P$="Push FIR
E to ":Q$="Pos Cursor for "
140 FOR W=K0 TO K256*K10 NEXT W
150 GRAPHICS K0 SETCOLOR K2,K0,K0:SETCOL
OR K1,K12,K12:POKE CRSINH,KI:? " ";
160 POKE SDMCTL,MS POKE PCOLR0,K12:POKE
GRACTL,3:POKE HPOSP0,119
170 GOSUB 1000
200 POKE ATRACT,K0:LOCATE X+K5,Y,OC H=12
8:CC=OC+H
210 POSITION X+K5,Y ? CHR$(CC); H=-H:CC=
CC+H:FOR W=K0 TO K23:NEXT W P=STICK(K0):
T=STRIG(K0)
215 IF P=K15 AND T THEN 210
220 POSITION X+K5,Y:? CHR$(OC); IF T THE
N 300
222 IF CSW THEN GOTO CRT
225 IF X=K22 THEN 400
230 CC=ASC(B$): IF OC=CC THEN CC=ASC(I$)
240 POSITION X+K5,Y ? CHR$(CC); A=PMBASE
+Y:PM=PEEK(A):WM=INT(K2^(K7-X)+0.5): IF O
C=ASC(B$) THEN PM=PM+WM GOTO 260
250 PM=PM-WM
260 WY=Y GOSUB 800
270 IF P<>K15 THEN 300
280 P=STICK(K0): IF  NOT STRIG(K0) THEN 2
70
300 XC=K0 YC=K0 IF P>K8 AND P<K12 THEN X
C=-K1 GOTO 320
310 IF P>4 AND P<K8 THEN XC=K1
320 IF P=6 OR P=K10 OR P=14 THEN YC=-K1
GOTO 335
330 IF P=K5 OR P=9 OR P=K13 THEN YC=KI
335 IF X=K22 AND XC AND YC THEN YC=K0
340 X=X+XC Y=Y+YC
343 IF CSW THEN GOTO CRT
345 IF X<K8 AND X>=K0 THEN 365
350 IF X=K22 THEN 380
355 IF X=21 OR X=K23 THEN X=K0 Y=K0 GOSU
B 1100 GOTO 200
357 IF  NOT STRIG(K0) THEN 357
360 X=K22 Y=K2 GOSUB 1150 GOTO 200
365 IF Y>K23 THEN Y=K0 GOTO 200
370 IF Y<K0 THEN Y=K23
375 GOTO 200
380 IF  NOT STRIG(K0) THEN 380
385 IF Y<K2 THEN Y=K19 GOTO 200
390 IF Y>K19 THEN Y=K2
395 GOTO 200
400 A=Y-K1 ON A GOTO 410,420,430,440,450
,460,470,480,490,500,510,2300,2200,1500,
900,1600,1700,1900
410 GOSUB 1200 YS=K0 YE=K23 YI=K1 GOTO 7
00
420 GOSUB 1200 YS=K23 YE=K0 YI=-K1 GOTO
700
430 GOSUB 1200 YS=K0 YE=K23 XS=K7 XE=K0
XI=-KI GOTO 750
440 GOSUB 1200 YS=K0 YE=K23 XS=K0 XE=K7
XI=K1 GOTO 750
450 YI=K1 GOSUB 580 YS=YE-K1 YE=K23 GOTO
700
460 YS=K23 YI=-K1 GOSUB 580 GOTO 700
470 XS=K7 XE=K0 XI=-K1 GOSUB 580 YS=YE G
OTO 750
480 XS=K0 XE=K7 XI=K1 GOSUB 580 YS=YE GO
TO 750
490 GOSUB 2500 GOSUB 1200 GOSUB 1000 GOT
O 200
500 GOSUB 590 GOTO 650
510 X=K0 Y=K0 T$=C$(K1,K5):GOSUB 1160 CS
W=K1:CRT=515 GOTO 200
515 Y=K0 IF  NOT T THEN 530
520 IF X>K7 THEN X=K0 GOTO 200
525 IF X<K0 THEN X=K7
527 GOTO 200
530 GOSUB 1200 WM=INT(K2^(K7-X)+0.5):FOR
 WY=K0 TO K23:LOCATE X+K5,WY,OC IF OC=AS
C(B$) THEN 550
540 A=PMBASE+WY PM=PEEK(A):PM=PM-WM GOSU
B 800
550 POSITION X+K5,WY ? B$, NEXT WY
570 CSW=K0 IF X=K22 THEN GOSUB 1150 GOTO
 200
575 GOSUB 1100 GOTO 200
580 T$=S$(K1,K5) GOTO 600
590 T$=C$(K1,K5)
600 X=K0 Y=K0 POSITION K19,K23:? Q$,T$,
GOSUB 1300 CSW=K1:CRT=610 GOTO 200
610 X=K0 IF T THEN 365
620 YE=Y GOSUB 1200 RETURN
650 POSITION K5,YE FOR WX=K0 TO K7 ? B$,
:NEXT WX
660 A=PMBASE+YE WY=YE PM=K0 GOSUB 800 GO
TO 570
700 FOR WY=YS TO YE-YI STEP YI FOR WX=K0
 TO K7:LOCATE WX+K5,WY+YI,OC POSITION WX
+K5,WY+YI:? CHR$(OC),
710 POSITION WX+K5,WY ? CHR$(OC), NEXT W
X A=PMBASE+WY PM=PEEK(A+YI) GOSUB 800 NE
XT WY
720 GOTO 650
750 FOR WY=YS TO YE FOR WX=XS TO XE-XI S
TEP XI
760 LOCATE WX+K5+XI,WY,OC POSITION WX+K5
+XI,WY ? CHR$(OC), POSITION WX+K5,WY ? C
HR$(OC), NEXT WX
770 POSITION XE+K5,WY:? B$, A=PMBASE+WY
PM=PEEK(A) IF XI=-K1 THEN PM=INT(PM/K2)
GOTO 780
775 PM=PM*K2: IF PM>=K256 THEN PM=PM-K256
780 GOSUB 800 NEXT WY GOTO 570
800 POKE A,PM POSITION 14,WY:? PM," ",
RETURN
900 GOSUB 990 ? "Color", GOSUB 1400: IF P
<K0 OR P>K15 OR P<>INT(P) THEN 900
910 A=P*16
920 GOSUB 990:? "Luminance", GOSUB 1400
IF P<K0 OR P>14 OR P<>INT(P/K2)*K2 THEN
920
930 A=A+P POKE PCOLR0,A
940 GOSUB 950 GOTO 570
950 A=PEEK(PCOLR0) POSITION 28,21 ? "COL
OR=",A," ", RETURN
990 POSITION K19,K23 ? "
    "; POSITION K19,K23 RETURN
1000 FOR Y=K0 TO K23 POSITION K2,Y ? Y,
FOR X=K0 TO K7:POSITION X+K5,Y ? B$, NEX
T X
1010 A=PMBASE+Y PM=K0 WY=Y GOSUB 800 NEX
T Y
1020 POSITION K27,K0 ? "COMMANDS"
1030 POSITION K27,K2 ? S$,A$,"Esc Esc Es
c Up-Arrow"; POSITION K27,3 ? S$,A$,"Esc
 Esc Esc Down-Arrow";
1040 POSITION K27,4 ? S$,A$,"Esc Esc Esc
 Right-Arrow", POSITION K27,K5 ? S$,A$ "
Esc Esc Esc Left-Arrow";
1050 POSITION K27,6 ? S$,L$,"Esc Esc Esc
 Up-Arrow", POSITION K27,K7 ? S$,L$,"Esc
 Esc Esc Down-Arrow",
1060 POSITION K27,K8 ? S$,L$,"Esc Esc Es
c Right-Arrow", POSITION K27,9 ? S$,L$,"
Esc Esc Esc Left-Arrow",
1072 POSITION K27,K13:? "Change Mode",
1075 POSITION K27,14 ? "Change Width", P
OSITION K27,K15 ? "Poke P/M",
1080 POSITION K27,16:? "Set Color ", :POSI
TION K27,17 ? "Poke Color"
1090 POSITION K27,18 ? "Save Data" :POSI
TION K27,19 ? "Load Data" GOSUB 2400 GO
SUB 2250 GOSUB 950
1095 IF CSW THEN RETURN
1100 T$="Change " GOTO 1160
1150 T$="Select " GOTO 1160
1160 POSITION K19,K23 ? P$,T$ GOSUB 130
0
1170 SOUND K0,K0,K0,K0 RETURN
1200 POSITION K19,K23 ? "Processing" FO
R W=K1 TO K10 ? " "; NEXT W SOUND K0,250
,6,K2 RETURN
1300 SOUND K0,50,K12,4 FOR W=K0 TO K23 N
EXT W:SOUND K0,K0,K0,K0 RETURN
1400 P=K0 W=K0 OPEN #1,4,0,"K " GOSUB 13
00 POKE CRSINH,K0 ? "?",
1410 GET #1,W IF W=155 THEN 1490
1420 IF W=126 THEN P=INT(P/K10) ? "Esc L
eft-Arrow Space Esc Left-Arrow", GOTO 14
10
1430 IF W>47 AND W<58 THEN P=P*K10+(W-48
):? CHR$(W); GOTO 1410
1440 ? "Esc Ctl-Clear"; GOTO 1410
1490 CLOSE #1 POKE CRSINH,K1 ? " ", RETU
RN
1500 POSITION K19,K23 ? "Enter Poke Valu
es    ", FOR WY=K0 TO K23
1510 POSITION K13,WY GOSUB 1400 IF P=999
 THEN 1590
1520 IF P<K0 OR P>=K256 THEN 1510
1530 PM=P GOSUB 2100
1560 POSITION K13,WY ? " ", NEXT WY GOTO
 570
1590 A=PMBASE+WY PM=PEEK(A) GOSUB 800 PO
SITION K13,WY ? " " POP  GOTO 570
1600 GOSUB 990 POSITION K19,K23 ? "Poke
Color", GOSUB 1400 IF P<K0 OR P>=K256 OR
 P<>INT(P/2)*2 THEN 1600
1610 A=0 GOTO 930
1700 FOR YE=K23 TO K0 STEP -K1 IF PEEK(P
MBASE+YE)<>K0 THEN 1720
1710 NEXT YE POSITION K19,K23 ? "No P/M
Data to Save " FOR W=K0 TO K512 NEXT W
GOTO 570
1720 POP  GOSUB 2500 GOSUB 1790 A=K0
1730 OPEN #1,8,0,"C " SN=SN+K10 T$=STR$(
SN) GOSUB 1810 T$=" DATA " GOSUB 1810 T$
=STR$(MS) GOSUB 1810
1735 T$=STR$(WD) GOSUB 1800 T$=STR$(PEEK
(PCOLR0)) GOSUB 1800
1740 FOR WY=K0 TO YE PM=PEEK(PMBASE+WY)
T$=STR$(PM) GOSUB 1800
1760 NEXT WY T$="-1" GOSUB 1800 PUT #1,1
55 CLOSE #1 GOTO 570
1790 POSITION K19,K23 ? "Ready Tape Reco
rder ", RETURN
1800 PUT #1,44
1810 FOR WX=K1 TO LEN(T$) PUT #1,ASC(T$(
WX,WX)) NEXT WX RETURN
1900 GOSUB 2500 GOSUB 1200 CSW=K1 GOSUB
1000 CSW=K0 SOUND 0,0,0,0
1905 GOSUB 1790 OPEN #1,4,0,"C " FOR WX=
K0 TO K10 GET #1,A NEXT WX
1910 GOSUB 2000 MS=PM GOSUB 2400 GOSUB 2
000 WD=PM GOSUB 2250 GOSUB 2000 POKE PCO
LR0,PM GOSUB 950
1920 FOR WY=K0 TO K23 GOSUB 2000 IF P=45
 THEN POP  GOTO 1990
1930 P=PM GOSUB 2100 NEXT WY
1990 CLOSE #1 GOTO 570
2000 PM=K0 FOR WX=K0 TO 4 GET #1,P IF P=
44 THEN POP  GOTO 2090
2010 IF P=45 THEN POP  GOTO 2090
2020 PM=PM*K10+VAL(CHR$(P)) NEXT WX
2090 RETURN
2100 A=128 FOR WX=K0 TO K7 POSITION WX+K
5,WY IF P<A THEN 2120
2110 ? I$, P=P-A GOTO 2130
2120 ? B$,
2130 A=A/K2 NEXT WX A=PMBASE+WY GOSUB 80
0 RETURN
2200 IF WD=K0 THEN WD=K1 GOTO 2230
2210 IF WD=K1 THEN WD=3 GOTO 2230
2220 WD=K0
2230 GOSUB 2250 GOTO 570
2250 POKE SIZEP0,WD POSITION 24,21 ? "W=
",WD RETURN
2300 GOSUB 1200 IF MS=46 THEN MS=62 GOTO
 2330
2310 MS=46
2330 GOSUB 2400 FOR WY=K0 TO K23 PM=PEEK
(PMSAVE+WY) POKE PMBASE+WY,PM POKE PMSAV
E+WY,K0 NEXT WY GOTO 570
2400 POKE SDMCTL,MS POSITION K19,21 ? "M
=",MS, PMSAVE=PMBASE
2410 WX=K512+34 IF MS=46 THEN 2430
2420 WX=1024+68
2430 PMBASE=TRAM*K256+WX RETURN
2500 IF  NOT STRIG(K0) THEN 2500
2505 GOSUB 990 POSITION K19,K23 ? P$,"Co
nfirm", GOSUB 1300 LOCATE X+K5,Y,OC H=12
8:CC=OC+H
2510 POSITION X+K5,Y ? CHR$(CC), H=-H CC
=CC+H FOR W=K0 TO K23 NEXT W P=STICK(K0)
 T=STRIG(K0)
2520 IF P=K15 AND T THEN 2510
2530 POSITION X+K5,Y ? CHR$(OC) IF P<>K1
5 THEN POP  GOTO 570
2540 RETURN
```

It's time Your Computer stopped just playing games

and started doing some work around the house!

Let Creative Software's home programs turn your ATARI® or VIC® into a really useful household appliance—the results may well amaze you!

TITLE	ATARI 400/800	VIC (cassette only)
• Household Finance	34.95 cassette 39.95 disk	34.95
• Home Inventory	19.95 cassette 24.95 disk	14.95
• Car Costs	19.95 cassette 24.95 disk	14.95

CREATIVE SOFTWARE

201 San Antonio Circle, #270
Mountain View, CA 94040
(415) 948-9595

Ask about our many other recreational and home applications!
TO ORDER: VISA MasterCard, check or money order accepted. If charge, please include expiration date of card. Add $1.50 for shipping and handling. Calif. residents add sales tax.

WARNING!

Electric Power Pollution.
Spikes & Lightning
HAZARDOUS to
MICROCOMPUTERS!!

Patented ISOLATORS provide protection from . . .
- Computer errors caused by power line interference
- Computer errors due to system equipment interaction
- Spike damage caused by copier/elevator/air conditioners
- Lightning caused damage

** FULLY GUARANTEED**

- ISOLATOR (ISO-1) 3 isolated 3-prong sockets; Spike Suppression; useful for small offices, laboratories, classrooms. $69.95
- ISOLATOR (ISO-2) 2 isolated 3-prong socket banks; (6 sockets total); Spike Suppression; useful for multiple equipment installations. $69.95
- SUPER ISOLATOR (ISO-3) similar to ISO-1 except double isolation & oversize Spike Suppression; widely used for severe electrical noise situations such as factories or large offices. $104.95
- SUPER ISOLATOR (ISO-11) similar to ISO-2 except double isolated socket banks & Oversize Spike Suppression; for the larger system in severe situations. $104.95
- MAGNUM ISOLATOR (ISO-17) 4 Quad Isolated Sockets; Multiple Spike Suppressors; For ULTRA-SENSITIVE Systems in extremely Harsh environments. $181.95
- CIRCUIT BREAKER, any model (Add-CB) . . . . Add $9.00
- CKT BRKR/SWITCH/PILOT (-CBS) . . . . Add $17.00

AT YOUR DEALERS MasterCard, Visa, American Express
ORDER TOLL FREE 1-800-225-4876 (except AK, HI, PR & Canada)

ESP Electronic Specialists, Inc.
171 South Main Street, Natick, Mass. 01760
Technical & Non-800: 1-617-655-1532

CIRCLE 142 ON READER SERVICE CARD

SPEED
POWER
EFFICIENCY

OSI
65D3 SYSTEMS

R-EDIT: Edit any program or text with ease! **$40**
- FULL CURSOR control Insert, delete add anywhere on the screen
- BASIC assembler, etc edited without reloading RAM resident editor
- SYSGEN relocates R EDIT and customizes

SPUL65: Printer Spooler & Virtual Indirect File **$95/$10**
- DON'T WAIT for your printer Process words Write programs Put multiple print jobs in the queue Keep working while the printer runs!
- TWO printers accomodated on any ports Multiple copies with pagination
- SYSGEN relocates SPUL65 and allows extensive customization
- VIRTUAL INDIRECT FILES on disk End space problems when using temporary files Now do extensive editing of BASIC with your word processor

XREF: BASIC Cross Referencer **$25**
- TABULATES Referenced line numbers, all variable names and functions
- FAST machine language program
- DISK based to handle the largest BASIC source files on any drive

FBASIC: BASIC Compiler **$155/$10**
- FAST machine code now can be written with the ease of BASIC
- SPEED optimized native code compiler An integer subset of OSI's BASIC
- DISK based to allow large source and object files
- EXTENSIONS to BASIC for Easy interface to system hardware/software Direct access to 6502 registers Array initialization and optional absolute location WHILE and other structures Interfacing compiler output and interpreter
- UTILITIES (plus source), manual, and many useful examples

CP/M to OSI Translation

Frustrated by all those good CP/M disks that won't run on your OSI CP/M system? Send us your disk, $15 and we'll send it back with an OSI compatible version

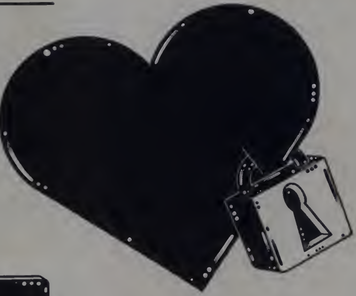
drc software

Data Research Corporation, Suite 202
1040 Lunaai St Kailua, HI 96734 (808) 261 2012

Manual orders applied to software purchases Programs supplied on 8 in. single density single sided disks Hawaii residents add 4% tax

CIRCLE 256 ON READER SERVICE CARD

Lose Your Hearts for Greater Graphics Control



Marni Tapscott

The Atari has nine graphics modes. Modes 1 through 8 have a split screen, however, the split screen may be overridden by adding 16 to the mode number. Modes 1 and 2 are text modes with five colors. Characters in graphics mode 1 are twice as high and twice as wide as those in mode 0. Characters in mode 2 are twice as high and twice as wide as those in mode 0.

If you have ever tried to use the Atari graphics characters in mode 1 or 2 only to be dismayed by a screen full of hearts, or have had difficulty using all five colors available in those modes, read on. Solutions to some of the problems encountered in both areas will be discussed.

The character set in graphics mode 0 has 128 characters, upper and lower case letters, punctuation, numbers and Atari graphics characters. However, in graphics modes 1 and 2, only 64 characters are available at a time. There are three choices: numbers, upper case letters and punctuation including a blank space; the Atari graphics characters and lower case letters with no blank space; or your own character set.

Marni Tapscott, 297 Missouri St., San Francisco, CA 94107.

Listing 1.

```
100 REM FIGURE 1
110 GRAPHICS 1:POKE 756,226
120 ? "THIS IS WHAT HAPPENS WHEN 756 IS POKED WITH 226 IN GR. 1"
130 FOR WAIT=1 TO 2000:NEXT WAIT
140 SETCOLOR 0,0,0:REM SET COLOR REGISTER 0 TO SAME COLOR AS BACKGROUND
150 ? "THIS IS WHAT HAPPENS WHEN A COLOR REGISTER IS MADE SAME COLOR AS
    BACKGROUND."
160 FOR WAIT=1 TO 2000:NEXT WAIT
```

Creating Blank Spaces

Frequently, you will want to use blank spaces as well as the graphics characters. There are two ways of creating blank spaces. One is to give up one of the five colors available; simply make color register 0 the same color as the background and proceed to plot other characters using only color registers 1, 2 and 3. This is the straightforward solution. The short program in Listing 1 illustrates this alternative.

The second method of creating blank spaces requires more work; one character must be redefined. Novice programmers may be put off by the imposing sound of "redefining a character set," but I have discovered that it is not difficult and that it can open the door to greater graphics control and creativity.

It is important to point out that one or several characters can be redefined without redefining the whole character set. There are four basic steps.

First, we must allocate space in RAM for the character set and protect it from Basic. The top of RAM is the end of the section of memory accessible to the user. The physical top of RAM is stored in a location called RAMTOP. The area above the value stored in RAMTOP is Read Only Memory or ROM which contains permanent storage of programs and data that may never be changed. The operating system, for example, is stored here.

If we store a lower value in RAMTOP, we effectively reserve a section of RAM. The operating system will be fooled into thinking less RAM memory is available, and we can keep our new character set from being changed or erased by storing it in this area.

When I refer to "up" in memory, I am referring to those memory locations with higher numbers; "down" refers to memory locations with lower numbers. The diagram in Figure 1 may help.

COMPUTERS BY MAIL

P.O. Box 1805 Hawthorne, CA 90250

PRINTER AND INTERFACES	
ANADEX 9500132 COL	1290 00
ANADEX 9501 132 COL	1290.00
EPSON MX80 PIN FEED	585 00
EPSON MX80 TRACTOR/FRICTION	675 00
EPSON MX70 PIN FEED	405 00
EPSON PARALLEL CARD	65 95
EPSON SERIAL ADAPTOR BOARD	61 95
EPSON CARTRIDGE RIBBON	13 00
EPSON PARALLEL INTERFACE CABLE	21 95
TRENDCOM 200 80 COL	540 00
CENTRONICS 7721 W/O CABLE	95 95
CENTRONICS 7728 W/O CABLE	95 95
CALIFORNIA COMPUTER SYSTEMS	
ASYNCHRONOUS SERIAL	125 95
SYNCHRONOUS SERIAL	139 95
PARALLEL	95 95
MONITORS	
AMDEK 13" COLOR	420 00
AMDEK 12" B & W	150 00
AMDEK 12" 100 GREEN	175 00
SANYO 9" B & W	169 00
SANYO 12" HI - RES B&W	249 00
SANYO 13" COLOR	425 00
SANYO 12" HI-RES GREEN	270 00
NEC 12" COLOR	360 00
MODEMS	
HAYES MICROMODEM II (APPLE II)	295 00
HAYES MICROMODEM 100 (S-100)	315 00
HAYES STACK (RS-232)	239 00
SOUTHEASTERN DATA CAPTURE 4 0	44 95
DISK DRIVES	
MICRO-SCI 40 TRACK W/CONT	460 00
MICRO-SCI 40 TRACK W/O CONT	395 00
EDUCATIONAL SOFTWARE	
EDUWARE	
STATISTICS	24 95
EDU - PAK I	32 95
STORY TELLER	16 95
ALGEBRA I	32 95
UNI - SOLVE	19 95
COMPU - MATH ARITH SKILL	32 95
COMPU - MATH FRACTIONS	32 95
COMPU MATH DECIMALS	32 95
COMPU - SPELL (REQ DATA DISK)	24 95
SPACE	24 95
SPACE II	19 95
NETWORK	16 95
TERRORIST	24 95
WINDFALL	16 95
PRISONER	24 95
MICROSOFT TYPING TUTOR	16 95
SUB - LOGIC FLIGHT SIMULATOR	29 95
SYNERGESTIC STAR GAZERS GUIDE	25 95
ACCESSORIES	
DANATRONICS COOLING FAN	39 95
T.G. JOYSTIX	44 95
GAME PADDLES	32 95
80 COLUMN SYSTEMS	
M + R SUPERTERM	24 95
APPLE DOUBLE VISION	235 00
APPLE II 80 COL VIDEO CARD	315 00
VIDEX VIDEO TERM CARD 80 COL	295 00
MISC HARDWARE	
VIDEX SWITCHPLATE	16 95
KEYBOARD DISPLAY ENHANCER	99 95

★ APPLE II 48K + APPLE DISC II DRIVE W/CONT. + 3.3	$1299.00
	559.95
★ XEROX SAM MICROCOMPUTER	2595.00
★ MICROPRO WORD STAR	249.95
★ MICROSOFT Z-80 CARD	285.00
★ MICROSOFT 16K RAM BOARD	149.95
★ DANATRONICS 16K RAM BOARD	126.75
★ MOUNTAIN	
CPS MULTIFUNCTION CRD	175.00
CPS CABLE	21.95

ADVANCE BUSINESS TECHNOLOGY	
10 KEY PAD (OLD OR NEW)	99 95
APPLE CLOCK	239 95
100,000 DAY CLOCK	319 00
SUPERTALKER	254 00
ROMPLUS	129 95
ROMWRITER	145 00
INTROL/X-10 CONTROLLER	
CARD ONLY	170 00
MUSIC SYSTEM W/SOFTWARE	450 00
A/D D/A W/O CABLE	285 00
I/0 CABLE ASSEMBLY	42 95
BUSINESS SOFTWARE	
PERSONAL SOFTWARE	
DESK TOP PLAN	155 95
CCA DATA MGT	72 95
LJK	
LETTER PERFECT	109 95
CONTINENTAL SOFTWARE	
HOME MONEY MINDER	28 95
CPA I GENERAL LEDGER	177 95
CPA II ACCTS RECEIVABLE	177 95
CPA III ACCTS PAYABLE	177 95
CPA IV PAYROLL	177 95
MUSE SUPER TEXT II	115 00
ADDRESS BOOK	39 95
FORM LETTER MODULE	85.00
STONEWARE DB MASTER (NEW)	179 95
MISCELLANEOUS SOFTWARE	
PERSONAL SOFTWARE	
VISICALC 3 3	155.00
VISIPLOT	149 95
VISIDEX	159 95
VISITERM	119 95
VISITREND/VISIPLOT	210 00
ON-LINE EXPEDITER II	79 95
HAYDEN APPLESOFT COMPILER	159 95
LAZER LOWER CASE ADAPTER	59 95
PAYMAR LOWER CASE REV 7/LATER	39 95
SOLID STATE MUSIC	
AIO SERIAL PARALLEL CARD	160 00
S-100 SYSTEMS	
CALIFORNIA COMPUTER SYSTEMS	
32K STATIC RAM MODULE	650 00
64K STATIC RAM MODULE	560 00
INTEGRATED SYSTEM	
W/MAINFRAME	1995 00
DISK CONTROLER	300 00
MOTHER BOARD	105 95
4-PORT SERIAL I/O INTERFACE	250 00
Z-80 CPU	259 95

NOTE: COMPLETE SELECTION OF ENTERTAINMENT SOFTWARE AVAILABLE. PLEASE CALL (213) 533-4071

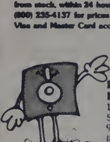
INCLUDE NAME, ADDRESS, PHONE NUMBER. ADD 3% FRT/HANDLING CALIF RESIDENTS ADD 6% SALES TAX ALL MFRS WARRANTIES APPLY **ALL PRODUCTS IN STOCK!** VISA/MC ADD 3% — INCL EXP DATE PRICES SUBJECT TO CHANGE

CBM P O BOX 1805, HAWTHORNE, CA 90250
(213) 533-4071

CIRCLE 108 ON READER SERVICE CARD

Dysan
CORPORATION

Solve your disc problems, buy 100% surface tested Dysan diskettes. All orders shipped from stock, within 24 hours. Call toll FREE (800) 235-4137 for prices and information. Visa and Master Card accepted.



PACIFIC EXCHANGES
100 Foothill Blvd
San Luis Obispo, CA
93401 (In Cal call
(805) 543-1037)

CIRCLE 169 ON READER SERVICE CARD

$24.95

CHESS MASTER

THE COMPUTER CHESS GAME

Chess Master, a new concept in Computer Chess. Encode computer ... then hone your wits and chess prowess by solving the end-game problems from simple mates-in-1 to fiendishly complicated mates-in-3. Comes with 1350 problems. If you cannot solve a problem, just push the "peek" button and Chess Master will show you the answer. Comes complete with battery. Immediate delivery for Money Order or VISA customers. (Include VISA No. and Expiration Date).

MASTER DISTRIBUTORS
1116 Laramie Street
Manhattan, KS 66502

CIRCLE 184 ON READER SERVICE CARD

ELCOMP BOOKS and SOFTWARE

For ATARI – PET/CBM – OSI – 6502

8K Microsoft BASIC Reference Manual
Authoritetive refarence for the original Microsoft 4K + 8K BASIC developed for Alteir and later computers including OSI, PET and TRS-80
Order-No. 141 $9.95

Expension Handbook for 6502 and 6802
S-44 Card Manual describes all of the 4 5 x 6 5 44-pin S-44 cards incl schematics A MUST for every KIM-, SYM- and AIM-owner
Order-No. 152 $9 95

Microcomputer Application Notes
Reprint of Intel's most important application notes including 2708, 8085, 8255, 6251 chips. Vary necessary for the hardware buff
Order-No. 153 $9.95

Complex Sound Generation
New revised applications manual for the Taxes Instruments SN 76477 Complex Sound Generetor Circuit Board avallable ($8 95)
Order-No. 154 $9.95

Small Business Programs
Complete listings for the business user Inventory, Invoice Writing, Mailing List and much more Introduction to Business Applications
Order-No. 156 $14.90

The First Book of Ohio Scientific
Introduction to OSI computers. Diagrams, Hardware and software Information not previously aveilable in one compact source 192 pages
Order-No. 157 $7.95

The Second Book of Ohio Scientific
Vary veluable information about OSI microcomputer systems Introduction to OS-65 D end OS-65U Networking. Hardwara and Software hints and tips Systams specifications Business epplications
Order-No. 158 $7 95

The Fourth Book of OHIO
Very Important Programs
Many Interesting programs for OSI computers. Sorting (Binary Tree), Differential Equitation, Statistics, Astrology, Gas Consumption, Games a s o
Order-No. 160 $9.95

VIP Package – Above book plus a cassetta with the programs
Order-No. 160 A $19.95

Invoice Writing Program for OSI-C1PMF, C4P, Disk and Cassette, 8K RAM.
Order-No. 8234 $29.80

Mailing List for C1PMF or **C4PMF 24K RAM**
250 addresses incl phone number and parameters on one 5 1/4 Disk)
Order-No. 8240 $29.80

Programs for the Challenger C1/C2 8K
Order-No. 2004 "Bare Bones" Wordprocessor **$9.95**
Order-No. 2005, "Bare Bones" Mailing List **$9.95**

Cara and Feeding of the Commodore PET
Eight chapters exploring PET hardware Includes repair and interfacing Information Programming tricks and schematics
Order-No. 150 $9.95

Important Softwara for CBM 16K/32K
Must powerful Editor/Assembler for Commodore CBM 16/32K on cassette Assembler can be started directly from editor or from the TIM Monitor. Translates in three passes If an error is encountered, automatic raturn to the editor Cassetta with DEMO
Order No. 3276 $39.00

MONJANA/1 Makes Machine Language Programming Easy!
In every Commodora CBM there is e spera ROM sockat waiting for it's MONJANA/1. The new MONJANA/1 Machine Language Monitor in ROM offers mora user guidance and debugging eids than any other monitor aveilable todey Comprehensive manuat included
Order-No. 2001
SPECIAL PRICE $49.00

JANA-Monitor on Cassette for the PET Similar to MONJANA/1 Very powerful
Order-No. 2002 $19.95

Programming in Machine Language with the Commodore PET
This book includes EDITOR/ASSEMBLER, MONJANA, JANA, EDITOR, ASSEMBLER, LINKER and DISASSEMBLER, HEXDUMP end completa descriptions of the programs.
Order-No. 165 $19.95

BLANK CASSETTES
Highest Quality C 10 cassettes Blank Cassettes (Quantity 10)
Order-No. 8095G $4.99

ATARI OWNERS TAKE NOTE:

EPROM-BURNER für ATARI 400/800. Bare boards only with description, schematic + software (2716, 2732)
Order-No. 7041 $99.00

Invoice Writing for very smell business with ATARI 400/800 16K RAM
Order No. 7022, cass. $29.95
Order-No. 7200, disc. $39.95

ATARI-BASIC – Learning by Using
A new book with programs and learning exarcises Meny of the programs ere appropriate for beginners as well as experienced computer users (Screen Drewings, Speciel Sounds, Keys, Paddles + Joysticks Specialized Screen Routines, Graphics and Sound, Peeks and Pokes end special stuff)
Order-No. 164 $9.95

ATMONA-1 Machine Language Monitor for the ATARI 400/800
This powerful monitor provides you with the firmware support that you need to get the most out of your powerfut system, ATMONA-1 comes on a bootable cassette No cartridges required, Disassemble, Memory Dump HEX + ASCII, (Change Memory Locations, Blocktransfar, Fill memory block, Save and Load Machine Language Programs, Start Mach Lang Progr (Printer Options))
Order-No. 7022 $ 19.95

ATMONA-2 Superstepper
A very powerful Tracer to explore the ATARI ROM/RAM area Stop et previously selected address, Opcode or operand (cassette)
Order-No. 7049 (includes ATMONA-1) $49.95

EDITOR/ASSEMBLER for ATARI 800, 32K RAM
Extremely fast and powerful Editor/Assembler. (8K Source-code in about 5 seconds) includes ATMONA I (cass)
Order-No. 7098 $49.95

MACRO-Assembler for ATARI 800, 48K RAM (cass)
Order-No. 7099 $89,00

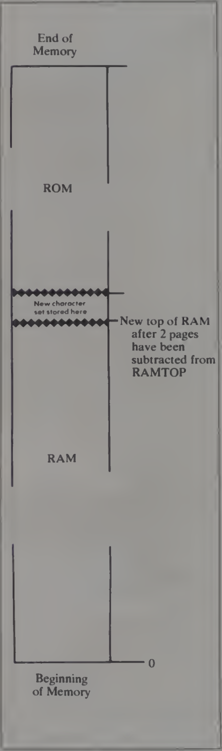
ELCOMP Publishing, Inc.
53 Redrock Lane, Pomona, CA 91766
Phone: (714) 623-8314

Payment: Check, Money Order, VISA, Mastercharge, Eurocheck POSTPAID or PREPAID in USA $ 5 00 handling fee for C O D All orders outside USA: ADD 15 % shipping. CA add 6 % sales tax ATARI is a registered trademark of ATARI INC PET/CBM is a registered trademark of Commodore Business Machines

CIRCLE 167 ON READER SERVICE CARD

Hearts, continued...

Figure 1.



Step one: Reserve memory for the new character set. Graphics modes 1 and 2 require 512 bytes or two pages for redefining a character set. In mode 0, we need 1024 bytes or four pages to redefine the 128 characters available. We PEEK at what is stored in RAMTOP (location 106), subtract the appropriate number of pages (each page=256 bytes) from that value and POKE it back into 106.

Step two: Move the present character set from ROM into the reserved section of memory. This is easily accomplished with a FOR/NEXT loop PEEKing the character set in the ROM location and POKEing it into the new location. The character set containing upper case letters, numbers and punctuation is located at 57344 in ROM and the alternate set containing the graphics characters is located at 57856 in ROM.

Step three: Inform the operating system where the new character set is located with a POKE 756, X where X equals the address of the new character set. Every time a graphics statement or reset is executed, the value in location 756 is reset to 224, the starting page address of the old character set in ROM, so it is best to include this POKE statement after any graphics mode statement.

Step four: Redefining the characters. The definition of a character uses 8 bytes in memory. Eight 0's must be poked into memory to take the place of an existing character. Since the heart is the first character in this set, I found it easiest to replace. The first 8 bytes or locations 0 through 7 in the section of memory we have set aside contains the heart. If we POKE 0's into these locations we will finally have a blank space. Incidentally, the reason the screen fills with hearts in modes 1 and 2 when you are trying to use the graphics characters is that the heart is stored in the same relative position as the blank space in the other character set.

These four steps eliminate the heart and define a blank space. Now we are ready to assign colors and positions to characters.

Assigning Color and Position

There are two methods; we may use either the POSITION and PRINT #6 statements or the COLOR and PLOT statements. Color manipulation is less obvious when using POSITION and PRINT #6 statements.

The ATASCII number that corresponds to both the character and the color desired must be obtained through some experimentation.

Since the other method employs charts already available in the Atari Basic Reference Manual, this method will be described in greater detail. For convenience the charts from pages 55 and 56 in the Atari Basic Manual have been reproduced here.

Figure 2.

Column 1				Column 2				Column 3				Column 4			
#	CHR	#	CHR	#	CHR	#	CHR	#	CHR	#	CHR	#	CHR	#	CHR
0	Space	16	0	32	@	48	P	64		80		96		112	p
1	!	17	1	33	A	49	Q	65		81		97	a	113	q
2	"	18	2	34	B	50	R	66		82		98	b	114	r
3	#	19	3	35	C	51	S	67		83		99	c	115	s
4	$	20	4	36	D	52	T	68		84		100	d	116	t
5	%	21	5	37	E	53	U	69		85		101	e	117	u
6	&	22	6	38	F	54	V	70		86		102	f	118	v
7	[illegible]	23	7	39	G	55	W	71		87		103	g	119	w
8	(	24	8	40	H	56	X	72		88		104	h	120	x
9	)	25	9	41	I	57	Y	73		89		105	i	121	y
10	*	26	[illegible]	42	J	58	Z	74		90		106	j	122	z
11	+	27	[illegible]	43	K	59	[illegible]	75		91		107	k	123	
12	[illegible]	28	<	44	L	60	\	76		92		108	l	124	|
13	-	29	[illegible]	45	M	61	[illegible]	77		93		109	m	125	
14	[illegible]	30	>	46	N	62	^	78		94		110	n	126	
15	/	31	?	47	O	63	_	79		95		111	o	127	

Figure 3.

Table 9.7—CHARACTER COLOR ASSIGNMENT					
		Conversion 1	Conversion 2	Conversion 3	Conversion 4
MODE 0	SETCOLOR 2	#+32	#+32	# [illegible]	NONE
		POKE 756,224		POKE 756,[illegible]	
MODE 1 OR MODE 2	SETCOLOR 0	#32	[illegible]	[illegible]	[illegible]
	SETCOLOR 1	NONE	#+64	# 64	NONE
	SETCOLOR 2	#+160	#+16[illegible]	# 96	# [illegible]
	SETCOLOR 3	#+128	#+192	#+64	#+[illegible]

Charts provided courtesy Atari Inc. ©1980.

First, the four colors desired are established in the color registers using SETCOLOR statements. SETCOLOR 0,1,8 establishes gold in register 0. Next, find the character you wish to use in the chart in Figure 2. Make note of both the number next to the character and the column in which it is located. Looking at the second chart in Figure 3, add or subtract the number listed here according to the color desired. The "columns" on the first chart correspond to the "conversions" on the second chart.

For example, I want a gold up arrow to appear at Row 5, Column 5. The up arrow is 92 in Column 3 in Figure 2. Looking at Figure 3, we subtract 32 from 92 since gold is in color register 0. The statement below accomplishes our goal:

COLOR 60:PLOT 5,5

Listing 2 is a short program which illustrates both the redefinition of the heart character to a zero and the use of SETCOLOR, COLOR and PLOT statements for full use of all five colors. (The fifth color is the background color.) One word of caution regarding running the program: always press the system reset button before re-running because the system continues to subtract pages in memory until it interferes with the display memory.

Listing 2.

```
90 REM FIGURE 5
100 REM CHARACTER REDEFINITION
110 REM STEP ONE: SET ASIDE MEMORY FOR CHARACTER SET
120 POKE 106,PEEK(106)-2
130 GRAPHICS 2+16:REM GR.STMT.HERE PREVENTS OVERLAP OF DISPLAY LIST
    & CHARACTER SET
140 REM STEP TWO MOVE: CHARACTER SET INTO NEW LOCATION
150 A=PEEK(106)*256
160 FOR B=0 TO 511
170 POKE A+B,PEEK(57856+B)
180 NEXT B
190 REM STEP THREE: POKE NEW ADDRESS OF CHARACTER SET
200 POKE 756,PEEK(106)
210 REM STEP FOUR: CHANGE HEART TO BLANK SPACE
220 FOR C=0 TO 7
230 POKE A+C,0
240 NEXT C
250 REM
310 REM SET UP COLOR REGISTERS
330 SETCOLOR 0,13,8:REM GREEN
340 SETCOLOR 1,4,8:REM PINK
350 SETCOLOR 2,10,8:REM TURQUOISE
360 SETCOLOR 3,2,8:REM GOLD
365 SETCOLOR 4,12,4:REM BACKGROUND COLOR TO GREEN
370 REM
390 COLOR 60:PLOT 5,5:REM GREEN ARROW
400 COLOR 28:PLOT 6,5:REM PINK ARROW
410 COLOR 188:PLOT 7,5:REM TURQUOISE ARROW
420 COLOR 156:PLOT 8,5:REM GOLD ARROW
450 GOTO 450:REM KEEPS DISPLAY ON SCREEN
```

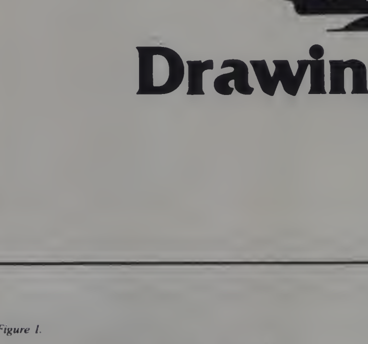
Suggestions for further experimentation are:

- Redefine more characters for greater graphics variety.
- Combine two or four or more characters for a larger, more complex shape.
- Animate shapes through color rotation.
- Animate shapes through redefinition of a figure (animal, person) in several positions and rotation of positions. □

Graphics Drawingboard

William E. Bailey

Figure 1.



Designing TRS-80 computer graphics and converting them into ASCII graphics codes is a very boring and time-consuming job. In addition, it is next to impossible to complete the conversion process without making at least one mistake. Graphics Drawingboard greatly facilitates the design and conversion of graphic figures. In addition to saving hours of time, it also turns what would normally be considered a burden into a pleasure.

At the start of the program a cursor appears in the middle of the screen and the corners are lit to indicate their locations. The cursor can then be moved around the screen using the arrow keys. The six pixels in the character block are represented by the numbers 2, 3, 5, 6, 8, and 9 on the numeric keypad. Hitting one of these numbers lights up the corresponding pixel in the character block at the cursor location. Now the fun starts.

Using these keys, you can draw anything from maps to androids. To draw a given figure, trace the outline on a clear sheet of plastic, tape it to the TRS-80 screen, and use Graphics Drawingboard to transfer the figure to the screen. The outline of the continental United States (Figure 1) took about 15 minutes to complete—a task that would have taken hours otherwise.

William E. Bailey, 4601 N. Park Ave., Apt. 1811, Chevy Chase, MD 20815.

Drawingboard, continued...

Figure 1.

The United States:

LOCATION	VALUE	LOCATION	VALUE	LOCATION	VALUE	LOCATION	VALUE
60	160	61	176	66	156	67	186
68	131	69	131	70	131	71	140
72	140	73	140	74	140	75	164
76	176	77	176	78	176	79	176
80	176	81	176	82	176	83	176
84	176	123	150	124	129	126	137
127	144	129	168	130	129	149	131
150	131	151	131	152	131	153	131
154	131	155	131	156	131	157	131
158	131	159	131	160	131	161	131
162	131	163	131	164	131	165	187
166	176	167	176	168	176	169	140
170	164	171	176	172	176	184	152
185	140	186	131	191	154	192	160
193	133	235	152	236	129	237	150
238	131	239	137	240	140	241	176
242	160	243	152	244	140	245	164
246	176	247	140	248	129	252	160
253	140	254	131	256	154	299	149
301	149	306	129	316	176	317	155
320	149	363	137	364	140	365	129
377	176	378	140	379	131	384	149
440	150	448	149	504	137	505	176
512	130	513	164	568	176	569	176
570	133	578	131	579	140	580	176
629	160	630	176	631	134	645	131
646	140	647	176	648	176	692	150
693	129	713	131	714	140	715	140
716	140	717	140	718	140	719	140
720	140	721	176	722	144	756	149
786	130	787	137	788	164	789	176
790	140	791	140	792	164	793	144
800	176	801	152	802	140	803	140
804	140	805	140	806	140	807	140
808	140	809	176	810	152	811	131
812	131	813	131	814	131	815	131
816	131	817	131	818	164	820	130
821	148	857	130	858	164	859	144
862	152	863	131	883	165	884	144
885	138	886	144	923	130	924	137
925	140	926	141	948	130	949	131
950	129						

Figure 2.

Android:

LOCATION	VALUE	LOCATION	VALUE	LOCATION	VALUE	LOCATION	VALUE
480	176	481	191	482	191	483	191
484	176	544	190	545	189	546	143
547	190	548	189	608	184	609	174
610	191	611	157	612	180	671	130
672	173	673	186	674	191	675	181
676	158	677	129	737	170	739	149
800	136	801	142	803	141	804	132

COLOR COMPUTER

COMPUVOICE

TRS-80

Give your computer a voice of its own - build speech into your BASIC programs. This machine language program is a must for your library - no hardware modification needed. $44.95

MADNESS & THE MINOTAUR

The best adventure game available for the color computer. Over 200 rooms, 6 creatures, 8 magic spells, loads of treasures. Written in machine language, extended Basic not required. $19.95

RAMCHARGER 32K UPGRADE

- EXTEND MEMORY FROM 16K to 32K
- 100% Compatible With Extended Basic
- No Soldering Or Modification
- Fits Inside Computer
- $79.95

NEW EXTENDED BASIC GAMES!

- SUB HUNT $14.95
- LASER ATTACK $10.95
- ALCATRAZ II $ 8.95

Complete with high resolution graphics and sound

- CROID $12.95

Eliza type artificial intelligence game

Space Invaders

Space War

- The Best Games Available
- High Resolution Graphics
- Fast, Machine Language
- Ext. Basic Not Required
- $21.95 each, cassette
- $25.95 each, disk

THE FACTS

At last, a complete description of the "guts" of the Color Computer. Specs on all the ICs, complete schematics, theory of operation and programming examples.

$14.95

SOUNDSOURCE

Store music or voice from a cassette tape in the computer and display it on the TV screen. Shorten it, lengthen it, modify it and replay it through the TV's sound system. Build and test your own sounds for games. No hardware mods needed.

$24.95

EXTENDED BASIC GAMES

- LOTHAR'S LABYRINTH) Word Search Puzzle
- BATTLEFLEET Battleship Search Game (one or two players)
- SPACE TRADERS Galactic trading game

$14.95/ea.

UTILITIES

- EDITOR/ASSEMBLER $34.95
- SUPER MONITOR 19.95
- EPROM PROGRAMMER ...... 89.95 (Program your own ROMs for the ROM-PAC port)
- MAGIC BOX .... 24.95 Load MOD I/III Tapes into the color computer
- TYPING TUTOR 19.95
- TEXT EDITOR

DEALER INQUIRIES INVITED

CIRCLE 271 ON READER SERVICE CARD

SPECTRAL ASSOCIATES

143 HARVARD AVE.
Tacoma, Washington 98466

WRITE FOR COMPLETE CATALOG
ADD 3% FOR SHIPPING $1.00 minimum
Allow 2-3 wks. for delivery

(206) 565-8483

VISA OR MASTERCARD ACCEPTED

TRS-80* Model III

Hardware & Software at discount prices.

COMPUTER HOUSE

RADIO SHACK	List Price	OUR PRICE
26-1066 Mod III, 48 K, 2-Disk	2,495.00	2,100.00
26-1062 Mod III, 16 K	999.00	849.00
26-1906 Invasion Force (T)	14.95	11.95
26-1590 Super Scripsel (D)	199.00	155.00
26-1591 Scripsel Dictionary (D)	149.00	119.20
26-1569 Mod III Visicalc (D)	199.00	155.00
26-1592 Profile III Plus	199.00	155.00
ADVENTURE INTERNATIONAL		
Star Trek 3.5 (T)	14.95	11.95
Space Intruders (T)	14.95	11.95
Maxi Manager (D)	99.95	79.95
Star Fighter (T)	24.95	19.95
BIG FIVE SOFTWARE		
Robot Attack (T)	15.95	12.75
Cosmic Fighter (T)	15.95	12.75
Attack Force (T)	15.95	12.75
Super Nova (T)	15.95	12.75

(T) = Cassette Tape (D) = Disk

We represent 20+ mfgrs with 300+ programs. Write for our FREE catalog for Mod II, Mod III and Color Computer

COMPUTER HOUSE
P.O. Box 538 Mammoth Lakes, CA 93546
(714) 934-6538

Orders less than $100.00 add $1.50 for postage and handling. Over $100.00 shipped free. MC & VISA accepted

*TRS-80 is a trademark of Tandy Corp

CIRCLE 152 ON READER SERVICE CARD

Common Cents

FORECASTER

With your computer, you can forecast the stock market like the Wall Street experts. FORECASTER, a mutual and money market fund tracker, monitors the stock market and helps you make timely decisions to achieve a high and safe growth of your investment dollars. Our program tracks, estimates and predicts future movements in the stock market and selected mutual funds based on an extensive data base.

- AVOID CONFUSION
- ACHIEVE HIGH YIELDS
- PRESERVE CAPITAL
- LOW RISK
- TOP INTEREST RATES
- TAKES LESS THAN ½HOUR PER WEEK

FORECASTER is written in simple, clear language. No advanced knowledge of mathematics, computer programming, or investing experience is required. Send $10.00* for programming report and user's manual, or $75.00* for complete software package. Please specify Apple II+ (Applesoft), CP/M Basic 80, or TRS 80 Level II. (Apple II+ and Applesoft are trademarks of Apple Computers, CP/M is a trademark of Digital Research, Basic 80 is a trademark of MicroSoft, and TRS 80 is a trademark of Tandy Corp.
* Add $2.00 for postage and handling
New Mexico residents also add 4% tax

META SOFTWARE ENGINEERING
P. O. Box 18066
Albuquerque, NM 87115

CIRCLE 192 ON READER SERVICE CARD

Drawingboard, continued...

The picture of an android (Figure 2) was also rapidly created in this manner.

To correct a mistake in any part of the design, just move the cursor to the block in which the mistake is located and hit the "C" key to clear that character block of its contents; then, use the numbers to change the contents of the block as needed.

When the design is finished, hit the "P" key to print out the location of the character blocks composing the picture (same as "PRINT AT" locations) and their corresponding values (ASCII graphics codes). The tedious graphics-ASCII conversion is completed without human error. □

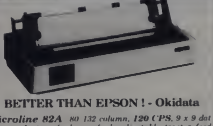
Listing for Graphics Drawing Board.

```
10 I=0:LN=128:L=480:DIM LO(1023):C=1
20 CLS
22 PRINT"    HIT 'P' TO PRINT SCREEN DATA
   HIT 'C' TO CLEAR LOCATION"
25 SET(0,0):SET(127,0):SET(127,47):SET(0,47)
30 POKE 15360+L,95
35 '-----------SCAN KEYBOARD-----------
40 IF PEEK(14340)=1 THEN 900
50 V=PEEK(14400):V=V/8
60 ON V GOTO 500,600
70 V=V/4
80 ON V GOTO 700,800
85 IF PEEK(14337)=8 THEN POKE15360+L,95:LO(L)=0
87 LN=PEEK(15360+L):IF LN<128 THEN LN=128
90 ON VAL(INKEY$)GOTO 100,400,450,100,300,350,100,200,250
100 GOTO 40
195 '------------MAKE GRAPHIC PIXELS LIGHT UP-------------
200 IF LN+1>191 THEN40 ELSE LN=LN+1:POKE 15360+L,LN:GOTO 40
250 IF LN+2>191 THEN40 ELSE LN=LN+2:POKE 15360+L,LN:GOTO 40
300 IF LN+4>191 THEN40 ELSE LN=LN+4:POKE 15360+L,LN:GOTO 40
350 IF LN+8>191 THEN40 ELSE LN=LN+8:POKE 15360+L,LN:GOTO 40
400 IF LN+16>191 THEN40 ELSE LN=LN+16:POKE 15360+L,LN:GOTO 40
450 IF LN+32>191 THEN40 ELSE LN=LN+32:POKE 15360+L,LN:GOTO 40
495 '-----------MOVE CURSOR----------
500 IFL-64<1ORL-64=63THEN85
505 IFPEEK(15360+L)>127THENLO(L)=LN
510 IFPEEK(15360+L)=95THENPOKE15360+L,32
520 L=L-64:IFPEEK(15360+L)<128THENPOKE15360+L,95:FORI=1TO20:NEXTI
530 GOTO85
600 IFL+64>1022ORL+64=960THEN85
605 IFPEEK(15360+L)>127THENLO(L)=LN
610 IFPEEK(15360+L)=95THENPOKE15360+L,32
620 L=L+64:IFPEEK(15360+L)<128THENPOKE15360+L,95:FORI=1TO20:NEXTI
630 GOTO85
700 IFL-1<1ORL-1=63ORL-1=960THEN85
705 IFPEEK(15360+L)>127THENLO(L)=LN
710 IFPEEK(15360+L)=95THENPOKE15360+L,32
720 L=L-1:IFPEEK(15360+L)<128THENPOKE15360+L,95
730 GOTO85
800 IFL+1>1022ORL+1=63ORL+1=960THEN85
805 IFPEEK(15360+L)>127THENLO(L)=LN
810 IFPEEK(15360+L)=95THENPOKE15360+L,32
820 L=L+1:IFPEEK(15360+L)<128THENPOKE15360+L,95
830 GOTO85
895 '-----------DISPLAY GRAPHIC CODES FOR PICTURE-----------
900 IFPEEK(15360+L)<128THEN905ELSELO(L)=LN
905 CLS:FORI=1TO4:PRINT"LOCATION-VALUE",:NEXTI
910 FORI=0TO1023:IFLO(I)=0THENGOTO930
920 PRINTTAB(P+2)I;TAB(P+9)LO(I);
925 P=P+16
927 C=C+1:IFC=5THENPRINT:C=1:P=0
930 NEXTI
940 PRINT:PRINT:INPUT"DO YOU WANT TO OUTPUT
    THE DATA TO A PRINTER(Y/N)";A$
950 IFA$="N"THEN1030
960 '-----------OUTPUT TO PRINTER---------
965 C=1:P=0
970 FORI=1TO4:LPRINT"LOCATION-VALUE",:NEXTI
975 LPRINT
980 FORI=0TO1023:IFLO(I)=0THEN1020
990 LPRINTTAB(P+2)I;TAB(P+9)LO(I);
1000 P=P+16
1010 C=C+1:IFC=5THENLPRINT:C=1:P=0
1020 NEXTI
1025 LPRINT
1030 INPUT"DO YOU WANT TO ADD TO THE PICTURE";B$
1040 IF B$="N" THEN PRINT"GOOD-BYE":END
1050 '-----------DRAW PICTURE ON SCREEN-------------
1060 CLS
1065 PRINT" HIT 'P' TO PRINT SCREEN DATA
     HIT 'C' TO CLEAR LOCATION"
1067 SET(0,0):SET(127,0):SET(127,47):SET(0,47)
1070 FORI=0TO1023:IFLO(I)=0THEN1090
1080 POKE15360+I,LO(I)
1090 NEXTI
1095 IF LO(L)<128THENPOKE15360+L,95
1097 C=1:P=0
1100 GOTO 40
```

JADE

Computer Products

Printers



BETTER THAN EPSON ! - Okidata

Microline 82A *80 132 column, 120 CPS, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (removable), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle 200,000,000 character print head, bi directional logic seeking, both serial & parallel interfaces included, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*

PRM-43082 *with FREE tractor* **$539.95**

Microline 83A *132 232 column, 120 CPS, handles forms up to 15" wide, plus all the features of the 82A*

PRM-43083 *with FREE tractor* **$749.95**

PRA-27081A *Apple card* **$39.95**
PRA-27082A *Apple cable* **$19.95**
PRA-27087A *TRS-80 cable* **$24.95**
PRA-43080 *Extra ribbons pkg. of 2* **$9.95**

INEXPENSIVE PRINTERS - Epson

MX-70 *80 column, 80 CPS, 5 x 7 dot matrix, adjustable tractor feed, & graphics*

PRM-27070 *List $459* **$399.95**

MX-80 *80 column, 80 CPS, bi-directional logic seeking printing, 9 x 9 dot matrix, adjustable tractor feed, & 64 graphics characters*

PRM-27080 *List $645* **$469.95**

MX-80FT *same as MX-80 with friction feed added.*

PRM-27082 *List $745* **$559.95**

MX-100 *132 column, correspondence quality, graphics, up to 15" paper, friction feed & adjustable tractor feed, 9 x 9 dot matrix, 80 CPS.*

PRM-27100 *List $945* **$759.95**

PRA-27084 *Serial interface* **$69.95**
PRA-27088 *Serial intf & 2K buffer* . **$144.95**
PRA-27081 *Apple card* **$74.95**
PRA-27082 *Apple cable* **$22.95**
PRA-27086 *IEEE 488 card* **$52.95**
PRA-27087 *TRS-80 cable* .. **$32.95**
PRA-27085 *Graftrax II* **$95.00**
PRA-27083 *Extra ribbon* **$14.95**

NEC 7700 & 3500

NEC Spinwriter w/Intelligent Controller

Standard serial, Centronics parallel, and current loop interfaces • Selectable baud rates 50 to 19,200 • Automatic bidirectional printing • Logic seeking • 650 character buffer with optional 16K buffer • 55 characters per second print speed • Comes with vertical forms tractor, ribbon, thimble and cable • Diablo compatible software • Available with or without optional front panel

PRD-55511 *1K no front panel* ... **$2795.00**
PRD-55512 *16K no front panel* . **$2895.00**
PRD-55515 *1K w front panel* .. **$2995.00**
PRD-55516 *16K w front panel* **$3095.00**

Intersell NEC 3500Q

New from NEC - the 3500 series Spinwriters. Incorporates all the features and reliability of the 5500 and 7700 series Spinwriters into an inexpensive 30 CPS letter quality printer with an optional bi-directional tractor assembly.

PRD-55351 *3500Q 1K* **$1995.00**
PRD-55352 *3500Q 16K* **$2095.00**
PRA-55100 *Deluxe tractor option* .. **$300.00**

Accessories for Apple

16K MEMORY UPGRADE

Add 16K of RAM to your TRS-80, Apple, or Exidy in just minutes. We've sold thousands of these 16K RAM upgrades which include the appropriate memory chips (as specified by the manufacturer), all necessary jumper blocks, fool-proof instructions, and our 1 year guarantee.

MEX-16100K *TRS-80 kit* **$25.00**
MEX-16101K *Apple kit* **$25.00**
MEX-16102K *Exidy kit* **$25.00**

16K RAM CARD - for Apple II

Expand your Apple to 64K, 1 year warranty

MEX-16500A *Save $70.00 !!!* **$129.95**

Z-80° CARD for APPLE

Two computers in one, Z-80 & 6502, more than doubles the power & potential of your Apple, includes Z-80° CPU card, CP M 2.2, & BASIC-80

CPX-30800A *A & T* **$299.95**

8" DISK CONTROLLER

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CPM 2.2, Shugart & Qume compatible

IOD-2700A *A & T* **$499.95**

2 MEGABYTES for Apple II

Complete package includes: Two 8" double-density disk drives, Vista double-density 8" disk controller, cabinet, power supply, & cables, DOS 3.2/3.3, CP/M 2.2, & Pascal compatible.

1 MegaByte Package *(Kit)* **$1495.00**
1 MegaByte Package *(A & T)* ... **$1695.00**
2 MegaByte Package *(Kit)* **$1795.00**
2 MegaByte Package *(A & T)* **$19.95**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock calendar, serial interface, & parallel interface all on one card.

IOX-2300A *A & T* **$199.95**

AIO, ASIO, APIO - S.S.M.

Parallel & serial interface for your Apple (see Byte pg 11)

IOI-2050K *Par & Ser kit* **$139.95**
IOI-2050A *Par & Ser A & T* **$169.95**
IOI-2052K *Serial kit* **$89.95**
IOI-2052A *Serial A & T* **$99.95**
IOI-2054K *Parallel kit* **$69.95**
IOI-2054A *Parallel A & T* **$89.95**

A488 - S.S.M.

IEEE 488 controller, uses simple basic commands, includes firmware and cable, 1 year guarantee, (see April Byte pg 11)

IOX-7488A *A & T* **$399.95**

Modems

CAT MODEMS - Novation

CAT *300 baud, acoustic, answer/orginate*

IOM-5200A *List $189.95* **$149.95**

D-CAT *300 baud direct connect, answer orginate*

IOM-5201A *List $199.95* **$169.95**

AUTO-CAT *Auto answer/orginate, direct connect*

IOM-5230A *List $299.95* **$239.95**

Apple-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer auto-dial, auxiliary 3-wire RS232C serial port for printer

IOM-5232A *Save $50.00!!!* **$325.00**

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface, programmable

IOM-5400A *Smartmodem* **$269.95**

Single Board Computer

AIM-65 - Rockwell

6502 computer with alphanumeric display, printer, & keyboard, and complete instructional manuals

CPK-50165 *1K AIM* **$424.95**
CPK-50465 *4K AIM* **$474.95**
SFK-74600008E *8K BASIC ROM* .. **$64.95**
SFK-64600004E *4K assembler ROM* **$43.95**
PSX-030A *Power supply* **$64.95**
ENX-000002 *Enclosure* **$54.95**

1K AIM, 8K BASIC, power supply, & enclosure

Special package price **$649.95**

Z-80 STARTER KIT - SD Systems

Complete Z-80 microcomputer with RAM, ROM, I/O, keyboard, display, kludge area, manual, & workbook

CPS-30100K *KIT* **$299.95**
CPS-30100A *A & T* **$469.95**

SYM-1 - Synertek Systems

Single board computer with 1K of RAM, 4K of ROM, key pad, LED display, 20ma & cassette interface on board.

CPK-50020A *A & T* **$249.95**

Video Monitors

HI-RES 12" GREEN - Zenith

15 MHz bandwidth, 700 lines/inch, P31 green phosphor, switchable 40 or 80 columns, small, light-weight & portable.

VDM-201201 *List price $150.00* **$118.95**

Leedex / Amdek

Reasonably priced video monitors

VDM-801210 *Video 100 12" B&W* . **$139.95**
VDM-801230 *Video 100-80 12" B& W* **$179.95**
VDM-801250 *12" Green Phospor* ... **$169.95**
VDC-801310 *13" Color I* **$379.95**

12" COLOR MONITOR - NEC

Hi-res monitor with audio & sculptured case

VDC-651212 *Color Monitor* **$479.95**

12" GREEN SCREEN - NEC

20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution. A fantastic monitor at a very reasonable price

VDM-651200 *Special Sale Price* **$199.95**

Video Terminals

AMBER SCREEN - Volker Craig

Detachable keyboard, amber on black display, 7 x 9 dot matrix, 10 program function keys, 14 key numeric pad, 12" non glare screen, 50 to 19,200 baud, direct cursor control, auxiliary bi-directional serial port

VDT-351200 *List $795.00* **$645.00**

VIEWPIONT - ADDS

Detachable keyboard, serial RS232C interface, baud rates from 110 to 19,200, auxiliary serial output port, 24 x 80 display.

VDT-501210 *Sale Priced* **$639.95**

TELEVIDEO 950

VDT-901250 *List $1195.00* **$995.00**

DIALOGUE 80 - Ampex

VDT-230080 *List $1195.00* **$895.00**

JADE
Computer Products

S-100 CPU Boards

THE BIG Z* - Jade
2 or 4 MHz switchable Z-80 CPU with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600*

CPU-30201K	*Kit*	$139.95
CPU-30201A	*A & T*	$189.95
CPU-30200B	*Bare board*	$35.00

2810 Z-80* CPU - Cal Comp Sys
2 4 MHz Z-80A CPU with RS-232C serial I O port and on-board MOSS 2.2 monitor PROM, front panel compatible.*

CPU-30400A	*A & T*	$269.95

CB-2 Z-80 CPU - S.S.M.
2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K	*Kit*	$239.95
CPU-30300A	*A & T*	$299.95

S-100 PROM Boards

PROM-100 - SD Systems
2708, 2716, 2732 EPROM programmer w/software

MEM-99520K	*Kit*	$189.95
MEM-99520A	*A & T*	$249.95

PB-1 - S.S.M.
2708, 2716 EPROM board with built-in programmer

MEM-99510K	*Kit*	$154.95
MEM-99510A	*A & T*	$219.95

EPROM BOARD - Jade
16K or 32K uses 2708's or 2716's, 1K boundary

MEM-16230K	*Kit*	$79.95
MEM-16230A	*A & T*	$119.95

S-100 Video Boards

VB-3 - S.S.M.
80 characters x 24 lines expandable to 80 x 48 for a full page of text, upper & lower case, 256 user defined symbols, 160 x 192 graphics matrix, memory mapped, has key board input.

IOV-1095K	*4 MHz kit*	$349.95
IOV-1095A	*4 MHz A & T*	$439.95
IOV-1096K	*80 x 48 upgrade*	$39.95

VDB-8024 - SD Systems
80 x 24 I/O mapped video board with keyboard I O, and on-board Z-80A.*

IOV-1020A	*A & T*	$459.95

VIDEO BOARD - S.S.M.
64 characters x 16 lines, 128 x 48 matrix for graphics, full upper lower case ASCII character set, numbers, symbols, and greek letters, normal reverse blinking video, S-100.

IOV-1051K	*Kit*	$149.95
IOV-1051A	*A & T*	$219.95
IOV-1051B	*Bare board*	$34.95

S-100 Motherboards

ISO-BUS - Jade
Silent, simple, and on sale - a better motherboard

6 Slot (5¼" x 8¾")		
MBS-061B	*Bare board*	$19.95
MBS-061K	*Kit*	$39.95
MBS-061A	*A & T*	$49.95
12 Slot (9¾" x 8¾")		
MBS-121B	*Bare board*	$29.95
MBS-121K	*Kit*	$69.95
MBS-121A	*A & T*	$89.95
18 Slot (14½" x 8¾")		
MBS-181B	*Bare board*	$49.95
MBS-181K	*Kit*	$99.95
MBS-181A	*A & T*	$139.95

S-100 RAM Boards

MEMORY BANK - Jade
4 MHz, S-100, bank selectable, expandable from 16K to 64K

MEM-99730B	*Bare Board*	$49.95
MEM-99730K	*Kit no RAM*	$199.95
MEM-32731K	*32K Kit*	$239.95
MEM-64733K	*64K Kit*	$279.95
Assembled & Tested		add $50.00

64K RAM - Calif Computer Sys
4 MHz bank port bank byte selectable, extended addressing, 16K bank selectable, PHANTOM line allows memory overlay, 8080 Z-80 front panel compatible.

MEM-64565A	*A & T*	$575.00

64K STATIC RAM - Mem Merchant
64K static S-100 RAM card, 4-16K banks, up to 8MHz

MEM-64400A	*A & T*	$789.95

32K STATIC RAM - Jade
2 or 4 MHz expandable static RAM board uses 2114L's

MEM-16151K	*16K 4 MHz kit*	$169.95
MEM-32151K	*32K 4 MHz kit*	$299.95
Assembled & tested		add $50.00

16K STATIC RAM - Mem Merchant
4 MHz 16K static RAM board, IEEE S-100, bank selectable, Phantom capability, addressable in 4K blocks, "disable-able" in 1K segments, extended addressing, low power

MEM-16171A	*A & T*	$164.95

S-100 Disk Controllers

DOUBLE-D - Jade
Double density controller with the inside track, on-board Z-80A, printer port, IEEE S-100, can function on an interrupt driven buss*

IOD-1200K	*Kit*	$299.95
IOD-1200A	*A & T*	$375.00
IOD-1200B	*Bare board*	$59.95

DOUBLE DENSITY - Cal Comp Sys
5¼" and 8" disk controller, single or double density, with on-board boot loader ROM, and free CP M 2.2 and manual set.*

IOD-1300A	*A & T*	$374.95

S-100 I/O Boards

S.P.I.C. - Jade
Our new I/O card with 2 SIO's, 4 CTC's, and 1 PIO

IOI-1045K	*2 CTC's, 1 SIO, 1 PIO*	$179.95
IOI-1045A	*A & T*	$239.95
IOI-1046K	*4 CTC's, 2 SIO's, 1 PIO*	$219.95
IOI-1046A	*A & T*	$299.95
IOI-1045B	*Bare board w/ manual*	$49.95

I/O-4 - S.S.M.
2 serial I/O ports plus 2 parallel I/O ports

IOI-1010K	*Kit*	$179.95
IOI-1010A	*A & T*	$249.95
IOI-1010B	*Bare board*	$35.00

S-100 Mainframes

MAINFRAME - Cal Comp Sys
12 slot S-100 mainframe with 20 amp power supply

ENC-112105	*Kit*	$329.95
ENC-112106	*A & T*	$399.95

DISK MAINFRAME - N.P.C.
Holds 2 8" drives and a 12 slot S-100 system. Attractive metal cabinet with 12 slot motherboard & card cage, power supply, dual fans, lighted switch, and other professional features

ENS-112325	*with 25 amp p.s.*	$699.95

CIRCLE 199 ON READER SERVICE CARD

Disk Drives

Handsome metal cabinet with proportionally balanced air flow system • Rugged dual drive power supply • Power cable kit • Power switch, line cord, fuse holder, cooling fan • Never-Mar rubber feet • All necessary hardware to mount 2-8" disk drives, power supply, and fan • Does not include signal cable

Dual 8" Subassembly Cabinet

END-000420	*Bare cabinet*	$59.95
END-000421	*Cabinet kit*	$225.00
END-000431	*A & T*	$359.95

8" Disk Drive Subsystems
Single Sided, Double Density

END-000423	*Kit w/ 2 FD100-8Ds*	$924.95
END-000424	*A & T w/ 2 FD100-8Ds*	$1124.95
END-000433	*Kit w/ 2 SA-801Rs*	$999.95
END-000434	*A & T w/ 2 SA-801Rs*	$1195.00

8" Disk Drive Subsystems
Double Sided, Double Density

END-000426	*Kit w/ 2 DT-8s*	$1224.95
END-000427	*A & T w/ 2 DT-8s*	$1424.95
END-000436	*Kit w/ 2 SA-851Rs*	$1495.00
END-000437	*A & T w/ 2 SA-851Rs*	$1695.00

QUME DT-8
8" Double-Sided, Double-Density Disk Drive

1 Drive ...	$524.95 each
2 Drives .	$499.95 each
10 Drives	$479.95 each

Jade Part Number MSF-750080

Shugart 801R
8" Single-Sided, Double-Density Disk Drive

1 Drive ...	$394.95 each
2 Drives .	$389.95 each

Jade Part Number MSF-10801R

SIEMENS 8"
8" Single-Sided, Double-Density Disk Drive

1 Drive ...	$384.95 each
2 Drives .	$349.95 each
10 Drives	$324.95 each

Jade Part Number MSF-201120

MPI B-51
5¼" Single-Sided, Double-Density Disk Drive

1 Drive ...	$234.95 each
2 Drives .	$224.95 each
10 Drives	$219.95 each

Jade Part Number MSM-155100

END-000213	*Case & power supply*	$74.95

David & Sandy Small

A Note from the Author

Once upon a time, a very imaginative company looked at the home computer market. It found the graphics available on many of the machines to be limited. So the company designed a powerful machine with particularly good graphics capabilities. And it sent this machine out onto the market.

But no one understood how it worked. It was not a mere clone of earlier machines; it incorporated some revolutionary ideas. So few were bought. The company began to see that until the inner workings were understood, this machine would not sell very well.

On the other hand, they felt, when the power and flexibility of the machine became known, it would have no competition in its field. But there was absolutely no tutorial material available to unwrap the powerful goodies in the Atari. And without a tutorial, discerning the concepts behind the computer was very, very difficult.

Compounding the problem was the fact that the only available documentation was reference manuals, which were never intended to be teaching guides. Once the basic concepts were understood, the machine wasn't difficult to use, but mastering those concepts was nearly impossible.

A few magazines were running scattered tutorials in bits and pieces. For the most part, authors were in the same boat as the general public, but they shared what knowledge they had with the computing public. Gradually, the available information began to spread.

In June of 1981, *Creative Computing* began a tutorial series on the Atari in this column. The tutorial series has covered the abilities of the Atari from the point of view of the Basic programmer, and has assumed little knowledge on the reader's part of esoteric computer buzzwords. (What was needed was explained.) The series has been well-received by readers, and will be published shortly as part of *The Creative Atari* from Creative Computing Press. It remains the only beginner's level tutorial on the Atari.

Creative does deserve kudos for publishing the series and really trying to help its Atari readers.

Even though the number of Atari owners in the readership is much smaller than, for example, TRS-80 owners, *Creative* has devoted a good deal of space to the series. If you're in the letter writing mood, you might drop George Blank or Betsy Staples a line and thank them for their efforts and for taking the risk.

In future columns we plan to include more product reviews and the sorts of things one would expect in a column. Now that we have defined the basic concepts, we can discuss the Atari in other than beginning-level language, and add to the knowledge available. We will also try to keep you up to date on the latest from the rumour mill and from Atari.

Needless to say, as authors we leave many questions untouched—our articles sometimes raise more questions than they answer. Such is the way of the Atari: there is always another feature to cover. And we get many letters asking questions.

Sandy and I have been swamped with letters asking questions about the Atari. We try to answer them all, but we do tend to answer those with an S.A.S.E. enclosed the fastest (let's say within two months). If you do send a letter, please don't expect a typed reply, and try to keep the questions short so we can answer them fairly quickly. Also, if the answer is in a previous column, and long, we'll probably just refer you to that column; you can order back copies of magazines from *Creative* and most computer stores stock a few back issues.

In this column, we'll attempt to cover a variety of short subjects. None of them is broad enough to write a column about, yet all deserve an answer.

Questions & Answers

Q. PEEK(741)+256*PEEK(742) (from July '81) is not a good way to find the display list. PEEK(560) is. Why didn't you?

A: Knowledge about the Atari is a rapidly unfolding thing. We pass on what we know when we know it. And remember, we write columns about four months before you read them. Since we are experimenting with the Atari all the time, and learning more, sometimes we discover a better way of doing things about which we have already written. No matter; we try to give the best of what we know at the time.

Q: In the DLI article (December 1981) you don't use memory page 6. Why? If you did, you could fix the location of the program and avoid the relocation code.

A: First, we left the page alone so the user could use it along with the DLI routine. Remember, the DLI routine will coexist and coexecute along with many assembly routines as it is an interrupt handler. Hence, it is potentially more useful located outside of page 6.

Second, it gives us a chance to explain all about string handling and the general principles behind regarding a string as just a collection of bytes in memory, useful in other ways besides merely holding characters. These are tutorials, remember, and often the stated goal is far less important than the getting there. The principles behind the demonstration will be far more useful, in many ways, than will be the demontration.

Q: In the July article you show a mixed mode display, which I can't produce. Could you send me the code for this? (Multiply this by 80 letters or so.)

We omitted the code because I was addressing the principle of stacking display blocks, and the code is somewhat confusing. It tends to raise more questions that it answers, but I have included it here for the curious. See Listing 1.

Listing 1.

```
10 REM GRAPH PROGRAM
20 REM LAYOUT:
30 REM
40 REM 1 LINE GR.2      20 BYTES 16
50 REM 1 LINE GR.2      40       32
60 REM 1 LINE GR.0      80       40
70 REM 120 LINE GR.8 80+(4800)    160
80 REM 1 LINE GR.0      +40      168
90 REM 1 LINE GR.0      +40      176
100 REM 1 LINE GR.0     +40      184
110 REM 1 LINE GR.0     +40      192
200 REM SET MODE
210 GRAPHICS'8+16:REM FAKE LAST FOUR
220 REM DISPLAY LIST
230 ST=PEEK(560)+256*PEEK(561)
240 REM ST+0,ST+1,ST+2=112..LEAVE BE
242 REM ST+3=79. CHANGE TO 7+64.
243 POKE ST+3,7+64
245 REM ST+4,+5=DATA. LEAVE BE.
246 REM ST+6,ST+7=15. MOD TO 7,2.
247 REM (MODE 2, THEN MODE 0).
248 POKE ST+6,7
249 POKE ST+7,2
250 REM DM + 0 - DM + 29 = MODE 2 L1
255 GOSUB 1000
260 DIM A$(60)
261 SETCOLOR 4,8,2
270 A$=" MODE 2 BIG TITLE   "
280 REM 12345678901234567890
290 REM TRANSLATE A$ TO INTERNAL CSET
300 GOSUB 500
330 REM FIND DISPLAY MEMORY
340 DM=PEEK(ST+4)+256*PEEK(ST+5)
410 REM POKE INTO MEMORY
420 FOR T=1 TO 20
430 POKE DM+(T-1),ASC(A$(T,T))
440 NEXT T
450 A$=" MODE 2 SECOND LINE "
460 REM 12345678901234567890
470 REM TRANSLATE A$ TO INTERNAL
    CSET
480 GOSUB 500
485 REM POKE INTO MEMORY
490 FOR T=1 TO 20
493 POKE DM+20+(T-1),ASC(A$(T,T))
496 NEXT T
497 GOTO 600
500 REM SUBROUTINE TO XLATE ASC TO
510 REM INTERNAL CSET
520 FOR Z=1 TO LEN(A$)
530 IF A$(Z,Z)=" " THEN A$(Z,Z)=
    CHR$(0)
540 IF ASC(A$(Z,Z))<>0 THEN A$
    (Z,Z)=CHR$(ASC(A$(Z,Z))-32)
550 NEXT Z
560 RETURN
600 REM DO MODE 0 LINE NEXT.
    40 BYTES
610 A$="  A TEXT MODE 0 SUBTITLE"
620 REM XLATE
630 GOSUB 500
640 REM POKE INTO MEMORY
650 FOR T=1 TO LEN(A$)
660 POKE DM+40+(T-1),ASC(A$(T,T))
670 NEXT T
675 REM PLOT A SAMPLE GRAPH
676 SETCOLOR 2,8,0
680 XMIN=2
690 YMIN=5
700 XMAX=319
710 YMAX=159
720 COLOR 1
725 PLOT 1,70:DRAWTO 319,70:PLOT 1,70
726 XSAV=1:YSAV=70
730 FOR X=5 TO 315 STEP 5
740 Y=INT(RND(0)*70)+40
750 DRAWTO X,Y
752 PLOT XSAV+1,YSAV:DRAWTO X+1,Y
753 PLOT XSAV+2,YSAV:DRAWTO X+2,Y
755 XSAV=X:YSAV=Y
760 NEXT X
770 REM PUT IN 4 TEXT LINES AT BASE/
780 REM AFTER 160 (GR.8) INSTRUCTIONS
790 GOTO 790
1000 FOR Y=ST+150 TO ST+210
1010 IF PEEK(Y)=65 THEN 1100
1020 NEXT Y
1030 PRINT "PLATO OFF."
1040 STOP
1100 B1=PEEK(Y+1)
1110 B2=PEEK(Y+2)
1120 POKE ST+162,B2
1130 POKE ST+161,B1
1140 POKE ST+160,65
1150 RETURN
```

Basically we are modifying a graphics 8 display list to:

GR.2
GR.2
GR.0
Gr.8 x lots

We are not duplicating the July display exactly, but you can with the principles in the code.

We use two GR.2 lines to make the memory requirements come out to 40 bytes, to keep "in sync" with graphics 8. We then put data into the first 120 bytes of DM for character output.

Character data is translated from ATASCII to INTERNAL format for display; they are not the same. A machine language routine here would be quite nice; there is probably one in the operating system that could be used. The INTERNAL codes are then POKEd into memory.

Because we now generate 16+16+8+189 scan lines, instead of 192, we have a total of 229 generated lines. This will probably cause your TV to "roll." So we chop out the lower 40 graphics 8 instructions by moving the JVB instruction up. I copy the data bytes first, then the JVB byte, to prevent the JVB taking off into random memory.

Or so we thought. (And so we told you.) JVB is the jump and wait for vertical blank; it makes the display list into a GOTO loop, so we said. Except that just by accident we found out that where it jumps to doesn't matter. That's right: the data bytes following the JVB are irrelevant. Why? Because at the start of every screen refresh, the operating system copies the display list location shadows (560, 561) into Antic and re-sets him to the start of the DL. So all is well even if Antic, at the end of the DL, jumps off to kingdom come.

Except: during disk accesses, where apparently the Vblank routine copy is nulled. Then the screen will go wild. (See what I mean about "rapidly changing knowledge"?)

Along these lines, a fun display is to set up two display lists and two display memories, and have Antic execute them alternately. (Use a DLI in the first 112 instruction to swap display memories.) You'll get two displays superimposed on each other. For example, we had a graphics 0 display of Basic code imposed on the graphics 8 display it produces. Nice, and nifty for an editor or such. However, it does tend to flicker.

Q: Speaking of flickers, your DLI routine has an annoying flicker in midscreen—a border between two colors that jumps back and forth. Why?

A: You're right. Next question?

Seriously, the reason for this is that the 6502 just doesn't have enough time to copy all the data into the CTIA color registers before the TV scan line begins. In fact, it can't even start until midway through the last scan line of the display block with the interrupt flagged. The TV refresh process outruns this rather generalized routine. You'll have to learn assembly language to deal with this properly; use WSYNC, then rapidly store up to three colors after the WSYNC using STX, STY, and STA. You'll still be offscreen. For those of you I've lost, the timing of a DLI routine is a very touchy thing; if you don't know machine language and how the Atari relates to the TV, forget it.

This routine will also crash in graphics 8 as it will not complete between interrupts if you have interrupts on two consecutive scan lines. If you want that, learn assembly language, then write your own driver.

On Memory Boards

Q: My Atari dies after being on for a while. Or, my Atari freaks out unexpectedly. Or, my Basic programs scrozzle themselves. Or....

A: 1. If you squeeze the last few bytes of available memory, Basic seems to screw

"Now that's my idea of a 'user-friendly' system!"

up. Something in the upper memory management routines fails during tight squeezes, and there isn't much you can do about it. Sorry.

2. The Atari memory boards may be giving you trouble. Here's Small's Memory Board Fix (which works amazingly often on bizarre Atari problems):

The Atari memory boards get hot, really hot, in their enclosed metal cans in the enclosed metal cage. This heat can mess things up, particularly in the connectors. The metal is necessary to avoid spraying radio frequency interference all over, but it does cause problems. So every month or so we pull all the boards out of the Atari and re-seat them. This re-establishes the socket connection. Cleaning the ends of the connector (a pencil eraser works wonders) and coating them with Lubriplate, then re-seating them is also a good idea—helps prevent corrosion.

If this fixes it, fine. If not, go the drastic route (as we had to on one very touchy 800):

1. Remove the lid. Bypass the interlock with a taped in Q-Tip.

2. Remove the memory board lids (pull the two Phillips head screws). Re-install the boards.

This will really help to keep things cool. Of course, you may not be able to watch TV nearby (nor will your neighbors) but it *will* prevent overheating.

Now that you have the lid open, some of you are doubtless going to get the clever idea of copying ROM cartridges onto disk. After all, you can boot up, then plug them in with DOS running. Then, a simple binary save, right?

Wrong.

Atari has some nasty, nasty surprises awaiting you if you try this. First, plugging the cartridges in sends a nice hefty spike into the memory lines, straight into sensitive Antic, CTIA, and the 6502B. Do you really want your Atari in the repair shop? All it takes to destroy these chips is a little static electricity in the wrong place, and your body is probably full of it in the winter.

Second, the Atari people have some special checks to prevent this. For example, disk I/O doesn't work the way you might expect from cartridges. Ever had your directory mysteriously disappear? This should be food for thought.

On Piracy

Speaking of piracy in general, I have found copies of my software (what goes into these articles) floating around all over the place. This is really embarassing when the disk that was pirated is a development disk and you've saved all sorts of junk on it.

But second, when you think about it, the prices you pay for software nowadays in many cases are pretty low anyway (when was the last time you could go on a date for $20), so why not give the author his royalties, and get the documentation as well?

I wish that people didn't consider protection schemes a Scott Adams adventure #30 to be broken. If you think about it, the hours you spend breaking the scheme are equal in dollars to what you would pay for the software in many cases. (And if you're thinking about selling copies, don't: all the software companies I've talked to are *currently* prosecuting people caught doing this.)

Q: I have 32K. Should I get 48K?

A: Maybe. If you use no cartridges, the Atari can use up to 48K RAM. If you use one cartridge, you are reduced to 40K available; if you use two, 32K. Eventually, as more RAM-only programs become available, 48K will be more and more handy. For example, Microsoft Basic, which we are currently testing, requires 48K but has no cartridges (disk based). We're in a transition period, in other words, and it may be to your advantage to wait a bit; hardware prices are dropping quickly, as usual.

On Disks

Q: During a disk access, my disk stops for a while for no reason and then restarts. Why?

A: A bug in the O.S. program. No, the disk isn't stopping to cool off (like an 820 printer) or anything. This is fixed in the new revision cartridges, which are slowly becoming available.

Q: What are DOS 2.5, 2.7, 2.8, 2S, 2.0S, 2.0D?

A: DOS 2.0S is the final, "cast in concrete" version of DOS 2. The others are developmental versions. They are pre-release copies. There are lots of 2S disks lying around; these have a bug in the interrupt subsystem, so best get rid of them. Also, if you boot up under 2S, you can't "DOS" to a 2.0 version of DOS. They're incompatible. So your best bet is to change your disks over to 2.0S and use it.

DOS 2.0D is for the double density 815 drive, which has been cancelled, delayed, sent back, or whatever (depending on who you talk to).

Q: What is a "fast formatted disk?"

A: Inside the 810 disk drive there is a microprocessor. When the Atari wants a given disk sector (128 bytes), it asks that microprocessor for it. The micro then spins the disk and moves the head to get that sector. If you have a disk with a more efficient layout, you can go between sectors (without a complete spin between them, for instance). A "fast formatted disk" has this improved layout, and, thus, when you access it, disk I/O is around 20% faster.

Disks that you format with your 810 will not have this improved layout, because it lays them out the old, slow way. A new ROM, called the "C" ROM, can be installed into your disk drive to make it format disks the fast way.

Who knows when it will be available? The rumour mill says that 1) all disk drives going to Europe have it; 2) all disks to the East Coast have it; 3) all disks shipped after September 1981 will have it, etc. Probably by the time this is printed some policy will have been established.

For those of you who can't wait, the Chicago area user's group has constructed their own version of the format ROM, which requires a few wiring changes to the disk and programming a new EPROM (not your beginner-level stuff). The Chicago ROM is 10% faster than the Atari ROM, which is definitely interesting. The ROMs work quite well; I've seen them tested. However, since the Chicago folks developed them I'll let them document it and take the credit. Incidentally, modifying a drive this way (of course) violates the warranties.

"Waddaya wanna do now—Trolls and Wizards, Fun with Math, Space Invader, Amalgamated Industries' profit and loss statement for 4th quarter FY '80...?"

On GTIA

Q: What's the GTIA chip and how do I get one?

A: The CTIA chip actually generates color for your TV. A new chip, GTIA, replaces CTIA and allows graphics modes 9, 10, and 11 out of Basic. (The operating system was written with GTIA in mind, and so was Basic, by the way.) It is an upgrade to the CTIA chip. The rumour mill again says it is available everywhere except where the rumour originates. We have one as the result of extreme kindness on the part of Atari, and are testing it. The added modes are:

Graphics 9: Allows 16 intensities (select by COLOR #) of pixels to be displayed in the background color. Great for grey-scale shading.

Graphics 10: Allows eight different kinds of pixels to be displayed in any of the standard colors. Uses the four P-M registers and four playfield registers to set colors.

Graphics 11: Allows 16 different colors for pixels, all in the same intensity.

The pixel size is four bits long, and one scan line high. This is 80 x 192 resolution, an interesting twist on the general rule that vertical resolution is less than horizontal.

There will be a more complete article on the GTIA chip when it is more widely available. (The problem is, most people at Atari don't have them either, and are trying just as hard to get one. Who do you think will get priority?)

On Languages

Q: Forth?

A: Forth is a dynamite programming language available for the Atari. Its speed is somewhere between Basic and assembly language, but much closer to assembly language. Best of all, it's a reasonably high level language (very stack oriented, as a matter of fact). I'm trying to learn it now. Versions are available from many sources. Atari lists Forth in their APEX exchange, but will not release it yet. Beware of other versions which may use undocumented entry points in the operating system, and which will quit working when the new cartridges are generally available.

There has been a lot of good software written in Forth. I have a synthesizer program, lent to me by Ed Rotberg of Atari, which plays the best music I ever heard from an Atari (and has different instrument sounds, too; drums, guitar, hand clapping, etc.). The Atari demo with the "Disco Dirge" is written in Forth to give you an idea of its execution speed and flexibility.

Q: Microsoft Basic.

A: You will be hearing a great deal about this from us. We are currently working with Microsoft Basic and it is a fantastic product, indeed. It is much faster than the Atari 8K cartridge Basic and has many, many more functions. It really turns the Atari into a serious business computer, for example. Look at the description of Microsoft Basic in any Apple, TRS-80 or PET book and you will get an idea what is available. Add to that many special Atari functions, and soon you will be writing only in Microsoft. (Look for a complete review shortly). □

"Whew! For a while, I thought the house was haunted!"

images...ibm images...ibm ima

Will Fastie

The other night when I came home I carried the garbage cans around to the back of the house, a normal chore for a Tuesday evening. I was shocked to discover my IBM Personal Computer system table sitting outside instead of in its assigned place in the basement. Those of you who have been following my column to this point know about my table. (Those of you who don't—subscription information can be found in the front of this magazine, and back issues are available. Get with it!) Now there is a rule in my house about clutter—it ain't permitted. My table, this table of vast sentimental value, this foundation of future computing, had been evicted!

My wife and I are reasonable people. Naturally, we had a quiet, intelligent discussion to try to decide where the table should go. I could not accept her first suggestion. Upon determination that her second suggestion was anatomically impossible, I reconsidered the first proposal and found it worthy. See Photo 1.

So Where's Will's Computer?

That's what I'd like to know.

It's hard to be buying a computer just as it is introduced. My order has been in for thirty days and I expect another thirty to pass before I get it. My business associates, reciting folk wisdom about IBM delivery, argued that the IBM Personal Computer would be no different. IBM's Data Processing Division (DPD) said "no, we understand the nature of this business and the computers will flow like water." I decided (wanted) to believe them. I ignored the reality of a new computer product introduction, with its inevitable longer-than-average lead time resulting from production startup. I should have known better.

That's the story at deadline. Now that you're reading this magazine, I should have my machine and the general situation should have smoothed out somewhat. It is generally believed, although IBM will not comment on production volumes, that the Boca Raton facility has or will have the capacity to manufacture 100,000 units per year. I would certainly think that such a volume would handle the demand for the immediate future. The only question is how fast IBM can get to a production level that will satisfy that market demand.

I wondered if the situation was any different for Computerland, without question the largest buyer for retail distribution. I didn't get any facts, but rumor was that they had a backlog of orders for 2,000 units. It seems that some systems are trickling to the stores, but the local dealers I've spoken with won't commit to a delivery schedule as yet.

Besides the fact that I don't have my computer to play with yet, there is the question of what I will tell you about in this computerless column. I've decided to talk about what you need to do when you bring your system to its home, be it your home or business.

Where Should You Put It?

There are several things that will affect your decision about the location of the system.

In the office, convenience will play a dominant role for obvious reasons. Ease of access and user comfort are important for the office because it is likely that people will regularly spend long stretches of time with the system. There should be plenty of room for the system, including adequate space for the printer paper. There should be ample workspace next to the system for the user. The manuals should be kept close at hand, for easy and quick reference.

In the home, the location of the television will probably dictate a location for the system, especially if it is wired for cable TV. This is less of an inconvenience with the IBM computer because the keyboard is connected with a coiled cable and can be placed as much as six feet from the system unit. It is also probable that a home system will not be used quite as intensively as its sister in the office, so user fatigue is less a problem.

Environment is another factor, although

Photo 1. The Author's System.

W. H. Fastie, 7110 Sheffield Rd., Baltimore, MD 21212.

not as important as it was only ten years ago when virtually every computer had to be refrigerated. For computers like the IBM Personal, it is only necessary to avoid extremes of temperature and humidity. If you are reasonably comfortable, the computer probably is too. You should also try to keep the system away from dirty or dusty places. Relatively small amounts of dirt and grit can permanently damage diskettes. That same dirt affects the operation of the diskette unit as well.

I am not aware of the existence of a cover for the IBM system. This is a regrettable oversight if none is available. The simple act of covering the system when it is not in use can extend the life of the system and prevent damage which could result in large repair bills.

Finally, the system will have to be placed near an electrical outlet, as described in the next section.

Plugging It In

You should plan the location of your computer before you get it. This will give you some time to arrange to have the proper electrical power available when the computer arrives.

The IBM system unit contains a power supply which provides power for the system board, adapter cards plugged into the board, two diskette drives, and the IBM Monochrome display. This supply requires one standard wall outlet, a 120-volt receptacle with ground, and draws a maximum of 2.5 amperes. Voltage is supplied to the IBM display from a special receptacle on the back of the system unit. Note that the IBM display *will not* plug in to a wall receptacle because the plug is not standard. It *must* be connected to the system unit.

If you have the IBM 80 CPS Matrix Printer (or any printer), you will need another 120-volt wall outlet, also with ground. The IBM printer draws a maximum of one ampere.

If you are using a TV or color monitor for your display, you will need another outlet. This will also be a 120-volt wall outlet. The current draw will depend on the particular display device.

If you have a small system and are using a cassette tape as your storage medium, you may have an AC adapter for the recorder. This will obviously require another 120-volt outlet, but will require negligible current.

To summarize, you will need a maximum of four outlets supplying 120-volt AC power. The system will draw somewhere between three and five amperes, depending on its specific configuration. All the outlets must be grounded. One more hint: ideally, your system should have its own circuit from your fuse box or breaker panel.

There is one other device you may want to consider adding to your system. Contemporary integrated circuit devices are growing denser and denser, and at the same time more sensitive to the power that supplies them. Severe voltage fluctuations can damage circuits in the computer. A further problem is "noise" from the power source, which interferes with the signals on the computer and can "confuse" the electronics. To protect against these problems, you may want to consider one of a variety of devices designed to "filter" noise and "isolate" your computer. Filters electronically reduce or eliminate stray signals from the power source. Isolators prevent power surges or "spikes" from getting through to the computer. Good isolators allow computers to operate through abominable conditions. I recommend that you talk this over with your local computer dealer and decide what is best for your situation. If the dealer doesn't have these devices, check with an electronics store—they're really quite common and you should not have difficulty finding one. A filter will cost from $25 to $100, and an isolator will cost from $50 to $200 depending on the current load it can support and the number of receptacles built into it. Multiple receptacles in the isolator are an advantage, since the isolator requires only one wall outlet but supplies power to several devices.

©CREATIVE COMPUTING

Attaching Your TV

The average consumer will probably connect the computer to the family TV set, or perhaps to a TV purchased specifically for the purpose. Either way, you're left with a small problem. IBM does not supply the RF Modulator, a device which is absolutely essential if you want your computer to talk to your TV.

Why doesn't IBM supply this little device? Well, home computers must pass an FCC test for various kinds of emissions, including radio frequency emissions. Keeping emissions low makes your computer friendlier, so your big, burly neighbor doesn't drop by to ask you why there are Galactic Invaders all over his football game. The purpose of the RF Modulator is to convert the standard composite video (NTSC) signal into a signal that the tuner in the TV set can receive. In effect, it's a small transmitter. It's a weak signal, which is why you have to attach the wire directly to your TV, but it does transmit. That makes it harder for the system to pass the FCC test, and it's tough enough already—and getting tougher.

You can get an RF Modulator at just about any computer store. One that is very popular and very available is the Sup'r'Mod II from M&R Industries, in Sunnyvale, CA. This RF Modulator is designed for use with the Apple II, but the specifications match the requirements of the IBM Personal as well. I've already bought one (yes, even with no computer—do you have to rub it in?) from a local store for $29.95.

It comes with relatively simple instructions and includes the interface unit, a seven foot coaxial cable, and an antenna transformer/switch box. The transformer attaches to the UHF antenna screws. The coax connects the transformer to the interface unit. The interface unit connects directly to a 4-pin "Berg" strip on the Color Graphics Adapter. The interface unit is small and has a strip of adhesive on the back so that it can be mounted in an appropriate spot inside the system cabinet. The IBM cabinet has an extra hole in the middle of the back, so the coax can be threaded into the cabinet to be attached to the interface unit. Once connected, the TV set must be tuned to UHF channel 33 to receive the transmission from the computer.

FERD II Computer System

by Mech Mentor

Three keyboard options available, including an alphabetized version for young students.

32K ON BOARD MEMORY (RAM).

Three character sizes for screen display.

Computer controlled voice capability.

Disc option.

Full color (16 colors) plus graphic and animation capability.

Priced at $399 (without color monitor).

Also available on lease or lease purchase.

Mech Mentor 105 S. Lincoln Mahomet, IL 61853

217-586-3006

CIRCLE 191 ON READER SERVICE CARD

TERMINALS FROM TRANSNET

PURCHASE PLAN • 12-24 MONTH FULL OWNERSHIP PLAN • 36 MONTH LEASE PLAN

	DESCRIPTION	PURCHASE PRICE	PER MONTH 12 MOS	24 MOS	36 MOS
DEC	LA36 DECwriter II	$1,895	$105	$ 58	$ 40
	LA34 DECwriter IV	995	95	53	36
	LA34 DECwriter IV Forms Ctrl.	1,095	105	58	40
	LA120 DECwriter III KSR	2,295	220	122	83
	LA120 DECwriter III RO	2,095	200	112	75
	VT100 CRT DECscope	1,695	162	90	61
	VT101 CRT DECscope	1,195	115	67	43
	VT125 CRT Graphics	3,295	315	185	119
	VT131 CRT DECscope	1,745	167	86	63
	VT132 CRT DECscope	1,995	190	106	72
	VT18XAC Personal Computer Option	2,495	240	140	90
TEXAS INSTRUMENTS	TI745 Portable Terminal	1,595	153	95	58
	TI765 Bubble Memory Terminal	2,595	249	138	93
	TI Insight 10 Terminal	695	67	37	25
	TI785 Portable KSR, 120 CPS.	2,395	230	128	86
	TI787 Portable KSR, 120 CPS	2,845	273	152	102
	TI810 RO Printer	1,695	162	90	61
	TI820 KSR Printer	2,195	211	117	90
LEAR SIEGLER	ADM3A CRT Terminal	595	57	34	22
	ADM5 CRT Terminal	645	62	36	24
	ADM32 CRT Terminal	1,165	112	65	42
	ADM42 CRT Terminal	1,995	190	106	72
DATAMEDIA	DT80/1 CRT Terminal	1,695	162	90	61
	DT80/3 CRT Terminal	1,295	125	70	48
	DT80 5L APL 15" CRT	2,295	220	122	83
TELEVIDEO	920 CRT Terminal	895	86	48	32
	950 CRT Terminal	1,075	103	57	36
NEC SPINWRITER	Letter Quality, 7715 RO	2,895	278	154	104
	Letter Quality, 7725 KSR	3,295	316	175	119
GENERAL ELECTRIC	2030 KSR Printer 30 CPS	1,195	115	67	43
	2120 KSR Printer 120 CPS	2,195	211	117	90
HAZELTINE	Executive 80/20	1,345	127	75	49
	Executive 80/30	1,695	162	90	61
EPSON	MX-80 F/T Printer	745	71	42	27
	MX-100 Printer	895	86	48	32

FULL OWNERSHIP AFTER 12 OR 24 MONTHS • 10% PURCHASE OPTION AFTER 36 MONTHS

MICROCOMPUTERS

APPLE • COMMODORE • HP85 • DEC LSI 11

ACCESSORIES AND PERIPHERAL EQUIPMENT

ACOUSTIC COUPLERS • MODEMS • THERMAL PAPER • RIBBONS • INTERFACE MODULES • FLOPPY DISK UNITS

TRANSNET CORPORATION

1945 ROUTE 22 • UNION, N.J. 07083 • (201) 688-7800

985 5465

CIRCLE 181 ON READER SERVICE CARD

MITEC Brings You State-of-the-Art Language & Printer Cards At LOW Direct-to-You Prices!

APPLE II* DOUBLE FEATURE

16K RAM Card
$149.00

Includes selectable dip switch ● Works with Pascal, CP/M®, Visicalc, DOS 3.3 ● The most versatile RAM expansion on the market today ● Turns your apple into a 64K system

Parallel Printer Card
$114.00

Works with most printers with a parallel port ● Comes with on-board firmware and complete documentation ● Interface cables available for **$25** for Epson, NEC, MPI, IDS & Centronics printers—**specify type**

Both cards are fully guaranteed for one year. Add $2.00 for shipping and handling, California residents add 6% sales tax.

Send Check or Money Order to: **MITEC**
4710 Dexter Drive
Suite 26
Santa Barbara, CA 93110

MITEC
innovations in computers
(805) 967-9288

*APPLE II is the trademark of Apple Computers, Inc

CIRCLE 194 ON READER SERVICE CARD

Charter Subscription Opportunity

Heath®/Zenith Magazine

Introducing Sextant, the complete magazine covering only Heath®/Zenith computer systems.

Now you don't need to search through several computer magazines to find tidbits of news about your computer. Sextant publishes the information you need with in-depth technical articles, human-interest features, tutorials and articles about solid practical uses for your system. Sextant is not affiliated with Heath Company or the Zenith Radio Corporation.

Early issues of Sextant will have articles on using the H89 to produce color slides and articles for publication, a new disk operating system for the H11, Tiny Pascal, H89 parallel ports, print spoolers, simulation of Rubik's Cube, and writing assembly language disk software that doesn't require HDOS.

Start your subscription with the premiere issue of Sextant, to be printed in February, and receive all four 1982 issues. Just send your payment of $9.97 ($11.50 in Canada, $14 overseas) for a four-issue subscription. (Payment must be in U.S. dollars payable on a U.S. bank or by international postal money order.) A full refund is guaranteed any time you're not satisfied. Send your order today to: Sextant, Dept. T, 716 E St., S.E., Washington, DC 20003 or call 202/544-0900 and charge your subscription on VISA or MasterCard.

CIRCLE 210 ON READER SERVICE CARD

Table 1. Sup'r'Mod II RF Modulator Pin Assignments.

IBM Color Graphics Adapter		Sup'r'Mod II RF Modulator	
Signal	Pin #	Pin#	Color
+12 VDC	1	4	Orange
not used	2	3	Red
Video	3	2	Brown
Ground	4	1	Black

There is only one catch. The pins on both the Berg strip on the Color Graphics Adapter and the Molex connector on the Sup'r'Mod II are numbered 1 through 4, *but the pin assignments are reversed.* If you choose this RF Modulator, consult the documentation delivered with your IBM system to be sure you orient the connectors properly. Table 1 lists the pin assignments involved. You shouldn't have too much trouble with this since the Sup'r'Mod II is constructed with different color wires leading to the Molex connector and the instructions tell you which wire is which.

If you found all this too much to bear, try to buy an RF Modulator from the dealer who sells you the computer, and have him install it.

Attaching a Cassette Tape Recorder

This is another thing that IBM doesn't do for you. But take heart: they did a better job of this one. They provide the interface and connector, but not the cable or the cassette player.

There is a connector on the back of the system unit which is used to attach a cassette tape recorder. It is a round connector with five pins and is called a "5-pin DIN" plug. This particular one is an *audio* DIN connector. (I've recently learned that there are different kinds of DIN connectors.) You connect a standard cassette recorder with a cable that plugs into this DIN connector and into the jacks of the recorder.

The cable you need can be obtained from Radio Shack. It is part number 26-1207, 5-pin DIN to 3-plug Audio, and lists for $5.95 in the RSC-6 computer catalog. It is the same one that is used on the TRS-80 Model III and the Color Computer. I haven't tried this yet, but I have looked at both connectors and they are the same.

You may need a cassette recorder as well. Any recorder will do, of course. Radio Shack sells one called the CTR-80A Cassette Recorder, part number 26-1206, that costs $59.95 and comes with the cable described above and an AC adapter. They also sell a compact one, the Minisette-9, part number 14-812, for $79.95; the cable and AC adapter are extra. It's the one they suggest for the TRS-80 Pocket Computer.

I don't know enough about cassette recorders to make a strong recommendation. You don't really need a tremendously expensive one, but don't buy a cheap one either. Try to hit the middle. And be sure you get one with an AC adapter—you'll save its cost in batteries. Again, ask the dealer you buy the system from for suggestions.

Joysticks! (@%?#*&?!&@#!)

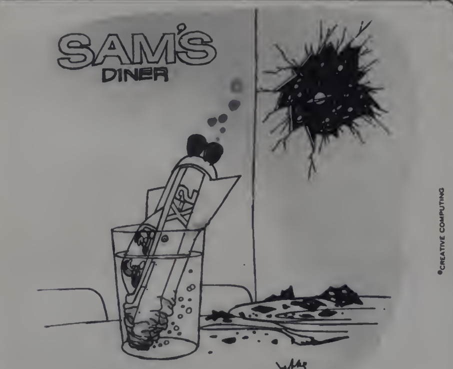
I don't know about you, but I want to play games with my computer. So I *will* have joysticks. Unfortunately (what, again?), IBM does not supply them.

The reason for my deleted expletives is the trouble I've had collecting information on available joysticks. Of course, I've tested nothing since I have no computer. Nonetheless, I think I've found a couple that fit the bill.

Our old friend Radio Shack sells a pair of joysticks (that's right, two) for $24.95, part number 26-3008. They happen to meet the IBM specification, which calls for two "linear taper" potentiometers with a resistance range of zero to 100,000 ohms and a momentary contact button which is normally open. Great! Let's plug them in and play, right? Nope. There is one tiny problem.

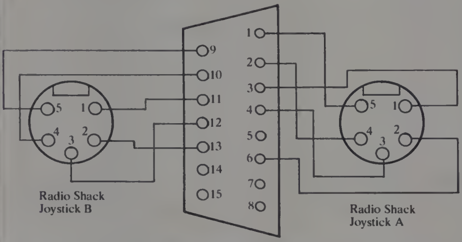
The Radio Shack joysticks each have a male 5-pin DIN connector. (It is *not* the same one that is used on the cassette cable.) The IBM Game Control Adapter, to which joysticks or paddles are connected, has a female 15-pin "D Shell" connector. Guess what—these two kinds of connectors don't go together. I tried to find some Radio Shack connectors that would allow me to build an interface cable or box which would have a male D Shell connector on one side and two female 5-pin DIN connectors on the other. No luck. I'm sure this can be done, but Radio Shack doesn't carry the parts.

I have to thank the folks at The Keyboard Company, in Garden Grove, CA. who were kind enough to send out one of their Joystick II joysticks. The Keyboard Company is a division of Apple Computer and manufactures game paddles, joysticks, and the 10-key numeric pad for the Apple II. The Joystick II is a really good looking device with a very nice feel. The stick itself it not as wishy-washy as the Radio Shack joysticks, but it could be a little firmer. I lent the joystick to a friend of mine who owns an Apple and he said he was generally pleased after trying it out on a number of games.



"...Well, now we know space isn't infinite..."

Figure 1. IBM to Radio Shack Joystick Wiring Diagram



Pin Assignments

IBM Game Control Adapter

1	+5 volts
2	Button - Joystick A
3	X position - Joystick A
4	Ground
5	Ground
6	Y position - Joystick A
7	Button - Joystick A (second button)
8	+5 volts
9	+5 volts
10	Button - Joystick B
11	X position - Joystick B
12	Ground
13	Y position - Joystick B
14	Button - Joystick B (second button)
15	+5 volts

Radio Shack Joystick

1	A (x) position
2	B (y) position
3	Ground
4	Button
5	+5 volts

Needless to say, Joystick II won't plug into the IBM either. The cable from the stick ends in a 16-pin DIP (dual inline package) plug and is designed to fit a DIP socket on the Apple II system board. As with the Radio Shack joysticks, you will have to build an adapter cable or box. In addition, the Joystick II does not quite meet the IBM specification, in that it ranges from zero to about 140,000 ohms.

This leads me to an interesting point. Any joystick which uses potentiometers (variable resistors) can be used with the IBM Game Adapter as long as you can get it connected. The amount of resistance from the "pot" determines the length of time a signal from the controller is left on. The software program must time the duration of this signal to determine the position of the joystick. The IBM Technical Reference manual gives a formula for this time as a function of the resistance:

TIME in microseconds = 24.5 + 0.011 * (RESISTANCE in ohms)

Therefore, at zero ohms the time is 24.5 microseconds and at 100,000 ohms the time is 1124.5 microseconds. The Joystick II, at 140,000 ohms requires a maximum of 1564.5 microseconds.

I am going to find out whether the IBM software, meaning Basic, can deal with an arbitrary maximum time, or whether it only times up to its specification of 1124.5 microseconds. I'll let you know.

I've listed the pin asignments for both joysticks and the IBM Game Adapter in Figures 1 and 2. I plan to try to connect whatever joysticks I can get my hands on to my system, whenever I get it. The Joystick II is the only one I have at the moment. Besides it and the Radio Shack joystick, I only know of the GSC Videostick, the Programma joystick, and the Peripherals Plus joystick. You'll hear about my progress.

By the way, the IBM Game Control Adapter will support four pots and four switches. This means either four game paddles with one button each, or two joysticks (two pots per stick) with two buttons per stick. Joystick II does, in fact, have two buttons. If you are interested in paddles, use my diagrams but "divide" them in half—a joystick is really two paddles.

By the way again, the Atari joysticks *will not* work on the IBM as they are switch type, not resistive.

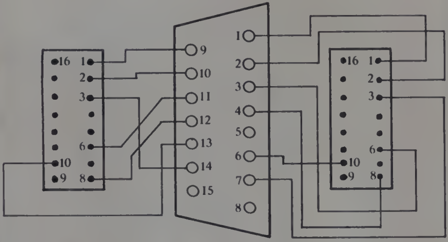
Now, on to other matters.

The IBM Technical Reference Manual

I mentioned in my December Evaluation article that IBM planned to provide a reference manual which would include schematics. Well they did, and I thank IBM for making one available to me. This document should be available to the public now, and costs $36.

IBM, continued...

Figure 2. IBM to Joystick II Wiring Diagram.



Joystick II
16-pin DIP

IBM Game Control Adapter
Male 15-pin D-shell
connector

Joystick II
16-pin DIP

Pin Assignments

IBM Game Control Adapter

1	+5 volts
2	Button - Joystick A
3	X position - Joystick A
4	Ground
5	Ground
6	Y position - Joystick A
7	Button - Joystick A (second button)
8	+5 volts
9	+5 volts
10	Button - Joystick B
11	X position - Joystick B
12	Ground
13	Y position - Joystick B
14	Button - Joystick B (second button)
15	+5 volts

Keyboard Co. Joystick II

1	+5 volts
2	Switch 0 (button)
3	Switch 1 (switch)
6	X position
8	Ground
10	Y position

IBM + Sears Doesn't Compute

So you want an IBM Personal Computer. Your local ComputerLand tells you they can give you delivery in three months but you know the Sears computer stores in Chicago and Dallas have them in stock and you've got a Sears credit card, so . . .

If my experience is typical, the three-month wait may be your best bet. I placed an order with Sears, Arlington Heights, IL, to be shipped to New Jersey. I put it on my personal credit card.

A week later Sears NJ Credit department called for additional credit information so they could increase my line of credit to the necessary $3500. A few days later, I got another call along the same lines.

The following week, Sears Credit called again to inform me that personal computers can't be ordered with a personal credit card but must be ordered using a company credit card. "But I'm buying the computer for me, an individual," I protested.

"Sorry, it will have to be paid for by a company credit card," Sears's Mr. Otterbeis replied. I gave him the Creative Computing company credit card number.

This is the last I heard. As each day ticks by, I wonder whom to call at the world's largest retailer or the world's largest computer company. I haven't found out yet.

In general, I would favor getting a computer system from a local outlet, particularly in view of later servicing needs (even on an IBM system). However, in this case we wanted a system as soon as possible so we could report on it to readers of *Creative Computing* and *Small Business Computers*.

Unfortunately, we found that buying from Sears is not the answer. Perhaps if I personally walked in with a certified company check . . . —DHA

Bit Pit

Chas Andres

Table 2. Contents of IBM Technical Reference Manual.

Section 1 - Hardware Overview

Section 2 - Hardware
- System Board
- Power Supply
- IBM Monochrome Display and Parallel Printer Adapter
- Color/Graphics Monitor Adapter
- Parallel Printer Adapter
- 5 1/4" Diskette Drive Adapter
- Memory Expansion Options
- Game Control Adapter
- Asynchronous Communications Adapter

Section 3 - ROM and System Usage
- ROM BIOS
- BIOS Cassette Logic
- Keyboard Encoding and Usage
- Low Memory Maps

Section 4 - Appendices
- A: ROM BIOS Listing
- B: Assembly Instruction Set Reference
- C: Of Characters, Keystrokes, and Color
- D: Logic Diagrams
- E: Unit Specifications

Glossary
Bibliography
Index

Table 3. IBM Personal Computer Physical Memory Map.

Start Address Decimal	Hex	Area Size (In Kbytes)	Allocated For:
OK	00000	64KB	RAM memory on system board
64K	10000	192KB	RAM memory on I/O channel (exp. slots)
256K	40000	384KB	RAM memory on I/O channel (future)
640K	A0000	16KB	IBM Reserved
656K	A4000	112KB	Graphics & Display Video Buffers
768K	C0000	192KB	Memory Expansion Area
960K	F0000	16KB	IBM Reserved
976K	F4000	48KB	ROM for Basic, BIOS, and self-test

Video Buffer Assignments

Start Address Decimal	Hex	Area Size (In Kbytes)	Allocated For:
656K	A4000	48KB	---
704K	B0000	16KB	Monochrome Display
720K	B4000	16KB	---
736K	B8000	16KB	Color/Graphics
752K	BC000	16LB	---

This manual is full of very detailed information about how the system is built and how it works. There is enough information for third party suppliers to learn how to build devices that plug into the expansion slots or write low-level software. This book also takes away the mystery of the ROM because a listing of the BIOS (basic input/output system) is included as an appendix. I've abstracted the table of contents in Table 2.

This manual is *not* a service manual. Not all the logic diagrams are included and there are no service instructions of any kind. IBM does have a service manual, but I'm not sure they will sell it to the public.

All That Memory...

I've talked before about the way IBM designed for the full megabyte physical address capability of the 8088 processor. The Technical Reference Manual has a map which shows the allocation of the memory. Table 3 shows the allocation.

It is possible to read and/or write any memory location in the machine using the Basic language. As in all versions of Microsoft Basic, the PEEK and POKE functions are available. However, for the IBM system they must be used in conjunction with the DEF SEG statement.

DEF SEG is used to establish a "base" address. When Basic begins execution, this base address is set to the beginning of the Basic workspace in memory. The statement "DEF SEG" restores this default. A statement of the form "DEF SEG = address" can be issued, where address is a value between 0 and 65535 and evenly divisible by 16. When an address reference is made with PEEK or POKE, the base address is multiplied by 16 (shifted left 4 bits) and added to the offset. This scheme allows each byte in the one million byte address space to be accessed.

Addresses are also required by BLOAD, BSAVE, CALL, VARPTR, and USR. The address calculation for these statements and functions is the same as above.

Although I have an aversion to PEEK and POKE, mostly on aesthetic grounds but also because they tie a program firmly to a specific hardware set, I understand their value. Next month I'll have a program which demonstrates their use.

News

IBM now has five product centers. Two new stores were opened in New York City last November.

Computerland is opening stores like crazy. I got a press packet containing announcements of 20 new stores they have opened. A new one also opened up very near my home and is the first one in the Baltimore area. □

Personal Electronic Transactions

Greg Yob

On Review Lag

Every day there are more and more PETs in the world, and more and more new PET products. During my absence from these pages, over 30 new products have arrived at my door step—it will take me at least seven columns to get through all of these nifty items. As I am faced with rather tight space limits (3 pages per issue) many of the reviews will be short to allow some non-review material. If you are a manufacturer and want an in-depth review, let me know—but be aware that the lag will increase.

PET Hits the Ringer

We all know that our PETs will soon get modems and become attached to the telephone lines. Bill Mallison adds to the fun by providing some sound effects for the telephone ring and busy signals in Listing 1. Press the space bar to get back to Line 20. (By the way, Bill's sounds are quite realistic—and realistic sounds are hard to do. Don't try to change the Lines 110-160 or 210-270 as this will change the sound. The time taken by Basic to convert numbers such as 59467 is part of the sound.)

Phontasy Error

Many of you wrote about the Phone Number Words program in the September 1980 column. Unfortunately a rather subtle error appeared in the listing. The correction is:

```
180 P(J)=ASC(MID$(P$,J))-48
```

The column had P() as P$() which gives a ?TYPE MISMATCH ERROR. At least one reader thought that the bad value came from the right hand side—and Basic will happily create an array without a DIM statement for P$ which leads to all sorts of things, none of them good.

Educational Programs by Don Ross

I am becoming slowly convinced that programming is an art, and that educational programming is a fine art. If you look at history, especially the history of technology or art, it soon becomes clear that progress proceeds with a few large steps and thousands of tiny ones. Just to make your discouragement total, remember that the central architecture of the computer was conceptually complete by 1952 or so—the remaining 30 years of progress represent minor improvements on the idea.

Don Ross gave me three programs (Addition, 123 Digit Multiplication and Long Division—$20. each, available from Microcomputer Workshops, 10 Elizabeth Pl., Armonk, NY 10504) which are better than Microphys but still need some refinements. Each program uses the same basic idea—that the screen of the computer can serve as a "worksheet" on which one works the math problem just as he does with as pencil and paper. For example, an addition problem begins with a cursor in the lower right where you would put the first digit when solving the problem. Then the cursor moves to the top of the next column to the left for you to enter the carry value. Eventually all the values are entered and you can go to the next problem. This is a nice idea—I always hated to do this by pencil, erase, etc., with my work looking like something from the art class wastebasket—and the mechanics of writing digits gets in the way of solving the problem at hand.

The programs lack several things I expect in educational programs, however. First, the program isn't "stop-proof." In fact, the instructions ask the student to press STOP when finished. This is fine for the cooperative students, but just won't work for those of less refined habits. Second, INPUT is used—though Don takes some trouble to get around the RETURN problem, I found that Shift-RETURN followed by RETURN crashed the programs nicely. In education, *always* use GET—never INPUT. The STOP and GET considerations are needed to protect the teacher from the heedless or nasty student.

The entry of each digit is set up to permit only the correct value. On the first error, you are told that you didn't get it right, on the second error, you are given the correct value and told "when you understand your error, type the correct answer." This is fine advice if the student knows what he is doing, and useless if he doesn't. If you persist in entering wrong values, you simply continue through the "it's wrong" and "when you understand" cycle indefinitely.

When a carry value is zero, you must enter it anyways, which I found a bit annoying. Also, after each problem, you must specify its complexity. A better approach would be to ask how many problems, and then not require the complexity until the set of problems are done. A final complaint: if I hadn't done the Addition program first, I would not have understood the carry limitations at all, as these are explained in the Addition program only.

Programs by Teaching Tools

To my great surprise, Teaching Tools (Box 50065, Palo Alto, CA 94303) offers several educational programs which "do it right." If you are writing educational software, get these programs and take a long look at them; the methods used might prove useful to you.

The programs offered are: Addition, Subtraction, Spelling Package, Letters and Numbers, and Match Game. All except Spelling are $20. each. The Spelling Package comes with a box which attaches to the Cassette Port and User Port and is used to control a standard audio cassette player. Two versions of the box are available, one with a video output for slave monitors. The Spelling Package therefore costs $89. or $139. depending on the box you select.

It would take most of this column to describe why I like these programs, so I will mention just a few reasons. First, the programs are crash-proof. I couldn't crash them; the STOP key is disabled and GET is used throughout. In fact, random key-banging comes back with a STOP IT message, which is quite a surprise for a disdainful student. Second, animation and graphics are used when a task is completed, and the little critters that appear are different each time. Third, errors are clearly shown, and on a second error, the answer is indicated, but you still must enter the

PET, continued...

Figure 1. SciTronics BSR Interface Wiring List.

RC-80 Cable	Function	PET	
1	Control 4	n/a	n/a = not applicable
2	n/c		n/c = not connected
3	Addr 10	n/a	
4	n/c		
5	Addr 13	n/a	
6	Addr 12	n/a	
7	Ground	n/c	
8	Addr 15	n/a	
9	n/c		
10	Addr 10	n/a	
11	Control 1	CB2	Acts as a 'strobe'
12	Addr 8	n/a	
13	n/c		
14	Addr 14	n/a	
15	60 HZ	CA1	60 Hz detection. Tie to Pin 6 of the 4538 chip which is on the upper left corner of the controller board.
16	n/c		
17	Data 4	PA4	
18	Addr 9	n/a	
19	Data 7	PA7	
20	Control 3	n/a	
21	Data 1	PA1	
22	n/c		
23	Data 6	PA6	
24	Control 2	n/a	
25	Data 3	PA3	
26	Addr 0	n/a	
27	Data 5	PA5	
28	Addr 1	n/a	
29	Data 0	PA0	
30	Ground	Ground	
31	Data 2	PA2	
32	Addr 4	n/a	
33	Addr 3	n/a	
34	n/c		
35	Addr 7	n/a	
36	Addr 5	n/a	
37	Addr 7	n/a	
38	n/c		
39	Addr 2	n/a	
40	n/c		

To get the 60Hz signal, you must install a jumper from the 4538 chip to the tie point for Line 15 on the ribbon cable. If you don't understand this, don't try it. This signal is a TTL level and is *not* connected to the power line.

SciTronics Jumper Options:

Switches 1-7, 11-14	Off
Switches 9, 10, 15	Don't Care
Switch 8	On
Jumpers 1, 2, 7-9	No Connect
Jumpers 3, 6	Connect
Jumpers 4, 5	Position 3

+5 option — NO
C4, C5 to Cable — NO
RST — Tie to +5 volts

These settings set the SciTronics controller to use a parallel interface.

answer. There was a deep sense of patience in these programs. When I talked with Teaching Tools I learned that the programs were developed for learning disabled children. Care was taken to avoid a major problem in programming for the disabled—the trap of making a task of so many minute details that the result is hopelessly boring.

Hidden in the programs are some options which are described in the instructions only. The program gives instructions for use but not for changing difficulty or how to stop the program. That's in the user's guide for the parent or teacher. The paper instructions are quite clear.

Teaching Tools has made some comparative studies of their programs vs normal paper and pencil work. They say that students work about the same rate, but do twice as many problems with the computer in a typical session. So, get these programs, and if you write educational software, let them be a lesson for you.

BSR Wars Continued

In the last column (May 1981) I described how to connect the SciTronics BSR controller unit to the PET. This is summarized in Figure 1 for your reference. There is one additional change, which is to connect the CA1 line on the User Port to the 60 Hz detection circuit in the RC-80 controller board. This is done by jumpering a wire from Pin 6 of the 4538 (This IC is in the upper left corner of the board looking at the components side.) to one of the unused lines in the interface cable. The other end of this line is connected to CA1.

Once you have wired up the interface (this requires some experience with soldering irons and the like. If you aren't sure about this, get an *experienced* friend to do it for you—this is not a Heathkit!), get a BSR Lamp Control Unit which plugs into a wall socket. This will cost about $17. and can be found at good hardware stores or Radio Shack. Then, enter the SciTronics Demo Program in Listing 2.

This program uses a simple code for controlling BSR modules. The commands are:

- H - House code (from A to P)
- U - Unit code (from 1 to 16)
- \+ - Turn lamp on
- \- - Turn lamp off
- \> - Dim up (brighten)
- < - Dim down (dimmer)
- * - All units on
- = - All units off
- & - "and" units for one command
- ! - Reset SciTronics controller

If your module is set to House A, Unit 1, you would enter:
HA U1 + to turn lamp on
HA U1 - to turn the lamp off

Super Cassette Sale

Cassettes A thing of the past? You might think so by the number of software houses that have dropped them from their line in the past year or so

However, we have always tried to make our software available on both cassette and disk for as many computers as possible This is a policy we intend to continue

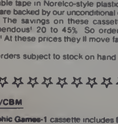
But right now we have so many new software packages coming along that we are consolidating and merging some of the programs from our cassettes into the new lineup As a result we are selling out of some existing cassettes now in stock

All of the cassettes are high quality, durable tape in Norelco-style plastic boxes and are backed by our unconditional guarantee The savings on these cassettes are tremendous! 20 to 45% So order yours now! At these prices they ll move fast

All orders subject to stock on hand

PET/CBM

Graphic Games-1 cassette includes Escape Snoopy, Chase, Sweep, and Darts Top rated by three reviewers! Available in old and new ROM version CS-1004 regular $11 95, sale price $7 95



Graphic Games-2 cassette includes Checkers, Dodgem, Bounce, Nuclear Reaction LEM, and Artillery Our most popular Pet cassette Available in old and new ROM version CS-1005 regular $11 95, sale price $7 95

Conversational Games cassette includes Hexletter Hurkle Hangman, Haiku, and Eliza Old and new ROM version available CS-1006 regular $11 95, sale price $7 95

Board Games cassette includes Yahtzee, One-Check, Backgammon, Trek 3, and Blackjack Old and new ROM available CS-1007 regular $11 95, sale price $7 95

SUPER PET SALE

Take all four cassettes (21 programs in all!) for only $29 95

Apple, Pet, Atari, TRS-80 and TI 99/4 are registered trademarks

ADVENTURES

Adventureland will excite you as you search for treasures on a deserted island, or so you think! Available for the 18K Apple II or Apple II Plus (CS-4011), or the Sorceror (CS-5003), list $14 95, sale price $11 95

Pirate Adventure takes you from your London flat to try to recover Long John Silver s buried treasure Available for the 18K Apple II or the Apple II Plus (CS-4012), TRS-80 (CS-3008) or the Sorcerer (CS-5004) List $14 95, sale price $11 95

Your **Mission Impossible** if you decide to accept it, is to save the world s first nuclear reactor from doom Available for the 18K Apple II or the Apple II Plus (CS-4013), or the Sorcerer (CS-5005) List $14 95, sale price $11 95

Wander through the **Voodoo Castle** in search of the secret of Count Cristo, but beware the Voodoo man Available for the 16K Apple II or the Apple II Plus (CS-4014), TRS-80 (CS-3010) or the Sorcerer (CS-5006) List $14 95 sale price $11 95

Beware **The Count** as you move through the haunted castle looking for clues to allow you to escape unharmed Available for the 18K TRS-80 (CS-3011), or the Sorcerer (CS-5007) List $14 95, sale price $11 95

Other suppliers are raising the price on these programs to $19 95 Save 50% with this never-to-be-repeated offer while supplies last!

Apple II
CS-4011 Adventureland
CS-4012 Pirate Adventure
CS-4013 Mission Impossible
CS-4014 Voodoo Castle
Package price $39 95

Sorcerer
CS-5003 Adventureland
CS-5004 Pirate Adventure
CS-5005 Mission Impossible
CS-5006 Voodoo Castle
CS-5007 The Count
Package price $49 95

TRS-80
CS-3008 Pirate Adventure
CS-3010 Voodoo Castle
CS-3011 The Count

Package Price $28 95

TRS-80

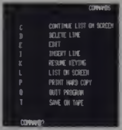
Space Games includes Star Lanes, Romulan, Star Wars and Ultra Trek Cassette (CS-3002) list $11 95 sale price $9 49

Strategy Games includes Evasion, Tunnel Vision, Motor Racing, Jigsaw and The Masters One of our most popular cassettes! Cassette (CS-3005) list $11 95, sale price $9 49

Battle Games includes Gunner, Sub Hunt, Tank Battle, and Getacross Rave reviews of this package Cassette (CS-3012) list $11 95, sale price $9 49

Deep Space Games includes three challenging games Space Liteboat, Asteriods, and Galaxy I Cassette (CS-3013) list $11 95, sale price $9 49

Text Processing is a line-oriented simplified text editor for letters, documents, reports, etc Cassette (CS-3302) list $14 95, sale price $11 95



Checking Account is a home budgeting system that keeps track of individual checks, payees, etc Cassette (CS-3304) list $11 95, sale price $9 49

IQ Test is a valid 60 question IQ test with a machine language scoring routine that defies cheating Cassette (CS-3203) list $14 95, sale price $11 95

TRS-80 SALE

Pick any four packages for $29 95 Take all seven for $49 00

SOL-20

Air Traffic Controller simulates, in real time the actions and responsibilities of an air traffic controller Cassette (CS-8001) list $11 95, sale price $9 50

Space Games includes Asteroids, Lunar Star Wars, and Romulan Cassette (CS-8003) list $11 95, sale price $9 50

Strategy Games includes Wumpus I, Wumpus II, Trap, Race and Kingdom Our most popular Sol package Cassette (CS-8004) list $11 95, sale price $9 50

Reading Comprehension will help students to learn the skills needed to master good reading habits Available in a five-cassette package for $50 00, sale price $39 95

GAME SALE

CS-8001 Air Traffic Controller
CS-8003 Space Games
CS-8004 Strategy Games
Package price $24 95

APPLE Games Sale

Space Games-1 includes four games by Bob Bishop Saucer Invasion, Rocket Pilot, Star Wars and Dynamic Bouncer Available in Integer and Applesoft version (CS-4001) list $11 95 sale price $9 49

Sports Games-1 includes Baseball, Breakout, Torpedo Alley and Darts Available in Integer version ONLY (CS-4002) list $11 95, sale price $9 49

Strategy Games includes Blockade, UFO, Skunk, Genius and Checkers Available in Integer version ONLY (CS-4003) list $11 95, sale price $9 49

Brain Games includes Dodgem, Nuclear Reaction, Parrot, Dueling Digits, Midpoints, Lines, and Tones Available in Integer version ONLY (CS-4004) list $11 95 sale price $9 49

Haunted House is a nightmare simulation leaving you only six hours to find the secret passage leading out of the many room mansion Available in integer version ONLY (CS-4005) list $11 95, sale price $9 49

Space Wars is a version of a classic MIT game redesigned for the Apple Available in Integer and Applesoft version (CS-4009) list $14 95, sale price $11 95

Outdoor Games includes Forest Fire, Fishing Trip, Treasure Island I and Treasure Island II Available in Integer version ONLY (CS-4010) list $14 95, sale price $11 95

Know Yourself includes Alcohol, Sex Role, Life Expectancy, Psychotherapy, and Computer Literacy Available in Integer version ONLY (CS-4301) list $11 95, sale price $9 49

INTEGER SALE

Pick any four tapes for $32 95 Pick any six tapes for $44 95 Take all eight cassettes for $54 95

Order Today

To order any of these software packages send payment plus $2 00 postage and handling per order to Creative Computing Morris Plains NJ 07950 Visa MasterCard and American Express orders may be called in toll-free

Order today at no risk If you are not completely satisfied your money will be promptly and courteously refunded

creative computing software

39 E Hanover Avenue
Morris Plains, NJ 07950
Toll-free **800-631-8112**
In NJ 201-540-0445

PET, continued...

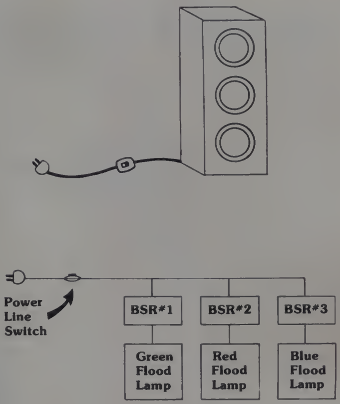
Listing 1. Bill Mallison's Phone Sounds.

```
PHONE RINGER
 10  REM BILL MALLISON'S RINGER
 20  INPUT"BUSYsp ORsp RINGsp ";A$
 30  IF A$="BUSY" THEN 110
 40  IF A$="RING" THEN 210
 50  GOTO 20
 100  REM BUSY
 110  FOR I=1TO250:NEXT
 120  POKE 59467,16
 130  POKE 59464,122
 140  POKE 59466,10
 150  FOR I=1TO500:NEXT
 160  POKE 59467,0
 170  GETA$:IFA$=""THEN110
 180  GOTO 20
 200  REM RING
 210  FOR I=1TO34
 220  POKE 59467,16
 230  POKE 59466,15
 240  POKE 59464,155
 250  POKE 59464,0
 260  NEXT I
 270  FOR I=1TO1000:NEXT
 280  GETA$:IFA$=""THEN210
 290  GOTO 20
```

Listing 2. SciTronics BSR Controller Demo Program.

```
SCI-TRONICS DEMO PROGRAM
 10  REM SCI-TRONICS BSR CONTROLLER
 20  REM DEMO PROGRAM
 30  REM OPERATES UP TO 256 BSR
 40  REM DEVICES
 50  REM
 60  REM BY GREGORY YOB
 70  REM
 80  REM STARTUP
 90  GOSUB 1000:GOSUB2600
 100  INPUT"clr HELPsp (Y-N)";A$
 110  IF LEFT$(A$,1)="Y"THENGOSUB3500
 120  GOSUB 3000
 130  INPUT"dn SEQUENCE:";S$
 140  REM
 150  REM PARSE COMMAND
 160  REM
 170  GOSUB 4000
 180  GOTO 120
 1000  REM * ARRAYS
 1010  REM
 1020  REM HOUSE CODES ARE:
 1030  REM
 1040  REM A-37  E-29  I- 5  M-61
 1050  PEM B-33  F-25  J- 1  N-57
 1060  REM C-45  G-21  K-13  O-53
 1070  REM D-41  H-17  L- 9  P-49
 1080  REM
 1090  DATA 37.33.45,41,29,25,21,17
 1100  DATA 5.1.13.9.61,57,53,49
 1110  REM
 1120  REM UNIT CODES ARE:
 1130  REM 1-27  5-35   9-59  13- 3
 1140  REM 2-31  6-39  10-63  14- 7
 1150  REM 3-19  7-43  11-51  15-11
 1160  REM 4-23  8-47  12-55  16-15
 1170  REM
 1180  DATA 27.31,19,23,35,39.43,47
 1190  DATA 59.63.51,55,3.7,11,15
 1200  REM
 1240  REM FILL ARRAYS
 1250  REM HC IS HOUSE CODES
 1260  REM UC ARE UNIT CODES
 1270  REM
 1280  DIM HC(16),UC(16)
 1290  FORJ=1TO16:READ HC(J):NEXT
 1300  FORJ=1TO16:READ UC(J):NEXT
 1310  REM
 1320  REM MISC USEFUL VALUES
 1330  REM
 1340  DR=59459 :REM DATA DIR REG
```

Figure 2. Mood Lights.



The "Mood Lights" unit uses the three primary colors, red, green and blue to make a variety of colors by adjusting the lamp brightness via the BSR lamp modules. Use ceramic light sockets and be sure to provide some ventilation as the lights can get very warm. I built two units and placed them in opposite corners of a room. The PET can be elsewhere in the house.

The program remembers the last House and Unit code you used, so once you turn the lamp on, a simple "-" will turn the same lamp off.

If you get the SciTronics controller (I personally like the unit and hope this review prompts SciTronics to offer a prewired interface cable and the Demo Program to PET users), be sure to study the Demo Program carefully. The program handles the rather strange control codes required by the controller and several handshake difficulties that I don't have room to discuss in detail. In particular, Lines 2500-2550 and Lines 4140-4190 must be followed exactly. The controller tends to get into a state which needs a reset to allow new commands and this is handled in the 4140-4190 area. (Ignore this at the price of several hours of frustration!)

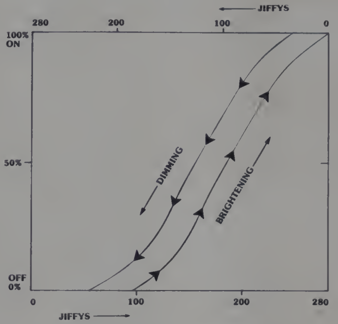
One small note about the listing—the asterisk in the REMarks usually means SET which is a token used by Disk-O-Pro. I haven't updated my PRINTER LIST program for Disk-O-Pro or BASIC4 tokens yet. INITIALIZE and NUMBER are also similarly hidden.

Once I had all of this working, I built some "mood lights" for use at parties and the like. Figure 2 shows a box with three colored floodlights (red, green, blue) which are controlled by lamp modules mounted in the box. A few keystrokes at the computer and I can alter the color moods of my home. Such power!

Those of you interested in home security can use the TI and TI$ functions of the PET to schedule the lighting sequences in your house to any degree of complexity

```
1350  PR=59468 :REM PERIPHERAL REG
1360  UP=59471 :REM USER PORT
1370  IR=59469 :REM INTERRUPT FLAG
1380  CL=204   :REM CB2 LOW
1390  CH=236   :REM CB2 HIGH
1400  ZR=0     :REM ZERO
1415  MX=192   :REM MASK BITS 6 & 7
1420  HC=HC(1) :REM DEFAULT HOUSE #1
1425  UC=UC(1) :REM DEFAULT UNIT #1
1430  REM
1440  REM * DATA DIRECTION REGISTER
1450  POKE DR,63
1460  REM * CB2 LOW
1470  POKE PR,CL
1480  REM
1490  REM CONTROLLER COMMANDS
1500  REM
1510  REM 0 'STOP' & CLEAR BOARD  0
1520  REM 1 TURN LAMP ON         18
1530  REM 2 TURN LAMP OFF        50
1540  REM 3 DIMMER - BRIGHTER    42
1550  REM 4 DIMMER - DIMMER      10
1560  REM 5 'AND' MORE UNITS     26
1570  REM 6 ALL LIGHTS ON        34
1580  REM 7 ALL LIGHTS OFF        2
1590  REM
1600  DATA 0,18,50,42,10,26,34,2
1610  REM
1620  REM FILL ARRAY CM() WITH COMMANDS
1630  REM
1640  DIM CM(7)
1650  FORJ=0TO7: READ CM(J):NEXT
1660  RETURN
2400  REM CONTROLLER HANDSHAKE
2410  REM A. * CB2 LOW
2420  REM B. *PUT HOUSE CODE HC
2430  REM C. * CB2 HIGH
2440  REM D. *PUT UNIT CODE UC
2450  REM E. * CB2 LOW
2460  REM F. * CB2 HIGH
2470  REM G. *PUT FUNCTION FC
2480  REM H. * CB2 LOW
2490  REM I. * CB2 HIGH
2500  POKE PR,CL:POKE UP,HC
2510  POKE PR,CH:POKE UP,UC
2520  POKE PR,CL:POKE PR,CH
2530  POKE UP,FC
2540  POKE PR,CL:POKE PR,CH
2550  RETURN
2590  REM CLEAR CONTROLLER
2600  POKE UP,0
2610  POKE PR,CL:POKE PR,CH
2620  RETURN
3000  REM DISPLAY INSTRUCTIONS
3010  PRINT"clr BSRsp CONTROLsp INSTRUCTIONS
3020  PRINT"dn dn sp sp Hsp -sp HOUSEsp CODEsp (A-P)
3030  PRINT"dn sp sp Usp -sp UNITsp CODEsp sp (1-16)
3040  PRINT"dn sp sp +sp -sp LAMPsp ON
3050  PRINT"sp sp -sp  sp LAMPsp OFF
3060  PRINT"dn sp sp >sp -sp BRIGHTENsp (1-300)
3070  PRINT"sp sp <sp  sp DIMsp sp sp sp sp sp (1-300)
3080  PRINT"dn sp sp *sp -sp ALLsp UNITSsp ON
3090  PRINT"sp sp =sp -sp ALLsp UNITSsp OFF
3100  PRINT"dn sp sp &sp -sp 'AND'sp UNITS
3110  PRINT"dn sp sp 'sp -sp CLEARsp CONTROLLER
3120  PRINT
3130  RETURN
3500  REM GIVE INSTRUCTIONS
3520  PRINT"clr sp sp THEsp PETsp WILLsp DISPLAYsp Asp SUMMARYsp OF
3530  PRINT"dn THEsp VALIDsp BSRsp COMMANDSsp LIKEsp THIS:
3540  GOSUB 3020
3550  GOSUB 3900
3560  PRINT"clr sp sp WHENsp THEsp PETsp ASKSsp FORsp Asp SEQUENCE
3570  PRINT"dn ENTERsp SOMEsp SERIESsp OFsp THESEsp COMMANDS
3580  PRINT"dn FORsp EXAMAPLE:
3590  PRINT"dn sp sp sp sp HBsp USsp +
3600  PRINT"dn sp sp sp sp sp sp sp HOUSEsp #B,sp UNITsp #S,sp TURNsp ON
3610  PRINT"dn SEVERALsp COMMANDSsp CANsp BEsp JOINEDsp TOGETHER
3620  PRINT"dn SUCHsp AS:
3630  PRINT"dn sp sp sp sp HAsp U3sp -sp U6sp &sp U8sp -sp HBsp U6sp >sp 100
```

Figure 3. BSR lamp module brightness curve.



When going from full on to the level you want, use the upper curve. If you start at fully dimmed, use the lower curve. To ensure that the Module is fully on or off, use at least 300 jiffys when you begin.

If you move up and down a lot, the level will drift and will be mostly fully on or off after a while. Go deliberately to full on or off to get "set" now and then to avoid this.

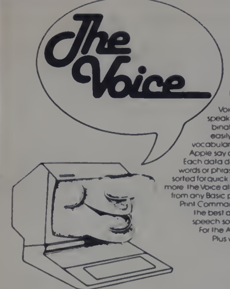
you want. Since Subroutine 4000 accepts the command string S$, just replace Lines 100 to 999 with your scheduling program.

BSR modules, by the way, are almost as mysterious as a new PET. If you want to try precise control of colors with the "mood lights," the BSR lamp module has around 100 levels of brightness. A "brighten" or "dim" of less than 36 will not change the level of the lamp. If you use more than about 250 jiffys, the Lamp Module ends up fully on or fully dimmed. If you set a level by starting at full on and going down, this will be a level different from starting at full dim and going up. For example, > 500 < 100 will leave you at about 70% of fully on. < 500 > 100 puts you at 10% of fully on. The useful range is about 280 jiffys, so < 500 > 180 should put you at 70% of full. It doesn't; you are at 45% full. If you go for 50 more jiffys, you will get to the 70% level. Figure 3 shows the Bright/Dim curve for a lamp module.

The expert could use the CA1 flag bit in the Interrupt Flags register to more precisely control the dimming intervals (the BSR commands are sent over the power lines at 60 Hz and the CA1 line can be used to count 60 cycles as they occur). This will not be in phase with the PET interrupts, but CA1 can interrupt the PET if you are really intrepid. I am content to dim all the way down and then go up to the desired point. □

PET, continued...

```
3640 PRINT"dn SPACESsp AREN'Tsp REQUIRED,sp YOUsp COULDsp USE
3650 PRINT"dn sp sp sp sp HAU3-U6&U8-HBU6>100
3660 PRINT
3670 GOSUB 3900
3680 PRINT"clr sp sp sp SOMEsp THINGSsp TOsp NOTE:
3690 PRINT"dn 1.sp BEsp SUREsp TOsp ENTERsp THEsp HOUSEsp ANDsp UNIT
3700 PRINT"sp sp sp CODESsp BEFOREsp YOURsp FIRSTsp COMMAND.
3710 PRINT"dn 2.sp THEsp DEFAULTsp HOUSEsp &sp UNITsp ISsp HAsp U1.
3730 PRINT"dn 3.sp YOUsp MUSTsp TURNsp Asp LAMPsp ONsp BEFOREsp YOU
3740 PRINT"sp sp sp CANsp DIMsp IT.sp ONCEsp DIMMEDsp ANsp 'ON'
3750 PRINT"sp sp sp COMMANDsp WILLsp BEsp IGNORED.sp THEsp BEST
3760 PRINT"sp sp sp WAYsp TOsp SETsp Asp LAMP'Ssp BRIGHTNESSsp IS
3770 PRINT"sp sp sp TOsp TURNsp ITsp ON,sp THENsp DIM.sp IFsp ALREADY
3780 PRINT"sp sp sp ON,sp USEsp <400sp THENsp >sp TOsp THEsp DESIRED
3790 PRINT"sp sp sp LEVEL.
3800 PRINT
3810 GOSUB 3900:RETURN
3900 PRINT"dn sp sp sp >>sp PRESSsp ANYsp KEYsp <<"
3910 GETA$:IFA$=""THEN3910
3920 RETURN
4000 REM LOOK AT COMMAND STRING
4010 GOSUB 5000 :REM GET A LETTER
4020 IF P$=""THEN RETURN
4030 IF P$="H" THEN 4200
4040 IF P$="U" THEN 4300
4050 IF P$="+" THEN FC=CM(1)
4060 IF P$="-" THEN FC=CM(2)
4070 IF P$=">" THEN 4400
4080 IF P$="<" THEN 4500
4090 IF P$="*" THEN FC=CM(6)
4100 IF P$="=" THEN FC=CM(7)
4110 IF P$="!" THEN 4600
4120 IF P$="&" THEN FC=CM(5)
4130 IF V<0 THEN 4010 :REM IGNORE BAD VALUES
4140 REM * HC,UC,FC & PAUSE
4150 GOSUB 2500
4155 FORJ=1TO 500:NEXT
4160 REM CLEAR IF NOT READY
4165 PK=PEEK(UP) AND MK
4170 IF PK=192  THEN 4190
4180 GOSUB 2600
4190 GOTO 4010
4200 REM HOUSE CODES
4210 GOSUB 5000:IFP$=""THEN 4020
4220 N=ASC(P$)-ASC("@")
4230 IF N<1 OR N>16 THEN 4020
4240 HC=HC(N):GOTO4010
4300 REM UNIT CODES
4310 GOSUB 5500
4320 IF N<1 OR N>16 THEN 4020
4330 UC=UC(N):GOTO4010
4400 REM BRIGHTER
4410 GOSUB 5500
4420 IF N=0 THEN 4020
4430 FC=CM(3):GOSUB2500:T=TI
4440 IFTI-T<NTHEN4440
4450 GOSUB2600:GOTO 4010
4500 REM DIMMER
4510 GOSUB 5500
4520 IF N=0 THEN 4020
4530 FC=CM(4):GOSUB2500:T=TI
4540 IFTI-T<NTHEN4540
4550 GOSUB2600:RETURN
4600 REM CLEAR UNIT
4610 GOSUB2600:GOTO 4010
5000 REM EXTRACT P$ FROM S$
5010 P$="":IFS$=""THENRETURN
5020 P$=LEFT$(S$,1)
5030 S$=MID$(S$,2)
5040 REM REMOVE BLANKS
5050 IF P$="sp "THEN 5010
5060 RETURN
5500 REM EXTRACT * N
5510 N=0
5520 GOSUB 5000
5530 IF P$<"0" OR P$>"9" THEN 5600
5540 N=10*N+ASC(P$)-ASC("0")
5550 GOTO 5520
5590 REM RESTORE S$
5600 S$=P$+S$:RETURN
```



The Voice gives your Apple the power of speech! Use the standard Voice vocabulary to speak an endless combination of phrases or easily record your own vocabulary and make your Apple say anything you like. Each data disk stores up to 80 words or phrases which can be sorted for quick reference. What's more, The Voice allows you to speak from any Basic program by using Print Commands. Guaranteed the best and easiest to use speech software available. For the Apple II or Apple II Plus with 48K ($39.95)

from the leader in quality software

MUSE SOFTWARE

347 N. CHARLES STREET
BALTIMORE, MD 21201
(301) 659-7212

CIRCLE 225 ON READER SERVICE CARD

FREE PREMIUM!

1982 subscribers will receive the special MATH1 package of PC programs. You qualify to receive this valuable free gift if you check either box 2 or 3 below! Don't delay! Get started learning how to enjoy your pocket computer today. Use this handy subscription card!

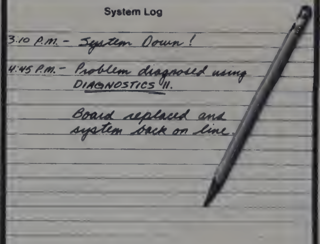
MC/VISA Phone Subscriptions: (203) 888-1946

- ☐ 1981 Charter Subscriber (Issues 1 – 10). $20.00 for U.S. delivery. (U.S. $24.00 to Canada. U.S. $30.00 elsewhere.)
- ☐ 1981/82 Charter Subscriber (Issues 1 – 20). $40.00 in U.S. (U.S. $48.00 to Canada. U.S. $60.00 elsewhere.)
- ☐ 1982 Regular Subscriber (Issues 11 – 20). $30.00 in U.S. (U.S. $36.00 to Canada. U.S. $45.00 elsewhere.)
- ☐ Sample issue. $3.00 in U.S. (U.S. $4.00 elsewhere.)

Orders must be accompanied by payment in full. We do not issue invoices for the POCKET COMPUTER NEWSLETTER. Thank you for your remittance.

Name: ____________________
Addr: ____________________
City: __________ State: ____ Zip: ______
MC/VISA # ______________ Expires ______
Signature: ____________________

CIRCLE 321 ON READER SERVICE CARD



DIAGNOSTICS II

Diagnostics II is SuperSoft's expanded Diagnostic package.

Diagnostic II builds upon the highly acclaimed Diagnostics I. It will test each of the five areas of your system.

Terminal Memory Printer CPU Disk

Every test is expanded.

Every test is "submit"-able. A "submit" file is included in the package which "chains" together the programs in Diagnostics II, achieving an effective acceptance test. All output can be directed to a log file for unattended operation, for example over night testing. Terminal test is now generalized for most crt terminals. A quick test has been added for quick verification of the working of the system.

The memory test is the best one we have encountered. It has new features, including:

- default to the size of the CP/M Transient Program Area
- printout of a graphic memory map
- bank selection option
- burn in test
- memory speed test

Diagnostics-II includes the only CPU test for 8080/8085/Z80

A Spinwriter/Diablo/Qume test has been added, which tests for the positioning and control features of the Spinwriter/Diablo/Qume as well as its ASCII printing features. (Serial Interface only)

And, as with all SuperSoft products, a complete online HELP system and user manual is included.

Price: $100.00 (manual only). $15.00
Requires: 32K CP/M

Software available for virtually all CP/M systems. Specify your system.

Available from fine dealers everywhere, or directly from:
SUPERSOFT ASSOCIATES
P.O. BOX 1628
CHAMPAIGN, IL 61820
(217)-359-2112
Technical Hot Line: (217)-359-2691

*CP/M REGISTERED TRADEMARK DIGITAL RESEARCH

U.K. and Europe
DIGITAL DEVICES
134 LONDON ROAD
SOUTHBOROUGH KENT
TUNBRIDGE WELLS
TN4 OPL
ENGLAND Telex 95582
Tel Tunbridge Wells (0892) 37977/9

Japan
ASR CORPORATION INTERNATIONAL
1-2-8 SHIBA DAIMON
TOKYO 105
JAPAN
Tel (03) 437 3901 Telex 242 3296

SuperSoft
First in Software Technology

CIRCLE 175 ON READER SERVICE CARD

Stephen B. Gray

Standing on the 37th rung of the TRS-80 ladder, we see ahead of us a CLOAD program that draws Lissajous figures, a Color Computer magazine, the Orchestra-85 music synthesizer with stereo and percussion, three Datasoft games (Iago, Football Classics, Arcade-80), and a very short program called Krazy-Keys.

Lissajous Figures

The "cover" of issue #17 of CLOAD magazine, dated July 1979, presents a different Lissajous figure each time it runs, due to three RND functions in the program, written by Robert Weaver of Santa Barbara, CA.

The Random House dictionary says Lissajous figures are named after French physicist Jules A. Lissajous (1822-1880), and are "the series of plane curves traced by an object executing two mutually perpendicular harmonic motions, forming a distinct pattern when the ratio of the frequencies of the motions is a ratio of small integers."

If you've studied electronics, you may know that you can get a Lissajous pattern on an oscilloscope screen by feeding various multiples of a common sinewave frequency into the X and Y inputs. From the shape of the figure, you can determine the relationship between the two frequencies.

You count the number of loops that touch the horizontal tangent line, and the number of loops that touch the vertical line, and the two numbers are the ratio of the input frequencies. If there are, as in the photo (Figure 1), five loops along one side and two along the other side, the frequency relationship is 5:2, such as would be achieved with inputs of 500 and 200 Hz, or 7,500 and 3,000 Hz.

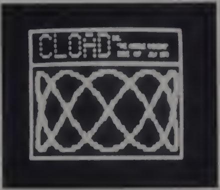


Figure 1. The Lissajous figure on the July 1979 cover of CLOAD magazine represents input frequencies with a ratio of 5:2.

In the program shown here, only the lines necessary to display the Lissajous pattern are retained from the much longer original. A is the horizontal-frequency factor, and B is the vertical-frequency factor. The third factor is C, the Z-axis factor, which might be thought of as the eccentricity factor.

```
100 CLS
110 I=0: J=0: A=RND(3)+1
111 B=RND(5): C=(RND(3)-1)*.7854
112 IF A>B THEN 110
113 IF A=B AND C=0 THEN 110
117 T=T+1: V1=63: V2=58
118 V4=30: V5=14: V3=6.6183
120 X=INT(V1+V2*SIN(A*I/V3+C)+.5)
130 Y=INT(V4-V5*SIN(B*I/V3)+.5)
140 IF POINT(X,Y) THEN J=J+1 ELSE J=0
150 SET(X,Y): SET(X+1,Y)
153 SET(128-X,60-Y): SET(127-X,60-Y)
156 I=I+1
160 IF J<30 THEN 120
```

If the two input frequencies A and B have a 1:1 relationship, the resulting figure will be a line, an ellipse or a circle, depending on where the value of C lies between zero and pi (Figure 2).

That is, the figure *would* be a circle if C were $\pi/2$, or 1.57, and if lines 120-130 were rewritten to get around the 3:7 aspect ratio of the pixel, which turns the circle into an ellipse. However, the author no doubt kept the 3:7 ratio because he needed to fit the figure into the lower two-thirds of the CLOAD cover, an area about seven by four inches.

You can examine the randomly-generated values by adding

115 PRINT @ 20, A;B;C

Figure 2. Chart of the Lissajous figures resulting from a 1:1 ratio of frequencies A and B, with values of C ranging from zero to pi.

or you can force the figures by adding

```
103 A=3: B=3: C=1.57
106 GOTO 115
```

and then changing the values of A, B and C to create different Lissajous patterns. For more on Lissajous figures, see a basic electronics textbook.

Sometimes a Lissajous figure has several "dead ends," for lack of a better phrase. For example, if the ratio is 3:2, you might have one loop and two dead ends on one side, and two loops and two dead ends on the other. Just count each pair of dead ends as a loop, which in this case gives you the 3:2 ratio.

What do the figures look like when C is greater than pi?

Incidentally, whether you use a ratio of 1:1 or 3:3 makes a difference in how the computer draws the figure initially. Use A and B values of 0.2 or less, and the figure will be drawn in one "pass," slower and slower as you use smaller and smaller values of A and B.

The V values in lines 117-118 position and scale the figure. The use of X and X+1 values for SET in line 150 creates the figures with a square made up of two pixels.

Line 153 may look as though it draws a mirror image of the figure, which is true, but the mirror image is drawn right over the original image, which is one way of drawing it faster. To see how this works, force an ellipse with lines 103-106, and you'll see the figure being drawn by two traces, one originating at 90 degrees and proceeding at 270 degrees and moving clock-wise. The figure is drawn in about 47 seconds.

Now add

```
152 GOTO 156
```

and the figure will be drawn with a single trace, and will take a little longer, maybe 60 seconds, to be completed. This double-trace method is something to keep in mind when drawing figures with polar coordinates.

"I hate to be the one to tell you this, but for the past hour and a half you've been trying to program our candy machine."

Lissajous In Color

This program can be adapted to the Color Computer by adding a third value to all the SET statements, by setting a value for it early in the program, and by cutting in half the X and Y values in lines 117-118 and 153.

However, because of the way pixels are turned on in the Color Computer, some of the Lissajous figures will be quite fanciful, and some others a mess. If you've got the 16K model, with Extended Basic, you can do some nice things with high-resolution figures, and on any model you should be able to take advantage of color for those figure-eight and pretzel-like convolutions.

Color Computer News

A 48-page bimonthly magazine, *Color Computer News*, has been published since last Spring. It is $9 for a subscription of six issues, from REMarkable Software (Box 1192, Muskegon, MI 49443).

The third issue contains a four-pager on using the DRAW statement, three and a half pages of a continuing series on 6809 machine code for those who like to probe the CC's innards, four pages on the CC ROM, several short programs, reviews of several CC programs, a three-page program that generates prime numbers, and 13 pages of ads.

There's no masthead listing the cast of characters, but presumably the editor is Bill Sias.

CCN is printed with a good matrix printer and contains enough of interest to be worth at least a year's subscription. Try it; you may like it.

Orchestra-85

The software music synthesizer of the 16K Model I TRS-80 called Orchestra-80 (Feb. 1981, p. 162; Oct. 1981, p. 246), has been improved and expanded into a new version, Orchestra-85, which features stereo and percussion.

Orchestra-85, priced at $129.95 plus $2 for shipping (Software Affair, 858 Rubis Dr., Sunnyvale, CA 94087) is also available as an upgrade to Orchestra-80, if you send in your PC board and $69.95 plus $2 for shipping.

Either way, you get the new, longer PC board, with twice as many components as the Orchestra-80 board, plus dual RCA phono jacks for stereo (Figure 3). You also get both tape and disk versions of the software on cassette, four sample music files, and an excellent 43-page manual.

Orchestra-85 supports clock rates from 1.77 to 4.0 MHz; the manual notes that the quality of the sound rises with the clock rate, and falls with the number of voices used. Thus "a five-voice, 1.77-MHz synthesizer will have very limited high-frequency response and is not recommended."

Figure 3. The Orchestra-85 PC board contains five ICs and four resistor networks. The printed page is from a chapter that shows non-musicians how to use the synthesizer's notation.

The signal-to-noise ratio has been improved by 6 db, and helps improve sound quality by cutting down on the "aliasing" or unwanted harmonics, but they're still there.

The fifth voice, violin, has been added for five-part harmony, in addition to Orchestra-80's trumpet, oboe, clarinet and organ.

Stereo separates by instrument; you can play any instrument on either channel, such as trumpet and oboe through channel A and clarinet and organ through channel B.

Instrument Definition

The 85 manual is basically the same as the 80 manual, with the addition of various improvements and new features, such as forward and reverse global string search (to find a particular place in a file, after you've written a piece), append (to combine separate music files), and multiple-get ("allows perpetual play of several music files...useful in background-music applications").

The totally new section in the manual is on instrument definition, which includes percussion. The section tells how to change the tone-color registers, which are based on spectral analysis of orchestral instruments, and which are defined by the sum of eight sinewaves. Each partial is an integral multiple of the fundamental frequency, and the eight digits in the parameter list define the relative strength of each partial in the register, much like the drawbars of a Hammond Organ.

If you'd rather not get into setting up your own voices, each tone-color register has default values, which create the approximate tones of a trumpet, oboe, clarinet, organ, and violin.

Professional Software

for TRS-80 computers

Investment Analysis

CS-3305 Cassette (32K) $24 95

This program was originally developed for personal use by an investment specialist. Creative Computing Software now makes this package available for you to analyze your investments and investment decisions. Programs in this package include regression analysis, stock market simulations, market/stock values, risk analysis, time related investments, and tax analysis.

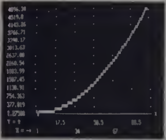
Graphic Package

CS-3301 Cassette (16K) $19.95
CS-3801 Diskette (32K) $24.95

This package provides a variety of interesting and useful graphing routines Graphing Package combines text and TRS-80 graphics to plot a variety of functions and other graphs

1. Bar Graph

Bar Graph plots graphs for up to six different categories An optional display does conversion to a line graph



2. Cartesian Coordinate Graphing

This program plots a standard X. Y graph from a user entered function A special feature of this program automatically scales of the Y-axis

3. Polar Coordinate Graphing

Rarely found in computer graphing packages, this polar

graphing program provides plots of polar functions. The program labels all axes, features automatic scaling, and lets you input the range and increment of the plot A unique and valuable program

4. Parametric Graphing

Parametric functions are functions in which both x and y are expressed in terms of an independent variable t The resulting graph is X vs Y This program allows the user to input two parametric functions and produces a graph

5. Linear and Parabolic Regression

These two programs are used for data analysis which can later be entered into the graphing routines Regression routines analyze how well a series of points fit on a linear or quadratic function

Advanced Statistics

CS-3303 Cassette (16K) $24 95 CS-3505 Disk (32K) $24 95

This package may be the ultimate in statisical applications for the TRS-80. Advanced Statistics will provide you with the ability to perform statistical tests never before available on small computers. Its cassette based data file system allows you to store, retrive and transform data files for use in several different tests.

1. File Manager

File Manager, the heart of the statistical file management, allows you to create, edit, and transform data files. Unique to this program are features that allow the user to perform transformations on variables, extract and create subfiles, and selectively copy records Up to twenty variables and an unlimited number of cases can be processed.

2. Descriptive Statistics

Descriptive Statistics computes the mean, standard deviation, standard error of estimate, variance, skewness, kurtosis, range, median, and quartiles for a variable and constructs a histogram for each value. A test scoring option for conversion of raw scores into percentiles is included

3. Two Variable Statistics

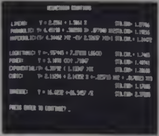
This program calculates descriptive statistics for each variable. It performs a t-test for the difference of means, computing the product-moment correlation coefficient and its associated significance level. In addition, it performs linear regression and computes standard error of estimate for Y.

4. Crosstabulation

This program constructs contingency tables for displaying frequencies, column percentages and table-wide percentages for each cell. It computes the Chi-square, the level of significance and gamma statistics. Tables as large as 10x10 may be evaluated

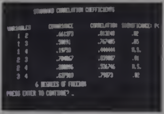
5. Regression-Trend Analysis

This program computes least-squares regression coefficients from time-series or paired data for best-fit equations (linear, parabolic, hyperbolic, logarithmic, power, exponential and cubic types) Calculates standard error of estimate for each equation and more



6. Multiple Linear Regression

Performs multiple linear regression using up to ten independent variables The program computes both unstandardized and normalized coefficients, covariance, multiple correlation coefficient, and the standard error of estimate



7. Correlation Analysis

Computes product-moment correlation matrices, multiple correlation coefficients and partial correlation coefficients with their associated significance levels

8. Analysis of Variance

This program performs one-way and two-way analysis of variance for a maximum of ten groups in each control variable Statistics include the mean and standard deviation for each group, sum of the squares, degrees of freedom, mean square, F-ratios, and significance level

Order Today

To order any of these software packages send payment plus $3 00 postage and handling per order to Creative Computing Morris Plains NJ 07950 Visa MasterCard and American Express orders may be called in toll-free

Order today at no risk If you are not completely satisfied your money will be promptly and courteously refunded

Creative Computing Software
Morris Plains NJ 07950
Toll-free 800-631-6112
In NJ 201-540-0445

creative computing software

TRS-80 is the registered trademark of Tandy Corp.

Percussion

When I first heard that Orchestra-85 included percussion, I thought that meant you'd specify a snare drum playing rolls, for example, or kettledrums playing heavy boom-bim-booms.

But using Orchestra-85's percussion is much more line defining the tone-color registers. There are no default values, such as one for bass drum, another for gong, etc. Instead of defining partial harmonics, the eight digits define random seeds and randomizing functions. "Because there are billions of combinations of seeds and functions, few generalizations can be made about the kinds of percussive effects available," says the manual.

A few samples are given: one sounds scratchy (003005); another squeaky (10100001); a third one, a sinusoidal waveform, like wooden blocks (80011001).

The percussion registers are toneless; "Just as you would not attempt to play a melody on a drum, you should not try to play music on a percussion register."

A short demonstration you can enter via Orchestra-85 shows what can be done with percussion. A later page provides 18 percussion samples, without defining what the author thinks they sound like.

"Stereo mapping" allows you, by using mapping symbols, to "balance or position voices in each stereo channel or to 'ping-pong' voices between channels."

The manual is a little skimpy on what the percussion feature can do, and how to use it. The reason, according to Software Affair president Bryan Eggers, is that percussion "is the last feature we put in. It was a matter of time; we decided to release it as it was. We're working on a newsletter, which maybe we should call an advanced programming guide, to send to users. We have a couple of dozen subjects, such as how to use percussion, additional effects, etc."

Eggers said there is "one undocumented command in Orchestra-85. If you are playing a piece and hear a sour note, and you want to find that note, you play the piece again, using the zero key to stop it at the bad note.

"Then you hit @, and for a moment everything freezes, while the program compiles to where you stopped. Then you use the SHIFT/BREAK keys, which puts you into edit mode right at the place you stopped."

This feature was originally put in by the author, Jon Bokelman, as a debugging routine, and is not in the manual.

Sound of Orchestra-85

None of the first three sample tunes, Haydn's *Gypsy Rondo*, *Entry of the Gladiators* (the old circus tune), or Monte's *Czardas*, uses percussion. The third, Stephen Foster's *Camptown Races*, does, just a little, and it's something like the sound effects in early Mickey Mouse films.

The percussion samples on page 41 sound like the clicks, pops and beeps more associated with robots than with music. Perhaps the newsletter will define some of the more recognizable percussion sounds.

The stereo of Orchestra-85 isn't true stereo, through which you should be able to hear, on each channel, a little of the opposite channel. Instead, the voices are heard *only* on the channel to which they are assigned, and thus often sound extraneous.

Incidentally, any music files written with Orchestra-80 will load in Orchestra-85, and play in stereo automatically.

And In Closing...

If this seems like a lot of space to devote to a music synthesizer, it's because the 80 and 85 seem to be the only such polyphonic devices now available for the TRS-80. Music Box (Oct. 1981, p. 244) hasn't been advertised for months because the manufacturer, Newtech Computer Systems, doesn't think it's competitive with Orchestra-80 or -85.

So, despite a few minor shortcomings, Orchestra-85 is well worth a look-see (look-hear?) if you're interested in a TRS-80 music synthesizer that can play more than one voice at a time.

You can do the Music Minus One type of play-along, by changing the loudness of a register to zero. The software, according to Eggers, is compatible with every known DOS for Model I, and in every single- and double-density configuration, "even LDOS."

He also says that "at least two dozen bulletin-board systems (plus three separate databases on Micronet) now offer free downloading of Orchestra-80/85 music files, "which requires an RS-232 board, modem, and terminal software. By the time you read this, Software Affair will probably have released Orchestra-90, for the Model III, with features identical to the Orchestra-85 for Model I.

Software Affair has released Volumes One and Two of their *Greatest Hits*, which are pre-programmed files, ready to load and play: $10 for each cassette of eleven classic music files, or all 22 on one disk for $20.

"You should have gotten suspicious when he said it had no moving parts."

Three Datasoft Games

Several challenging games for 16K Level-II Model I and III TRS-80 are available at $24.95 for disk, $19.95 for tape, from Datasoft (16606 Schoenborn St., Sepulveda, CA 91343), which also has word-processing, LISP, graphics and other such programs for various personal computers.

Iago

Iago (for Model I and III) is accompanied by a four-page leaflet (as are the other two) which says the game is "the classical Shakespearean challenger to Othello," goes back to the game of Reversi, and "continued into the 20th century when it developed into its modern incarnation in Asia." Actually, Iago is the same as Othello, which is the same as Reversi.

The object is to "outflank" (arrange your tokens on each side of) your opponent's (the computer's) tokens; you capture them in rows, and then flip them over to your color.

The game has seven layers of difficulty; at the top level, a game can take up to 20 hours. If you have an expansion interface, Iago displays the time you've taken to make your present move, and the total time taken by each side.

The game is deceptively simple, as you outflank your opponent's tokens one after the other. Then the tide begins to turn, unless you've managed to foresee the edge traps, and your legal moves dwindle down to a precious few.

Before long, you're hopelessly behind. So you play and play, looking for the winning strategies, but somehow the computer is always a step or two ahead of you.

Warning: This game is highly addictive. Don't buy it if you're easily upset, or have high blood pressure.

Football Classics

Setup takes a while with Football Classics (for Model I and III). You select from two to six teams, give them names, then provide names for the players (13 starters, six reserves). *Then* you enter statistics for each player, such as passes, completions, rushes, etc., plus team statistics. After which you do it all over again, for each of the other teams. You then save all this data on tape or disk, and verify the recording.

You switch to the *play* program, read in the data files, make last-minute player changes, and a gridiron is displayed on the top half of the screen, with yard lines, scoreboard and clock.

The ball is a pixel that moves back and forth on the playing field as you decide to punt, make a pass (short, long, screen, spot), make an end run, hand off to a player, etc. You spend most of the game looking at the 12-item menu, which may be OK if you're into playing football via menus, but there's much more real excitement in one of those little hand-held electronic football games.

Arcade-80

For the Level-II Model I you can get three games in a package called Arcade-80: Astro, Falling Bricks, and Star Run.

The object of Astro is to win points by destroying as many space mines as you can before you run out of fuel. You use the four arrow keys to turn the spacecraft, Shift to move it, the spacebar to fire.

You've got only about 90 seconds to destroy 20 to 30 large mines, except that 50 to 60 small mines are in the way of the large ones. So you shoot and move, shoot and move, improving your coordination as you go, but just when you've got only a couple of large mines left, you run out of fuel. So you play another game, and another, and another, trying for a bigger and bigger score, trying to get over 400, then over 500, then over 600....

Falling Bricks

As the first display puts it, "145 bricks poised at the top of your screen slowly begin to fall towards your defense line. It is up to you to destroy the bricks before they reach the bottom." You move left or right, and launch missiles. Sound familiar?

This is a very frustrating game, because it's timed so that if you make more than just a couple of small mistakes in moving your missile launcher or in shooting, you have no chance to destroy all the bricks before the rest fall on you.

This game is definitely out for anybody with heart problems. Especially since, right after the harrowing experience of destroying 145 bricks in the nick of time, you have to do it all over again, and again, and again.

Star Run

You've "just escaped from the dark star, and must try to out-run and destroy the galactic tie-fighter. You are equipped with a targeting computer and a laser...."

This is for experienced computer game-players who can watch several places on the screen simultaneously: the display of enemy ships, the gauge that indicates if the laser weapon is overheating, and the targeting-computer display.

Don't even try this one unless you've got several hundred hours of flight time on similar games, or are a natural-born space jockey with killer instincts.

Short Program #26: Krazy-Keys

Dan Rollins, of Azusa, CA, sent his "version of Krazy-Keys which uses a VARPTR trick:

```
0 'KRAZYKEYS -- BY DAN ROLLINS
10 A$="": V=VARPTR(A$)
20 POKE V,255     ' LENGTH OF A$
30 POKE V+1,0     ' POINT A$ AT
40 POKE V+2,56    ' KEYBOARD MEMORY
50 PRINT @ 0,A$; ' MOVE IT TO
60 GOTO 50        ' VIDEO
```

"Just RUN the program and start pressing different combinations of keys. It can be mesmerizing. Try SPACE,A,S,D; alternate on the Q with your pinkie.

"One note... NEWDOS80 uses several key combinations for various interrupts (JKL, DFG, 123). There is no provision to nullify this. Also, some key combinations, as well as the BREAK key, will cause a BREAK."

The more keys you press at once, the weirder the display. This is a great program for children. □

ucts...new products...new

APPLICATIONS SOFTWARE

MUSIC AND GRAPHICS

Grafpak is a family of high-resolution graphics dump programs for use with Apple II computers. It will dump either hi-res page horizontally or vertically, or both pages butted vertically. Grafpak is available for Epson, Anadex, IDS and NEC printers. Prices range from $29.95 to $39.95. Smartware, 2281 Cobble Stone Ct., Dayton, OH 45431. (513)426-3579.

CIRCLE 351 ON READER SERVICE CARD

Superplotter is a graphics package for applications in business, engineering, education and math. The Apple disk features pie graphs, bar charts, point and line graphs, a mathematical function file editor. $59.95. Dickens Data Systems, 433 Greenwood Dr., LaPlace, LA 70068. (504) 521-8744.

CIRCLE 352 ON READER SERVICE CARD

A programmable **character set** and game graphics editor has been introduced by Commodore Business Machines for the VIC 20 computer. The cassette comes with a 16-page instruction manual, and allows the user to create groups of 64, 128 or 192 programmable characters for use in Basic programs. $14.95. Commodore Business Machines, Inc., Computer Systems Division, 681 Moore Rd., King of Prussia, PA 19406. (215)337-7100.

CIRCLE 353 ON READER SERVICE CARD

The **VIC Piper** allows users to compose, save, recall and play back music on the VIC 20. Volume and tempo can be varied. $25. A **hi-res utility** for the VIC provides 104 x 152 plot positions, and a **multi-color utility** on the same cassette provides additional color on the 52 x 76 screen. $20. Abacus Software, P.O. Box 7211, Grand Rapids, MI 49510. (616)241-5510.

CIRCLE 354 ON READER SERVICE CARD

Computer Station announces **Graphic Writer** for the Epson MX-80 (with Graftrax) and MX-100 printers. The program is designed to be used in conjunction with Apple Writer to obtain different type styles on graphics printers. It is also available for Silentype and Paper Tiger printers, and requires DOS 3.3, DOS Tool Kit, Applesoft and a supported interface card. $34.95. Computer Station, 11610 Page Service Dr., St. Louis, MO 63141. (314)432-7019.

CIRCLE 355 ON READER SERVICE CARD

WORD PROCESSING

The **Refware Thesaurus** is designed to help writers choose the most appropriate words to express a specific idea. A total of 12,400 nouns and adjectives are arranged in associated groups; when the user types a word into the computer, the program responds with suggestions of from 9 to 45 synonyms or associated words. Separate programs are available for nouns and adjectives at $39.95 each. The Refware Thesaurus Builder, which chains together eight utility programs to enable the user to create a specialized thesaurus specific to the needs of a profession or business, is priced at $149.95. All require a 48K TRS-80 Model I or III and two disk drives. Refware, P.O. Box 451, Chappaqua, NY 10514. (914)238-8896.

CIRCLE 356 ON READER SERVICE CARD

Telewriter is a word processing program for the TRS-80 Color Computer. It upgrades the standard 32 x 16 screen display to 51 x 24, and adds lower case characters. The program can use cassette or disk for storage, and features a special cassette handler with auto-retry on I/O error. It runs in 16K or 32K and requires no hardware modifications. $49.95. Cognitec, 704 Nob Ave., Del Mar, CA 92014. (714)755-1258.

CIRCLE 357 ON READER SERVICE CARD

DATA BASE MANAGEMENT SYSTEMS

Jinsam is a data base manager for Commodore CBM 8032/CBM 4032 computers. Jinsam 1.0 provides file handling, manipulation and report generation. Jinsam 4.0 for the CBM 4000 series adds a list maintenance feature with an unlimited number of fields and unlimited record length. Jinsam 8.0 for the CBM 8000 series includes the 4.0 features plus unlimited sort, horizontal format and search by key or record number. Jinsam 8.2 expands the capabilities of 8.0 by adding information search by word, key or record number and machine language print, format and manipulation routines. Among the interface modules available are Wordpropack for the WordPro word processing system and Interac which can read both Visicalc and WordPro files. Jini Micro Systems, Inc., Box 274 Kingsbridge Station, Riverdale, NY 10463. (212)796-6200.

CIRCLE 358 ON READER SERVICE CARD

GAMES AND RECREATIONAL

Acorn Software announces **Astroball**, a pinball game with a space theme for 16K TRS-80 Model I and III computers. It features space craft, flying saucers and black holes which can devour the player's ball. Available on tape or disk for $19.95. Acorn Software Products, Inc., 634 North Carolina Ave., S.E., Washington, D.C. 20003. (202)544-4259.

CIRCLE 359 ON READER SERVICE CARD

Artworx Software introduces nine programs for Atari computers. They include space games (**Encounter at Questar IV**, $23.95; **Rocket Raiders**, $19.95; and **Space Trap**, $14.95), a landing simulator (**Pilot**, $16.95), a **blockade** game ($14.95), two adventures (**Cranston Manor**, $21.95 disk and the **Vaults of Zurich**, $21.95), a **text editor** ($39.95, disk), and a player-missile editor (**PM editor**, $29.95). Artworx Software Company, 150 N. Main St., Fairport, NY 14450. (800)828-6573 or (716)425-2833.

CIRCLE 360 ON READER SERVICE CARD

COMPUTERS

Multi-User System for Sorcerer

Multi-Net 80 from Exidy Systems brings multi-user capability to the Sorcerer.

The system consists of a timeshared global processor and up to 16 users which are basically single-user microcomputers (Z80 cpu and 64K RAM memory) communicating with the global processor (via high-speed block transfer) over the system bus.

The Multi-Net 80 supports 8" Winchester hard disk drives in one to eight increments of 45 megabytes each.

A single-user Multi-Net 80 system costs $6,000, an eight-user Multi-Net 80 system costs $24,500 and a sixteen-user Multi-Net 80 system costs $34,100.

Exidy Systems, Inc., 1234 Elko Dr., Sunnyvale, CA 94086. (408)734-9831.

CIRCLE 361 ON READER SERVICE CARD

Microcomputer Introduced By Zenith

Zenith Data Systems announces the Z-90 microcomputer.

The Z-90 has a double-density disk controller card, which increases storage available on 5 1/4" diskettes and comes with 64K bytes RAM.

Models of the Z-90 with a built-in disk drive have a suggested retail price of $3,195. Those with no built-in disk drive have a suggested retail price of $2,895.

Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025. (312)391-8181.

CIRCLE 362 ON READER SERVICE CARD

New Products, continued...

Video/Computer System

VidCom makes possible the interaction of recorded video taped programs and courses with computers, such as Atari 800, Apple II, PET, TRS-80 and others.

The Vidcom System consists of a Vidram board, which plugs into the computer memory channel, a videocassette recorder with connecting cable to the Computer Vidram board, a personal computer, and a program to interact with the VTR.

Prices are as follows: Vidram board, $395; VCR modification, $195; 48K Atari 800, or Apple II, with audio cassette recorder, including the Vidram board, a VTR modified with wiring and cable to connect to the Vidram boards $3,595.

VidCom Inc., Andre Lane, Peekskill, NY 10566. (914)737-7011.

CIRCLE 363 ON READER SERVICE CARD

PERIPHERALS

3-D Graphics Tablet

Micro Control Systems, Inc. and Penguin Software have announced a 3-D graphics tablet for the Apple.

The tablet surface is 16" by 13", with two-dimensional workspace approximately proportional to the Apple screen. The arm is located at the top center of the tablet, and has an "elbow" that allows it to swivel on the two-dimensional surface. It can also rotate up and down, giving it access to the area above the tablet. All the joints can rotate almost a full 360 degrees.

Included with the software package is a machine language subroutine that can be added to the user's program to allow the tablet to be polled for coordinates. $395.

Penguin Software, Box 432, West Chicago, IL 60185. (312) 231-0912.

CIRCLE 364 ON READER SERVICE CARD

Apple Light Pen

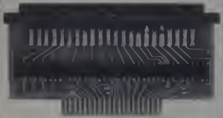
A slimline light pen for the Apple and Atari has been announced by Symtec, Inc. It provides high resolution with more than 55,000 screen locations.

The pen features a 1/2" stainless steel case, non-scratch tip, light weight telephone cord, and touch ring. It is available with a complete interface for the Apple and Atari, is supplied with full documentation and software on disk, and includes negative sync for interactive training use. $249.95.

Symtec, Inc., 15933 W. Eight Mile Rd., Detroit, MI 48235. (313)272-2950.

CIRCLE 365 ON READER SERVICE CARD

Color Buffer for Color Computer



TBH announces the Color Buffer, a peripheral for the TRS-80 Color Computer. Gaining access to the system bus through the game slot cartridge, the Color Buffer terminates in the standard 22/44 card edge connector providing the hobbyist or experimenter with easy access to fully buffered address, data and control lines. U.S., $59.95; Canada, $69.95.

TBH Canada, 67-3691 Albion Rd., Ottawa, Ontario, Canada K1T 1P2.

CIRCLE 366 ON READER SERVICE CARD

computer store of the month

Rainbow Computing, Inc.
Northridge, California

Numerous computer stores carry Creative Computing products. Creative Computing would like to recognize one of these stores for their service and dedication to their customers and the computer industry. This month, we are spotlighting Rainbow Computing in Northridge, California.

The founders of Rainbow Computing have over 60 collective years of consulting experience including systems analysis and programming on all major types of mainframe computers. In the fall of 1975, after visiting a computer store, the potential for the microcomputer became obvious. Realizing it was the "wave of the future" plans were made to open a retail store in Granada Hills, a suburb of Los Angeles. Rainbow's first store, a whopping 800 square feet, was opened in April, 1976. Sales grew from one magazine a week at first, to a whole computer system three months later.

When the Apple II was introduced, with its many dynamite features, fully assembled and tested, Rainbow had to carry it. Sales of the Apple II have been phenomenal, doubling or tripling each year since the beginning. In June, 1979, the store was moved to a much larger location in the Garden Plaza Shopping Center, where it is presently located. There is a complete Apple service center and a wide selection of peripherals, software, books, and magazines, including products from Creative Computing for immediate delivery.

Rainbow Computing has a large mail-order department and warehouse which stocks the largest collection of Apple related products anywhere. In addition, Rainbow runs an educational institute which offers computer literacy courses in Basic, Assembly, and Pascal.

If you are ever in the Northridge area, stop in and see them. Their address is 19517 Business Center Drive. You can call them at 213-349-5560.

...retail roster...retail roster...retai

CALIFORNIA

Advance Data Concepts—2280 Diamond Blvd., Concord 94520; (415) 871-9018. 9-5 Mon.-Fri. Vector-Graphic, CP/M Software Headquarters-User's Group.

D.E.S. Data Equipment Supply—8315 Firestone, Downey 90241. (213) 923-9381. 7 days. Commodore PET specialists. Hardware, Software, Books, Mags, Supplies, In House Maintenance.

CONNECTICUT

Computerworks—1439 Post Rd., East Westport 06880; (203) 255-9098. 12-8 Tues.-Fri., 12-9 Thu., 10-5 Sat.

GEORGIA

Atlanta Computer Mart—5091 Buford Hwy., Atlanta 30340; (404) 455-0647. 10-6 Mon.-Sat.

ILLINOIS

Computer Land/Downers Grove—136 Ogden Ave., Downers Plaza 80515; (312) 984-7782. 10-6 Mon.-Sat., 10-8 Tue., Thurs. Apple, Atari, Osborne, Xerox, Vector.

Data Domain of Schaumburg—1812 E. Algonquin Rd., Schaumburg 60195; (312) 397-8700. 12-9 Tues.-Fri., 11-5 Sat. Apple, Alpha Micro, Hewlett-Packard Calculators. Largest book and magazine selection.

Farnsworth Computer Center—1891 N. Farnsworth Ave., Aurora 80505; (312) 851-3888. 10-8 Mon.-Fri., 10-5 Sat. Apple, Hewlett-Packard series 80 systems, HP Calculators, IDS Printers.

Gavin Computers—5935 W. Addison St., Chicago 60634; (312) 286-4232. Mon.-Thurs. 9-8:30, Tues.-Sat. 9-6. Apple B & H, Atari & Commodore Systems.

Lillipute Computer Mart, Inc.—4448 Oakton, Skokie 80078; (312) 874-1383. M-F 10:30-8pm, Sat. 10-6. We sell Cromemco, Gimix, Bell & Howell, North Star and others. Starting our fifth year in business.

Video Etc.—485 Lake Cook Plaza, Deerfield 60015; (312) 498-9669; Open every day. Strong software support for Apple, Atari.

The Video Station—872 So. Milwaukee Ave., Libertyville 60048; (312) 367-8800. Open 7 days. Atari Computers, Hardware and Software.

MASSACHUSETTS

Neeco—679 Highland Ave., Needham 02194; (817) 449-1760. 9-5:30 Mon.-Fri. Commodore, Apple, Superbrain, Atari.

Science Fantasy Bookstore—18 Eliot St., Harvard Sq., Cambridge 02138; (817) 547-5917. 11-8 Thur. Apple, Atari & TRS-80 games; Epyx, Microsoft, Creative Computing.

MICHIGAN

Computer Center—Garden City; (313) 425-2470 & West Bloomfield; (313) 855-4220; Books, Magazines, Hardware and Software for Apple, North Star, TRS-80 & PET.

NEVADA

Home Computers—1775 E. Tropicana #6, Las Vegas 89109 (702) 798-1022. 10-7 Mon.-Sat. Apple, Commodore, Atari, AIM 85, (Books) Sales & Service.

NEW JERSEY

Computernook—Rt. 48, Pine Brook Plaza, Pine Brook 07058; (201) 575-9468. 10-8:30 MTWS, 10-8 Thurs., Fri. Apple/Commodore Authorized dealer.

The Computer Universe—155 Route 17S., Paramus 07652; (201) 262-0980—347-9008. Mon; Wed; Fri., and Sat., 10—8. Tues., and Thurs; 12—9. Specializing in Apple Computers.

Silent Partner—2050 Center Ave., Fort Lee 07024; (201) 947-9400; Mon.-Sat. 10-6. Apple/Atari/Commodore/Vector/Malibu.

Software Mart—352 Bloomfield Ave., Caldwell 07006; (201) 228-4949. Software for Apple, Atari, TRS-80 and PET always 10-20% off list.

Software City, Pine Brook—101 Rt. 46 East, 07058; (201) 575-4574. Bus/Rec Utility/Home Programs for TRS-80, Atari, Apple and IBM. Up to 20% off list.

Software City, River Edge—111 Grand Ave, 07881; (201) 342-8788. Bus/Rec/Utility Home programs for TRS-80, Atari, Apple and IBM. Up to 20% off list.

Software City, Armonk—146 Bedford Rd, 10504. (914) 273-3677. Bus/Rec/Utility Home programs for TRS-80, Atari, Apple and IBM. Up to 20% off list.

NEW YORK

Programs Unlimited—20 Jericho Turnpike, Jericho, 11753; (518) 333-2266. 10-8 Mon.-Sat. The largest microcomputer software selection available.

The Computer Center—31 East 31st St., New York 10018; (212) 889-8130. 10-7 Mon.-Fri., 11-6 Sat., 10-8 Thur.

Upstate Computer Shop—829 French Rd., Campus Plaza, New Hartford 13413; (315) 733-9139. 10-8 Mon.-Fri., 11-5 Sat. Apple—Commodore—Data General.

OHIO

Abacus II—1417 Bernath Pkwy., Toledo 43615; (419) 885-1099. 10-6, 10-7 Thurs. Apple, Osborne, Adds, NEC, Atari, Epson & IDS Printers.

Micro Mini Computer World—74 Robinwood Ave., Columbus 43213; (814) 235-5813/6058. 11-7 Tues.-Sat. Authorized Apple/Commodore dealer. Sales, Service, Business Software.

North Coast Computers—828 Dover Center, Bay Village 44140; (218) 835-4345. 10-6 Mon.-Sat., 10-8 Tue., Thur. Apple/Atari/Vector Graphic/Data General.

WISCONSIN

Petted—4285 W. Loom's Rd., (I-894-Hwy. 36, Milwaukee 53221; (414) 282-4181. 12-8 Mon.-Fri., 10-4 Sat. Authorized Commodore PET, CBM, VIC dealer. Books, Magazines, Chips, etc.

To include your store in Creative Computing's *Retail Roster, call the Advertising Department at (201) 540-0446.*

Steve Gray and David Ahl

The Lucifer Key by Malcolm MacPherson. E.P. Dutton, New York, NY. 338 pages, hard cover, $13.50, 1981.

A real page turner, *The Lucifer Key* is tautly written and almost believable.

The book centers around a young computer scientist, Stark Rousseau, who has developed a "formula" that could disrupt computer/satellite communications and bring to a halt nearly all the computers of the nation. Rousseau naively presents the concept of the formula at a computer science symposium and the race is on! The Russians are after it, unscrupulous industrialists are after it, and even a group of well-meaning anti-computer fanatics are after it.

The daughter of the leader of the anti-computer group is a gorgeous young model who has intelligence to match her looks. Predictably, she falls in love with the young scientist, Rousseau. Other than this somewhat implausible twist, the book is eminently believable and draws heavily upon existing programs and research in artificial intelligence, computer science, and satellite technology. Eliza, as usual, is pushed far beyond its limits and even Echo is drawn upon to write computer poetry, the likes of which have never seen the light of day. On the other hand, human characters are developed with realism and personality and respond appropriately to the computer threats as they come to light.

All in all, Malcolm MacPherson has shown that a gripping, chillingly believable adventure novel can be written with computers playing a central role. I recommend it—DHA

Graphic Software for Microcomputers, by B.J. Korites. Kern Publications, 190 Duck Hill Road, Box 1029, Duxbury, MA 02332. 188 pages, paperback $19.95. 1981.

This "self-teaching guide," as the introduction calls it, contains 61 programs for two- and three-dimensional graphics, all in Basic and all written on an Apple II Plus 48K system. A disk of the programs in the book is available for $18.95.

Like Shakespeare's comedies, this book can be enjoyed at several levels. You can just run the programs, which start with placing points and lines on the screen, move on to drawing pictures using points and lines, then show how to translate, rotate, scale and clip 2D and 3D drawings. Programs are given for shading, hidden-line removal and perspective transformations, for using tablets as input devices, and for typical graphics applications. The book ends with suggestions for practice problems for each section.

On a second level, you can read the text, if you're prepared to deal with vector math and matrices. The author says, "You can complete all of this book except the section on matric concatenation without understanding matrices."

On a third level, you might want to translate the programs for use on a non-Apple system, which of course would involve a great deal of changing the plotting commands. To make the translating easier, all the program lines consist of one statement each, and some of the more complicated lines are explained in the text.

This is probably the best book available on microcomputer graphics that can be read without a Ph.D. in mathematics, although it does require you to become fairly proficient in vector math and matrices if you want to get the most out of this undergraduate text.

TRS-80 Assembly Language by Hubert S. Howe Jr., Prentice-Hall Inc., Englewood Cliffs, NJ. 192 pages, paperback $9.95. 1981.

"Both beginners and experienced programmers have good reason to be dissatisfied with the material on assembly-language programming that has appeared thus far," according to the preface of this slim book that isn't going to satisfy all that many people either.

Although the back cover says it will give you a "clear presentation of all introductory concepts in the use of the TRS-80" and "explains assembly language programming in a thorough, yet easy-to-understand style," this isn't a book for beginners. It's much closer to being a reference book for those with some programming experience, who wouldn't feel overwhelmed by a summary, right up front on page 15, of all ten Z-80 addressing modes. Or by an Overview of the Z-80 Instruction Set on pages 18-31, a compact listing that would turn off any beginner, assuming he got that far.

After a chapter on machine language, two on the Z-80 CPU, and a short one on the stack, Howe gets right into memory mapping and using the editor/assembler. That's all you get of the Basic Concepts. Part II, Practical Programming, gets into reading and printing numbers, arrays and tables, moving data, arithmetic operations, floating-point, logical and bit operations, software multiply and divide, cassette I/O, USR subroutines, disk I/O and disk files.

This second part is pretty good, and if it explained the programs in more detail and were accompanied by a better, longer and much more detailed Part I, it might go a long way toward satisfying those people mentioned in the preface, who have yet to see a thoroughly detailed book on TRS-80 assembly language that takes a beginner from A to Z.

This book, incidentally, is typeset "using a Diablo HyType I printer with Michael Shrayer's Electric Pencil program on a TRS-80 Model I."

Program For a Puppet by Roland Perry. Pocketbooks, New York, NY. 326 pages, massmarket paperback, $2.95. 1981.

In this totally implausible story, the hero, an Australian journalist, is pitted against Lasercomp, the largest computer company in the world. Lasercomp is a thinly disguised IBM with its corporate headquarters in Westchester and a former Attorney General for its chief lawyer. It is run by the Brogans, a father-son team (harking back to the Watson days). The corporate goal is absolute power and, into their new generation of computer, the Cheetah series, the Brogans had installed a master program with a plan to elect their handpicked man to the presidency of the United States.

The journalist stumbles on the evil doing of the corporation while he is investigating the illegal sales of Lasercomp computers to communist countries. Graham, the journalist, falls in love with the proverbial beautiful Russian secret agent, finds other allies along the way, and eventually exposes the wicked scheme.

I find it curious that the Cheetah computer, although based on laser technology, uses teletypes for output. Indeed, the Brogans even have a teletype aboard their corporate jet. The story may be modern; the technology is not.

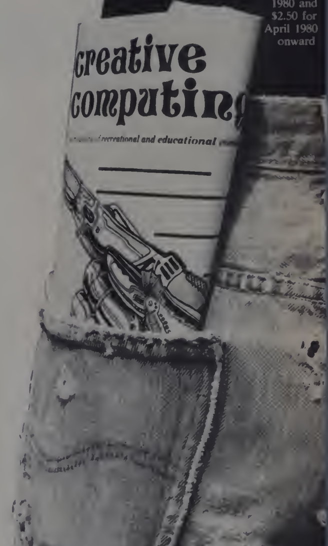
Despite favorable reviews from the *Times* and *Playboy*, I was not impressed with the book. If you must have the latest computer-related novel, by all means get it; as for me, I will wait for Robert Ludlum's or John MacDonald's next book.

—DHA

BACK

Are you missing any back issues of *Creative Computing*? The thoughtful articles, fascinating applications, stimulating problems and insightful programming techniques are practically timeless. Why not fill in the holes in your collection today while copies are still available?

Prices are $2.00 each for issues from 1977 to March 1980 and $2.50 for April 1980 onward



Vol. 3, No. 6-Nov/Dec 1977

Programming Techniques; File Structures; CAI; Multiple Problem Types; Computer History Quiz; Final Exams by Computer; Dwyer: 8 Hour Course in Basic—Part 3. Mastermind II, Othello, and Inorganic Chemistry Programs. Evaluations: Nine Microcomputer-based Toys, Comp IV, S-100 Compatible Kits, TDL Xitan, and Three 8080 8K Basics.

Vol. 4, No. 4-July/Aug 1978

Features on Business Computing and Word Processing; Special Section on Interfacing Your Computer to the Outside World; Three Perspectives on Video Games; ROM Section; High Resolution Graphics for Apple II; GAMMON and EVILK Motor Cycle Jump Game Programs. Evaluations: Pet, Apple II, Atari Video Pinball, Atari Video Computer.

Vol. 4, No. 5-Sept/Oct 1978

Educational Features; 4 Simulation Articles; Accounts Receivable Systems; Real World Games; A Real-Time Clock You Can Build; All about PASCAL; Intelligent Videodiscs; 40 Programming Ideas; ROM Section; Hex and Star War Games. Evaluations: Exidy Sorcerer, Radio Shack TRS-80, Bally Arcade, Speak & Spell and Spelling B, Computalker Speech Synthesizer, Peninsula Pet Cassettes, Merlin Video Interface.

Vol. 4, No. 6-Nov/Dec 1978

Consumer Computers Buying Guide; Critical Path Analysis; Experiment in Teaching Strategic Thinking; ROM Section; Subject Index and File Index in Basic. Programs for Mail Lists, Patterns, Plotting, Corral, Joust, Puzzle, and a Christmas Letter. Evaluations: CP/M Disk Operating Systems, NorthStar Horizon, Backgammon Computers, Smart Electronic Games and Video Games.

Vol. 5, No. 1-January 1979

Computers and Robots in Fiction; Guidance Counselor System; Survey of Educators' Attitudes; How to Hide Your Basic Program. A Program to Calculate Depreciation for Taxes, and the Space Maze Game. Counterfeit Cursor and Speed Reading for the PET. Evaluations: Microsoft Fortran 80, Structured Programming with Tiny c, Smoke Signal's Text Editor, Exidy Sorcerer, Ohio Scientific Superboard II.

Vol. 5, No. 2-February 1979

Multiple Regression Analysis Simplified; Budget Management; Sports Predictions; PEEKing and POKEing for Video Displays; Interview with Michael Shrayer; Computers and Education—Questions of Value; Game Programs for Gold Mine and Atom 20. Evaluations: Heathkit H-8, Thinker Toys Floppy Disk, Electric Pencil, Western Digital Pascal Chip Set, Four Computer Music Records.

Vol. 5, No. 3-March 1979

Six Articles on Data Base Management; Sports Judging on a Microcomputer; Shopping for a Payroll System; Programming the Game of Go; Business Computing with the Sorcerer; Social Science Survey Program. Evaluations: Terrapin Turtle, VideoBrain, PET Monitor, TRS-80 Floppy Disk, Apple Floppy Disk.

Vol. 5, No. 4-April 1979

Safeguarding Your Computer; Interpretive Programming; Elements of a Good Computer Game; Music Composition; Marin Computer Center. Programs for an Intelligent Calendar, Vertical Graphs and Bar Graphs, Flowers for the PET. Evaluations: Checker Challenger, Video Checkers, Checkbook Maintenance System, Whatsit Data Base Management Program.

Vol. 5, No. 5-May 1979

Word Processing Systems; Pilot Tutorial; Writing User-Oriented Programs; Amoritization Schedules, Reading and Comprehension Exams; Hiding Your Basic Program; Cribbage and Mille Bornes Game Programs. Evaluations: WP Daisy Word Processing, Wordmaster Text Editor, PDI IQ Builder, Malibu 160 Line Printer.

Vol. 5, No. 6-June 1979

Eight Articles on Computer Graphics and Plotting; Using Basic Strings; Microcomputers in the Hospital; Billing Program for the Sorcerer. Inkblot and Greed Game Programs. Evaluations: TRS-80 Voice Synthesizer, HIPLOT Digital Plotter, Structured Systems, Name and Address Program, ALF/Apple Music Synthesizer.

Vol. 5, No. 7-July 1979

Four Features on Sorting, Files and Data Bases; Creativity Test; World Power Systems; Personal Finance Model; Two Ecological Simulations; Programs for an Ecological Game, Niche, Brain Teaser, and Zone X. Evaluations: BrighterWriter, SWTPC CT-82 Graphics Terminal; APF PeCos One; Heuristics Speechlab; Micro Pro Super Sort; Diagnostic Programs for the PET.

Vol. 5, No. 8-August 1979

Can Computers Think?; 5 Basic Language Programming Techniques; The Law and Your Computer; muMath; Image Processing; Manipulating Pencil Files; Adventure: a new type of computer game simulation. The Games HVOLT and FORT. Evaluations: Texas Instruments 99/4; Radio Shack TRS-80 Model II; SWTPC PR-40 for the Pet; IMSAI VIO.

Vol. 5, No. 11-November 1979

Adventure: Complete Listing in Basic. Controlling Household Devices; Car Pooling; Mumps Language; Computer Art Exhibition; Build Your Own Joysticks; Telephone Dialer for TRS-80 or NorthStar; Teacher-Made Tests. Evaluations: Comparison Chart of 6 Popular Personal Computers; Comparison of 26 Single Board Computers; Electronic Games & Toys; Quick Printer II; Interact Computer; User-Definable Character Generators; TRS-80 Level III Basic; PET Software from Creative Software; Word Processor; Introl X-10 Home Control System.

Vol. 5, No. 12-December 1979

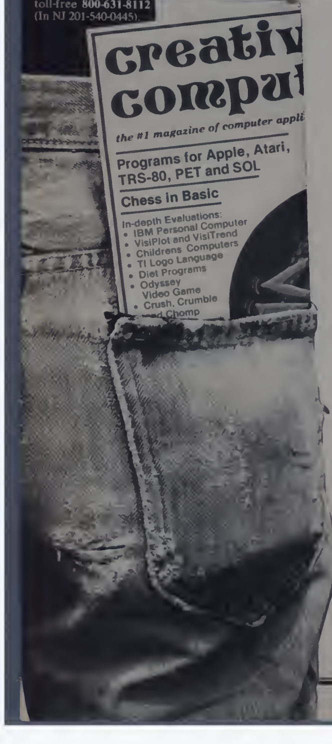
Controlling Household Devices: Part 2; LOGO; Computerized Biofeedback; Computers at the Rodeo; Creating Digitized Video Images. Programs for using the Microcomputer as an Investment Tool; Animation on the Apple; Magic Tricks; "Turn-Key" CP/M System. Evaluations: More Electronic Games; Language Translators; APF MP1000 Video Game System; 6 Word Processing Printers; Satellite Tracking Software; SysKit for the 8080; Assemblers: CP/M vs. TSC; Statistics for the TRS-80.

ISSUES

Order any five or more for $1.75 each or ten or more for $1.50 each. U.S. Postage is $2.00 for up to 4 issues or $3.00 for five or more. Foreign postage is $1.00 per issue.

Super Special: One of everything we have including five rare issues of *ROM*—36 magazines in all—for only $50 postpaid ($75 foreign)

Send payment or Visa, MasterCard or American Express card number and expiration date to Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07950. Or call toll-free **800-631-8112** (In NJ 201-540-0445).



Vol. 6, No. 1-January 1980

Interviews with Donald E. Knuth and William Wulf; Six Features on Artificial Intelligence; Air Traffic Controller; Computerized Resume; GROW: A Program that Learns; Evaluations: Six Basics; NEWDOS and TRSDOS; Auto Scribe; Micro Music.

Vol. 6, No. 2-February 1980

Six Articles on Investment Analysis; David Levy: Intelligent Computer Games; Programs: Geneology, Graphing, Genetics. Evaluations: Word Star vs Electric Pencil; Pascal for the TRS-80; Micro Composer; Data Dubber; Sorcerer Word Processing Pac; Trivia Contest Results.

Vol. 6, No. 4-April 1980

Dr. KiloBYTES's Creative Popular Personal Recreational Micro Computer Data Interface World Journal—the Famous 73 page April Fool parody. 8 Articles on Reading and Language; Interview with Gordon Bell; Evaluations: Heath WH-89; Atari 800 vs PET; Chatsworth Mark Sense Card Reader; Adventure.

Vol. 6, No. 6-June 1980

Fourteen Graphics Articles: Polar Plots, 3-D Graphics, Animation, Graphic Mazes, Motion Simulation, Inside Space Invaders. 7 Music Articles: Digital Audio, Computer-Aided Sight Reading, Design of a Synthesizer, Digital Enhancement of Old Recordings. Comparison of Printers; Evaluations: The Atari Machine, Neelco's Music Box for the PET, HeathKit-Thomas Electronic Organ Kit.

Vol. 6, No. 7-July 1980

Four Articles on Adventure Games: Dragon, Dungeon, How to Fit a Large Program into a Small Machine, How to Write an Adventure. 6 Simulation Features: Genetics, Electric Management, Medical, Ecological, Sports. Self-Reproducing Programs; Man-Machine Dialogs; Selecting a Computer Dealer. Evaluations: Super-Text vs. Easy Writer; Mountain Hardware ROM PLUS+; Toolkit for the PET; Chart Comparing Basics of 8 Popular Computers.

Vol. 6, No. 8-August 1980

Games Features: Computer Bismarck, Knight's Tour, Guess My Animal, Turnablock Game, Fifteen and Hot, Mind Exerciser. Marketing Your Own Program; Computer Graphic Design; Robotics Conference; Insertion Sort; Stocks and Listed Options. Evaluations: Magic Wand, VisiCalc, Beta-80, Asteroids in Space.

Vol. 6, No. 9-September 1980

Twenty Educational Applications and Features: Language Arts CAI Development, Grading Program, Computers in the Classroom. Asimov: Point of View; How to Heapsort; New Consumer Electronics Products; TRS-80 Shopping List for Schools. Evaluations: Milliken Math Sequences; Exatron Stringy Floppy; EDS Videotape Series "Little Computers—See How They Run"; 8 Apple II Software Packages; Educational Packages.

Vol. 6, No. 10-October 1980

Symposium on Actor Languages and Smalltalk, Linked Merge Sort; How to Solve It; 9 New Applications and Games: Election Prediction, The Presidential Campaign. Computer Division Evaluations: OSI C2-4P Computer, TRS-80 Voxbox, Two Text Editors, Five Music Systems, 15 Software Packages, BASEX.

Vol. 7, No. 2-February 1981

Comparison of Music Editors; Artificial Intelligence; Are Computers Alive?; Genetics Simulation in Pascal; National Programming Contest; Monster Combat; Introduction to Computer Control.

Vol. 7, No. 3-March 1981

Education; MECC In-Depth; Selecting a Computer; CAI; Prize-Winning Simulation; Commercial Software Evaluations; Fantasy Games; Show and Spell; Cutting Your Taxes; PET Word Processor; Space Invaders Championship; Microcomputers and Hyperactive Children; Realistic Simulations; 25 New Products.

Vol. 7, No. 4-April 1981

Networks and Telecommunication; Home Banking; Osborne I; ABM; New Horizons for the Apple; Column Board Comparison; Computerized Writer; Space Games; Small Computers in Big Business.

Vol. 7, No. 5-May 1981

Buyer's Guide to Small Business Computers; Bombproof Data Entry; Personal Finance; Home Accounting; Programs for the Investor; Financial Programming Language; Short-Range Forecasting; Fuel Economy Comparison Program; Music Synthesis Past and Future.

Vol. 7, No. 6-June 1981

Graphics and Animation; Interview with Leo Christopherson; Alien; OSI; Computers of Hollywood; Colored Tapestries; Computer Warfare; Digital Music Synthesis; Hi-Res Graphics for the TRS-80; Fantasy Games Old and New; Funny Numbers; Spiderman.

Vol. 7, No. 7-July 1981

Printers and Word Processing: Scripsit vs. Electric Pencil, Microline 82, Lazywriter, Paper Mate, Epson MX-80, Dynatyper; Computer Othello Tournament; Digital Music Synthesis; Atari Graphics; Computer-Assisted Proofreading.

Vol. 7, No. 8-August 1981

The Origin of Spacewar; Microcomputer Chess Tournament; Nuclear Power Plant Simulation; Evaluations: Apple Silentype Printer, TI 99/4 Music Maker, Hi-Res Cribbage, Apple-oids.

Vol. 7, No. 9-Buyer's Guide

Buyer's Guide: Personal Computers, Video and Electronic Games, Consumer Electronics, Which Computer Is For You?, What To Buy Under $1000, VIC-20, Xerox Personal Computer, Printers, Monitors, Memory, Music Synthesizers, Plotters, Voice Synthesis, Home Computer vs. Video Game, New Games for Atari VCS, Learning Aids, Video Products.

Vol. 7, No. 10-October 1981

Educational Applications; Computer Tutor; Educational Software; Preschool Games; Xymec Printer; Cardreaders; Hi-Res Soccer; Nursery Rhymes to Shakespeare; Computers in Britain; PLATO: Simulations in the Classroom; Speed Reading; Aircraft Rescue; Wombats.

Vol. 7, No. 12-December 1981

Chess in Basic; Evaluation of IBM Personal Computer; VisiPlot and VisiTrend; Children's Computers; TI Logo Language; Diet Programs; Odyssey; Seeing Eye Computers; Arrays and Matrices; Model of a Solar System; Murphy's Eleventh Law; Seymour Papert.

• index to advertisers •

*Write Advertiser Directly

"Some damn computer decided we are the average American family!"

2

February, 1982 • Expires May 1, 1982

creative computing

(Please Print)

Name ______________________

Title ______________________

Company ______________________

Address ______________________

City ______________________

State ____________ Zip ________

Please take a minute to answer the following questions. Your answers will help us make *Creative Computing* even better.

1 Which microcomputer, if any, do you own
☐ A No system at present ☐ F S-100 system
☐ B Apple ☐ G IBM
☐ C Atari ☐ H Sinclair
☐ D TRS-80 ☐ I Other
☐ E PET

2 How much do you spend on software annually?
☐ A Less than $50 ☐ D $250 - $500
☐ B $50 - $100 ☐ E Over $500
☐ C $100 - $250

3 If you own a computer, which of the following do you use?
☐ A cassette recorder
☐ B floppy disc drive
☐ C cassette recorder and floppy disc drive
☐ D hard disc drive

1

February, 1982 • Expires May 1, 1982

creative computing

(Please Print)

Name ______________________

Title ______________________

Company ______________________

Address ______________________

City ______________________

State ____________ Zip ________

Please take a minute to answer the following questions. Your answers will help us make *Creative Computing* even better.

1 Which microcomputer, if any, do you own
☐ A No system at present ☐ F S-100 system
☐ B Apple ☐ G IBM
☐ C Atari ☐ H Sinclair
☐ D TRS-80 ☐ I Other
☐ E PET

2 How much do you spend on software annually
☐ A Less than $50 ☐ D $250 - $500
☐ B $50 - $100 ☐ E Over $500
☐ C $100 - $250

3 If you own a computer, which of the following do you use?
☐ A cassette recorder
☐ B floppy disc drive
☐ C cassette recorder and floppy disc drive
☐ D hard disc drive

SUBSCRIPTIONS TO CREATIVE COMPUTING

☐ New
☐ Renewal

Term	USA	Canada and Foreign surface	Foreign air
3 yrs (36 issues)	☐ $53	☐ $80	☐ $143
2 yrs (24 issues)	☐ $37	☐ $55	☐ $97
1 yr (12 issues)	☐ $20	☐ $29	☐ $50

For a change of address, please attach old label.

BOOKS, POSTERS, RECORDS, GAMES

Quan	Cat	Title	List Price	Total
____	3G	Binary Dice	$1 25	____
____	6A	Best of Creative Computing-Vol 1	8.95	____
____	6B	Best of Creative Computing-Vol. 2	8 95	____
____	12C	Best of Creative Computing-Vol. 3	8.95	____
____	6C	Basic Computer Games	7.95	____
____	6C2	More Basic Computer Games	7 95	____
____	6C4	More Basic Games-TRS-80	7.95	____
____	6F	Best of Byte	11 95	____
____	6G	Colossal Computer Cartoon Book	4 95	____
____	6H	Be A Computer Literate	3.95	____
____	6Z	Computer Rage Game	8.95	____
____	9Y	Problems for Computer Solution Teacher's Edition	9.95	____
____	9Z	Problems for Computer Solution	4.95	____
____	10R	Computer Coin Games	3 95	____
____	12A	Katie and the Computer	6 95	____
____	12D	Computers in Mathematics-A Sourcebook of Ideas	15 95	____
____	12E	Impact of Computers on Society and Ethics Bibliography	17 95	____
____	12B	Tales of the Marvelous Machine	7 95	____
____	12G	Computers for Kids-Apple	3 95	____
____	12H	Computers for Kids-TRS-80	3 95	____
____	12J	Computers for Kids-Atari	3 95	____

SUBTOTAL ______

SOFTWARE T-SHIRTS BACK ISSUES

Quan.	Cat.#	Title	Price	Total

Books, Records, Games ______
$3 USA, $6 Foreign Shipping Charge ______
NJ residents add 5% sales tax ______
Magazine subscriptions ______
TOTAL ______

☐ Check or Money order enclosed (U S funds only)
☐ VISA ☐ MasterCard ☐ American Express

____
Card number

____
Expiration Date Signature

Name ______________________

Address ______________________

____

City ____________ State ________ Zip ______

CCBI

creative computing
P.O. Box 2976
Clinton, Iowa 52735

Place
Stamp
Here

creative computing
P.O. Box 2976
Clinton, Iowa 52735

Place
Stamp
Here

Place
Stamp
Here

creative computing
P.O. Box 789-M
Morristown, N.J. 07960


IDSI
PRESENTS
8
4
3
1
14
9
TRICK SHOT
IF YOU LIKED OUR POOL 1.5, YOU'LL LOVE TRICK SHOT!*
* Watch for the "GREAT TRICK SHOT TOURNAMENT"
FOR YOUR APPLE II
IDSI
P.O. BOX 1658
LAS CRUCES, NM
88004 505-522-7373

REMEMBER.

Elephant™ floppies.
They're guaranteed to meet or beat every industry standard for quality. They come standard with reinforced hub rings at no extra cost. They come in every popular 5¼" model, in both hard and soft sector. And they sell at some of the lowest prices in the business.
Elephant Flexible Disks.
They're heavy duty. They work for peanuts.
They never forget. Get yourself a trunkful.

HEAVY DUTY DISKS.

Distributed Exclusively by **Leading Edge Products, Inc.**, 225 Turnpike Street, Canton, Massachusetts 02021
Call: toll-free 1-800-343-6833; or in Massachusetts call collect (617) 828-8150. Telex 951-624.