October 1982
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creative computing

the #1 magazine of computer applications and software

A PRACTICAL GUIDE TO COMPUTERS IN EDUCATION

Pilot to Basic Translator

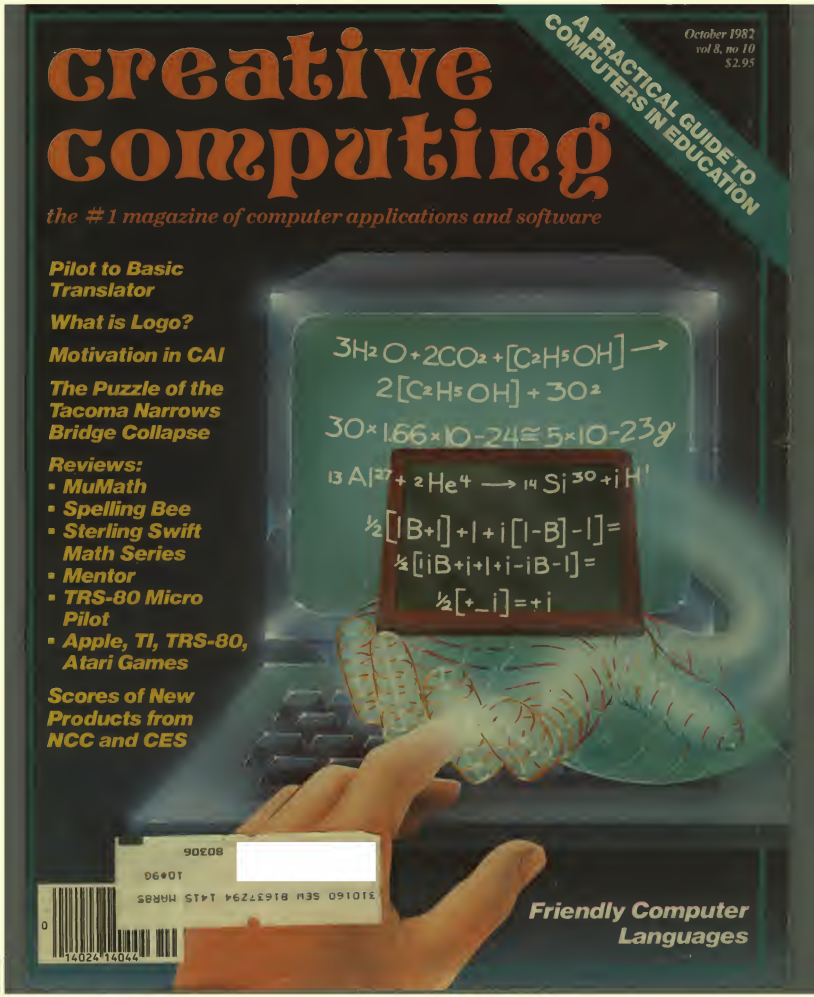
What is Logo?

Motivation in CAI

The Puzzle of the Tacoma Narrows Bridge Collapse

Reviews:
- **MuMath**
- **Spelling Bee**
- **Sterling Swift Math Series**
- **Mentor**
- **TRS-80 Micro Pilot**
- **Apple, TI, TRS-80, Atari Games**

Scores of New Products from NCC and CES



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in this issue...

evaluations & profiles

8 **Elementary Mathematics** ... *Fox*

14 **Factoring Whole Numbers** ... *Coan*

18 **Quiz Time In The Classroom** ... *Fox*
Spelling Bee and Math Competency

26 **MuMath** ... *Shochat*

34 **TRS-80 Micro Pilot** ... *Hardy & Effner*

38 **Mentor** ... *Glenn*
Apple CAI authoring system

55 **Friendly Computer Languages** ... *Muller*
A look at several versions of Logo and Pilot

65 **TI Munch Man** ... *Cashman*

66 **Apple Arcade Games** ... *Ahl*

89 **Dungeons and Asteroids** ... *Small*
Warlock's Revenge and Kayos

92 **TRS-80 Games** ... *Linzmayer & McCracken*

articles

100 **Puzzle of the Tacoma Narrows Bridge** *Zollman & Fuller*
An innovative approach to teaching physics

111 **Logo Ideas** ... *Lawler*

112 **What Is Logo?** ... *Watt*
A teacher offers some answers

134 **The Role of Motivation in CAI** ... *Swenson & Anderson*

140 **How To Solve It** ... *Piele*
Problem solving contest results

155 **The Summer Show Circuit** ... *Ahl*
Report on NCC and CES

186 **The Handicapple** ... *McConnell*
A low cost Braille printer

190 **Who Really Invented the Video Game?** ... *Anderson*
A *Creative Computing* exclusive

198 **Add a Joystick to Your TRS-80** ... *Stanis & Ahl*

202 **Joytricks** ... *Anderson*
Controller modifications for Atari computers and VCS

210 **Introduction to Data Structures** ... *Mitchell*
Searching techniques

296 **The Big Whoops** ... *Payack*

applications & software

226 **Pilot-to-Basic Translator** ... *Smith*

238 **Demonstrating The Gas Laws** ... *Holko*
A chemistry experiment

242 **Animath** ... *Wright & Ollman*
Drill and practice with the Atari

250 **Mortgage Amortization** ... *Green*
How much will it cost?

252 **Double Cross** ... *Johnston*
A Basic double-crosstic

260 **Valley Bomber** ... *Basham*
Destroy the valley, but not the mountains

departments

6 **Input/Output** ... *Readers*

17 **Notices** ... *Fee*

132 **Dateline: Tomorrow** ... *Ahl*

262 **The Other Side** ... *Kewney*
Notes from the UK

264 **The Graph Paper** ... *Luber*
Part four: the end of the beginning

270 **IBM Images** ... *Fastie*
Graphics and speculation

284 **TRS-80 Strings** ... *Gray*
Graphics, DOSes, and help numbers

298 **Personal Electronic Transactions** ... *Yob*
Games, CP/M, and more

304 **Book Reviews** ... *Gray, et al.*
Six books for home and classroom

308 **Retail Roster**

312 **Classified**

314 **Index to Advertisers**

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BPA

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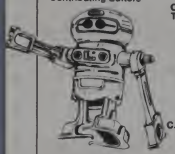

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Intelligential Intelligibility

Dear Editor:

I loved the program in the June 1982 *Creative Computing* "Machine Intelligence: A Function of Human Ingenuity" by C.J. Georgiou. There were, however, a couple of typographical errors:

```
960 IF(V>0) and V<=N) GOTO 980
1140 IF B=1 THEN Q1=0
```

For those of your readers who have personal computers with 80 characters (I have the Super Pet) I have made the following adjustments

```
110 DIM H(20,20), A(8), B(8)
151 PRINT "BE PATIENT IT TAKES TIME!"
152 PRINT
153 PRINT "TO CHECK WEIGHTS IN PROGRESS
    PRESS < RUN/STOP > FOLLOWED BY GOTO 1600"
154 PRINT
160 INPUT "ENTER SIZE OF BOARD <UP TO 20>," N
780 PRINT "----------": PRINT
1635 IF N = 20 THEN 1650
1640 PRINT delete second PRINT
delete lines 1670 —1720 Replace with
1670 S1$ = STR$(S1)
1680 S2$ = "          " + S1$          (4 spaces)
1690 PRINT RIGHT$(S2$,4);
1805 PRINT
1810 INPUT "TRY AGAIN";Q$
1820 IF "Y" = LEFT$(Q$,1) THEN 160
1830 END
```

S.L. Tuohy
748 Midland Rd.
Oradell, NJ 07649

Teed at Coffey

Dear Editor:

As an avid reader of *Creative Computing*, I find the software evaluations most informative. However, I feel I must comment on Michael Coffey's review of *GraForth II*, "A Graphic Language That's Downright Forthright," which appeared in the July issue.

Mr. Coffey mentions the ability to add new words (commands) to *GraForth* as a method to personalize the language. This is belittling one of the most powerful capabilities of Forth-like languages. If this capability were available in Basic, it would be used for more than just giving PRINT the pseudonym of P. In Forth-like languages, one builds commands until the final command built is the finished program. The capabilities of this type of system is awesome.

Another area where I must differ with Mr. Coffey is in the area of printer support and paddle support. In the documentation for *GraForth* supplied by Insoft there is a word (program) called PRINT.BUFFER which will print text for

Another area where I must differ with Mr. Coffey is in the area of printer support and paddle support. In the documentation for *GraForth* supplied by Insoft there is a word (program) called PRINT.BUFFER which will print text for the user. I have used this word, which is only ten lines long, with great success. I have even added it to the basic list of words available in *GraForth*. (Additions to the language can be permanent). Paddle support is also provided by Insoft in the form of the word PADDLE, a three line program.

Additional areas which should be mentioned are sound generation and documentation. *GraForth* has a quite good and easy to use sound generator. Seven different voices are available.

The documentation which comes from Insoft is superb and will get a user up and running shortly after ripping open the package. The quality of the documentation should have received some comment for the review to be complete.

I feel that omitting the areas mentioned above is slighting an excellent product unfairly. Having used GraForth for the last month and a half, I have found coding in the language a joy.

John-Francis Mergen
823 Quince Orchard Blvd. #34
Gaithersburg, MD 20878

Grafix

Dear Editor:

Please note this error in your July 1982 issue:

In the "Graphics Package for the Apple II" by Christopher Hansen on p. 112, there is an error in line 10670. The variable in line 10670, which is shown as C, should be C$.

Otherwise the program runs fine.

Keep up the good work—love your magazine and my Apple II.

Bob Baker
2 High Grove Rd.
S. Yarmouth, MA 02664

Let's Get Normal

Dear Editor:

In the April 1982 *Creative Computing* page 176 Marvin Weingast suggests an interesting method for approximating a normal distribution. Unfortunately his program does not do what he describes. He says, for example, 12.35% of the time X=1.5*(A+B-1) where A and B are uniformly distributed random variables which vary from 0 to 1. But in the program line 50 he uses A to determine the times when this formula should be used. Thus to get to X=1.5*(A+B-1) A must be between .8765 and 1. B still varies between 0 and 1. The resulting distribution is quite different from that intended.

The variable used for the test must be independent of the values used in the functions.

To correct the program:
In line 30 Add D=RND(1)
Change Lines 40 and 50 to read

```
40 IF D<.8765 THEN X=2*(A+B+C-1.5)
50 IF D=>.8765 THEN X=1.5*(A+B-1)
```

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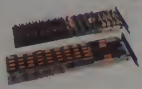

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CIRCLE 287 ON READER SERVICE CARD

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More Than Drill and Practice

Annie Fox

creative computing
SOFTWARE PROFILE

Name: Elementary Mathematics
Classroom Learning System
Set 1-Whole Numbers

Type: CAI

System: 48K Apple, 3.3 DOS

Format: Disk

Language: Applesoft Basic

Summary: great

Price: $495

Manufacturer:
Sterling Swift
1600 Fortview Rd.
Austin, TX 78704

Boy, am I excited! After looking at "educational" software since 1977 I have finally seen a program for microcomputers which is really worth something. I'm referring to Sterling Swift's *Elementary Mathematics Classroom Learning System*. I was ecstatic to find that somebody is creating quality educational software. Although this review pertains to the English Language Version of Set 1 - Elementary Mathematics (Whole Numbers), Sterling Swift also publishes another set dealing with fractions and decimals. Both sets are also available in Spanish.

To begin with the documentation is an outstanding "user manual" which presupposes no prior knowledge of computers. The binder which accompanies the set of six diskettes contains everything a teacher needs to know about using the package.

Annie Fox, 35 Aries Lane, Novato, CA 94947.

Specific hardware requirements are prominently displayed on page one of the manual (unlike some software products which print system requirements only on the diskette label).

The manual is nicely printed (typeset) and extremely well organized. Clearly defined objectives as well as the step-by-step sequence of events for each lesson are provided. One particularly welcomed addition is the abundance of screen display illustrations.

Help comes in the form of a little droid-like character who skitters across the screen and gives the student just the right piece of information at the appropriate time.

The package contains a management diskette which enables the teacher(s) to enter the names of a maximum of 200 students who can be grouped in five different sections (the children would most probably be grouped by age, grade or achievement level). After each student's name and group name have been entered on the management disk, the simplest of instructions ("Now place the Addition disk in Drive #1 and press RETURN") tells the teacher how to create a file for each student on each of the math disks.

Once all of the students have been entered (new students can easily be added and old ones deleted) the student is ostensibly on his own.

The student chooses a math operation (strand) on which to work, by selecting the Addition, Subtraction, Multiplication or Division diskette and placing it in drive #1. (I personally feel that students should be competent in operating computers and responsible for loading disks. However, since the disks from this package are not copyable and replacement disks are sold for $9.95 each after the 90 day warranty period expires, some schools might wish to prevent potential disasters by not allowing the students to handle the disks at all).

Once the disk has been loaded, the student is asked to log in with his name, group name and secret password of his own creation. This procedure insures the authenticity of the student's work and the confidentiality of his records.

The student takes a diagnostic test which enables the program to place him at the appropriate achievement level when he first enters the system. The first portion of the test is timed; the second is not. In neither case does the student receive any feedback for individual responses during the testing session.

When the competency test is over, the student is informed of the number of correct responses he gave. The computer then indicates at which of the six lessons within the strand the student is to com-

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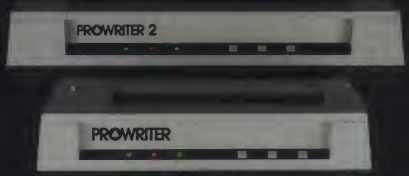

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Airsim is a trademark of Mind Systems Corporation

Space War.

Slam Dunk.

mence his work the next time he signs on to the system, which could be immediately or in two weeks time.

Lessons

The Lesson section, complete with a built-in tutorial is where this math package really shines. It is the closest thing I've ever seen to having a good teacher standing right there beside the student, leading him through a math problem step by step.

I have test driven other programs which claimed to be "educational" and some which even had the audacity to call themselves "instructional," but for the most part they were only effective in the area of drill and practice. This *Elementary Mathematics Classroom Learning System* actually does some teaching. Here the student who is having difficulty with the concept behind the math problem can receive some valuable help from the computer.

The most salient feature of this package is its consistent quality.

The help comes in the form of a little droid-like character who skitters across the screen and gives the student just the right piece of information at the appropriate time. For example, if the student is faced with a subtraction problem such as:

```
 96
-  9
```

and he places an incorrect digit in the ones column, the computer will draw out the 96 so that it is re-written as nine tens and six ones. Then the little droid will walk across the top of the screen, and "borrow" one of the tens (changing the 9 to an 8) and "carry" it over to the six in the form of a little 1, placing it directly beside the six so it becomes sixteen. He will then point to a message which simply states "I traded a ten for 10 ones in the top number."

Tutorials

The tutorial sections of each of the four strands are equally well presented. For example, if the student is having trouble with 4 x 5, our droid friend obliges by transforming it to an addition problem complete with four groups of five squares which the student can physically touch and count if he likes. It would have been an absolute pleasure for a non-math person like myself to have learned it like this back in elementary school. Who knows what mathematical heights I might have reached?

After the lesson has been completed, the student is given a report of his score and the option of repeating the drill cycle. If he chooses to end the lesson, a timed mastery check cycle begins. Each lesson objective has a "mastery criterion" ratio (correct responses/total problems) which must be achieved before he can advance to the next lesson. As always, the student is given a report of his performance and advised as to which lesson he will be working next time.

Although the graphics in this package are not in color (which seems a shame since it was written for the Apple), they are excellent and the animation is really delightful. I happily noted the use of upper- and lowercase text as well as inverse video for a varied display.

Also, for the sake of variety, the entire screen is used and you never know where the droid and the next problem will pop up next. Likewise, the acknowledgements and the accompanying animation which the student receives for correct responses are varied and randomized which adds a nice element of anticipation.

Games

Provided along with the Management disk and the four mathematics disks is a Games disk which contains two games, Slam Dunk and Space War. These games deserve special mention because as math

games go they are really quite good. They are designed to provide further opportunity for mastery of math skills.

Slam Dunk is a basketball-type one-person competition in which the player's ability to answer math problems (of the operation of his choice) determines the outcome of the shot to the basket. Get the answer right and the ball sails through, miss and it bounces off the backboard.

Each game lasts for a 30 second period (which is an excellent feature in a classroom situation where without a time limit a student might not have the self-control to give his classmates a turn). Incorrect response causes the clock to stop and the correct answer to be displayed on the screen.

When the clock starts again, the next problem the student must solve is the same as the one he just missed. The student's performance is rated on the number of correct responses given within the game period.

The second game is called Space War, and is not nearly as trite as the title sounds. In this game, two players race to solve identical addition and subtraction problems by dialing and entering the correct digits with the Apple game paddles. Incorrect digits are not accepted.

The first player to solve the problem correctly gets one point and the opportunity to deliver a phaser blast to his opponent's ship. Three points wins the game. It's a good test of math skills in addition to being great fun.

Although Slam Dunk can be used by any student who first signs on to the system, because the problems in Space War are more difficult, Sterling Swift recommends that it be played only by students who have demonstrated mastery of a strand.

How Many To Buy

So if you are interested in this kind of set up for your school what do you need? Well, according to the table included in the documentation, if you have between one and four computers (and we'll assume you already have them), you can get by with one set of diskettes.

If you have from five to eight computers you need two sets. And if you have nine to twelve computers you need three sets.

The first set costs $495 and each additional set (of the same version and "purchased and billed to the same account") is $295. This package is not inexpensive. School budgets being what they are, it probably would represent a sizable investment for an individual school or district. To lessen the risk of purchasing the product and finding it isn't what you want, a demonstration disk of the package can be purchased for $6 which will be applied towards the purchase price of the package if you decide to buy it. But because of the comprehensive nature of the package it certainly seems that the students could greatly benefit by the inclusion of this kind of computer assisted instruction in a traditional math curriculum. The most salient feature of this package is its consistent quality—quality which could only have been achieved by fine educators who knew what they wanted, working in conjunction with gifted programmers who knew how to create it. □

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creative computing software evaluation

Math For Older Students

James S. Coan

creative computing
SOFTWARE PROFILE

Name: Factoring Whole Numbers

System: TRS-80 16K, 6 tapes
TRS-80 Model I 32K,
3 diskettes,
TRS-80 Model III 32K,
3 diskettes,
Apple 3.2 32K,
3 diskettes,
Apple 3.3 Vers. 2.0 48K,
3 diskettes
Pet 16K, 6 tapes
Pet 16K, 3 diskettes

Summary: Twelve interactive lessons, games, and exercises

Price: $90

Manufacturer:
Quality Educational Designs
P.O. Box 12486
Portland, OR 97212
(503) 287-8137

The promotional material for *Factoring Whole Numbers* states: "These are highly interactive programs that your students will enjoy. Each lasts about 20-30 minutes depending on student responses. Pacing to suit the individual 'talking' to the computer is built into the programs so that the student succeeds as learning occurs. The Series is appropriate as new material for students in the upper elementary and junior high schools, and for review or remedial work at the secondary or junior college level."

I have the Apple Version 2.0 programs for 16-sector 3.3 DOS. This comes on three diskettes, each of which contains four well designed factoring exercises.

James S. Coan, RD #1, Box 149, New Hope, PA 18938.

Documentation

The software comes in a nice three ring notebook. The diskettes are in plastic jackets at the back. You get a title page, a single CPU software license, and five pages devoted to the teaching material itself. Non-profit educational institutions may purchase permission to make copies for additional CPUs. None of this material is required for the student. It is intended for the teacher.

However, there is no discussion of how to get the teaching material running on the computer, nor is there any mention of how to terminate a session.

Figure 1.

Diskette One
Introduction
1A Factor Pairs
1B The Rectangle Game
2A Pairs and Squares
2B Guess and Test

Diskette Two
Introduction
3A Primes and Composites
3B The Sieve of Eratosthenes
4A Exponents
4B How Many Factors

Diskette Three
Introduction
5A Highest Common Factor
5B The Euclid Game
6A Least Common Multiples
6B Factoring Finale

The Programs

The user soon learns that the display screen is set up for upper and lower case letters using the Apple hi-res graphics screen. The menu offers to run any of the programs on the current disk, and makes instructions optional. Each program has a nice leading hi-res display screen. Responses are ended by pressing Return. For word responses it is sufficient to enter the first letter only.

Figure 1 shows the contents of the three disks. Each A program introduces the topic and provides some practice. Each B program is designed to extend the concept and encourage the student to explore further. Most of the B programs finish up with a game or contest involving two or more students.

To quote the author: "Some of the B programs go beyond the standard junior high curriculum. These are designed to preview, in an informal fashion, ideas which will be important in later mathematical work." The material seems to do this very well.

Each lesson/exercise/game is designed to accommodate a wide range of skill levels within the topic being presented. Many of the instructions are optional. The display speed is user-controlled. Some of the games may involve up to six students.

The package is definitely user-friendly. All responses which one might expect are well fielded by the programs. Wrong answers are handled very well.

The analysis of responses is quite complete. It notices illegal decimal numbers,

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numbers too high, numbers too low, and illegal negative numbers, and requests, "Number please" when all else fails. It even handles responses such as 1.4E1 when the correct response is 14. This is well done.

There is never a sarcastic word in this package. Right answers are treated with enthusiasm, while wrong answers are handled in a supportive way. The whole idea is to promote successful progress through the programs.

Often a program will offer to explain a concept. This provides the first time user a chance to get the maximum instruction, and allows the repeater to pass over unwanted detail.

Some of the programs ask questions designed to assess just how appropriate this lesson is for the student at the time. If the user's responses are reasonable, the lesson proceeds. If his responses are clearly out of line, the program suggests another lesson to be studied and returns to the menu.

All questions recognize Q as a request to select another program. Ctrl-C or Reset at any time also returns the user to the menu.

Each diskette may be run independently by either turning the Apple on with it in the disk drive or by typing in #S (slot). One can easily move from one diskette to the next by placing the next one in the disk drive and issuing the Q request. There is no direct method offered for ending a session. The user is expected to turn the Apple off.

The optional instructions are well paced. The screen is presented a few lines at a time. Each screen is frozen in place with "Press return to continue" displayed on the bottom line.

I have selected a few sections to review here in detail.

Diskette One

Introduction: The introduction explains how to use the computer. The student is offered the option of all upper case or upper/lower case display. He can even control the time delay between sentences displayed on the screen. (It is assumed that the user has been able to put the disk in the drive and turn the machine on.)

1A Factor Pairs: Factoring a whole number into a factor pair is presented as finding the possible lengths and widths of a rectangle with a given area. It is recommended that you obtain 100 square floor tiles. Clearly you should get the little 1 inch by 1 inch ceramic ones. Alternatively you could cut cardboard squares. The student uses these squares to form rectangles and come up with areas and, later on, perimeters.

Diskette Two

3B The Sieve of Eratosthenes: This is an excellent treatment of the topic. The sieve is beautifully illustrated on the screen by actually crossing out all multiples of the most recently discovered prime. The student is asked for the first number to cross out and the computer does the rest. It is fun to watch.

In addition we learn when Eratosthenes lived and a little about Euclid as well. We learn about Twin Primes, Palindrome Primes, and even Goldbach's conjecture. (All even numbers can be written as the sum of two primes, one (1) may be used for this.) All in all, a math teacher's dream.

4A Exponents: This one very nicely teaches why exponents are useful by demonstration. If you properly factor 128, the program next asks if you want to try 16384. If you say "yes," the author is definitely up to the challenge. On the other hand, if the student repeatedly fails to get right answers, the program apologizes and returns to the menu. Clearly not threatening or intimidating at any level.

There is something in these programs for a wide range of students. Any teacher who has a computer which will support these programs and who teaches Factoring Whole Numbers will want to use them. □

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tices...notices...notic

Correction

Due to a printing error, Line 653 of "Zeno's Space Ships" (August 1982, page 170) is incorrect. The line should read: 653 PRINT ";"

New Journal Calls for Papers

A new quarterly, *The Journal of Computers Reading & Language Arts* (CRLA) is ready to receive papers. The purpose of the journal is to support the rapidly growing interest in computers and their relationship to reading, language arts and related issues.

The journal will be pragmatic in perspective, and will emphasize papers which have clear classroom/teaching implications.

The journal will be interdisciplinary and directed toward an audience of reading-language arts teachers, educational specialists, classroom teachers, educators of teachers and educational researchers.

Papers or requests for information should be sent to Gerald H. Block, CRLA, P.O. Box 13039, Oakland, CA 94661.

Graduate Fellowship

The Charles Babbage Institute for the History of Information Processing is accepting applications for a Graduate Fellowship to be awarded for the 1983-1984 academic year to a graduate student whose dissertation will be on some aspect of the history of computers and information processing.

Residence can be at the home academic institute, other research facility where there are archival materials, the Babbage Institute, or some combination of these. There are no restrictions on the location of the academic institution which will be the venue for the Fellowship. The stipend will be $5000 plus an amount up to $2500 for tuition, fees, travel, and other research expenses.

For more information, contact the Charles Babbage Institute, University of Minnesota, 104 Walter Library, 117 Pleasant St. S.E. Minneapolis, MN 55455, U.S.A. by January 15, 1983.

More tips from the authors of Beneath Apple DOS . . .

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By Don Worth and Pieter Lechner

Now there is more from the authors of the best selling book ***Beneath Apple DOS***—four comprehensive utility programs on diskette and **over 100 more pages** of valuable information about the Apple II's disk operating system.

BAG OF TRICKS is useful to beginners and experienced programmers alike. It includes many "hand holding" tutorials that assist you in repairing damaged diskettes and allow you to change sector ordering, reconstruct blown catalogs, etc. etc. etc. At the low price of $39.95, BAG OF TRICKS is one of the best software values ever.

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Quiz Time in The Classroom

Annie Fox

Spelling Bee from Edu-Ware is a well organized spelling package for kindergarten through third grade students. It was thoughtfully designed by people who seem aware of the problems inherent in a computerized spelling tutorial for classroom use.

I was particularly impressed with both the ease with which the teacher can become involved without any prior computer experience and the flexibility of the program in the area of setting parameters tailored to the individual student.

Spelling Bee consists of several different "modes" plus eleven units of spelling words (each accompanied by a line drawing). Three of these spelling unit categories are: "Simple 2 and 3 letter words," "Hard c's and silent e's," and "One syllable with Dipthongs" (which is really spelled "Diphthongs" and which just goes to show that even people who write spelling programs never outgrow the need for good spelling skills). In the Demonstration Mode the teacher may choose one of the spelling units and preview it.

The Learning Management Mode permits the teacher to enter the student's name, the spelling unit(s) on which he is to be tested, and the number of words to be chosen from each unit. This last feature is a very nice option in that it allows the teacher to take the child's attention span into consideration when setting up a test situation.

The Tutorial Mode gives the student an opportunity to practice spelling each of the words in the unit (after having seen them flashed briefly one at a time) without having his errors accepted by the computer or displayed on the screen.

Annie Fox, 35 Aries Lane, Novato, CA 94947.

Drill Mode

The Drill Mode is the electronic equivalent to the old Friday morning "Class, are you ready for this week's spelling test?" With the parameters previously set in the Learning Management Mode the teacher has designed a test for a student based on his individual needs.

creative computing
SOFTWARE PROFILE

Name: Spelling Bee
Type: CAI
System: 48K Apple II, DOS 3.3
Format: Disk
Language: Applesoft Basic
Summary: Cute
Price: $39.95
Manufacturer:
Edu-ware
28035 Dorothy Dr. #200
P.O. Box 2222
Agoura, CA 91301

If Jennifer needs practice with her diphthongs (which are, by the way, complex vowel sounds made by gliding continuously from the position for one vowel to that of another all within the same syllable, e.g., chain, boat, toy), that's just what she will get.

After the Drill Mode is completed the student's score is recorded and reviewed at the teacher's convenience. Since the computer keeps track of precisely which words were and were not spelled correctly the teacher is in a good position to pinpoint potential spelling problems and provide remediation.

Positive reinforcement is certainly a necessary element of the learning process. In this program, the reinforcer for a correctly spelled word takes the form of a point placed underneath a smiling face and a few bars from a familiar children's song. Although this is a nice touch, the graphics could have been a bit more spectacular.

As was mentioned before, in addition to the spelling words which are provided for the student, *Spelling Bee* also displays a drawing paired with each word. The pictures were included in adherence to the sound premise that learning takes place as the learner makes the transition through concrete concept (picture) to abstract, symbolic representation, (written word). Let's talk about these drawings for a moment.

I am one educator who heartily approves of the introduction of fun into learning, and trying to identify computer drawn pictures is fun. Some of the pictures, however, are difficult to decipher.

If the word to be spelled is determined by the student's ability to identify the corresponding picture, there could be problems. For example, the "oval" in the program could easily have been a drawing of an egg. (Which is what several of my young friends guessed it to be.) Likewise, one morbid individual thought the "swing" was a scaffold, and another was sure it was "two chicken feet."

I mention this not to nit-pick but to point out that this kind of ambiguity

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Software author Peter Fokos has created Alien Ambush, a space age nightmare. This hi-res, full-color arcade game is written completely in assembly language to give those nasty aliens every advantage.

So if you have access to a 48K Apple* with DOS 3.3, and you're hot for some new thrills, Alien Ambush was written for you. But be warned: It just got a lot tougher to survive in space.

Available at finer computer stores everywhere. *Apple is a trademark of Apple Computer, Inc.
Distributed exclusively by Micro D, 17406 Mt. Cliffwood Circle, Fountain Valley, CA 92708 (714) 540-4781

CIRCLE 206 ON READER SERVICE CARD

provides built-in frustration for the young child. After all, how can he spell a word correctly, if he doesn't know what word he is supposed to be spelling?

Two of the spelling units in the Demonstration Mode Menu were labeled "Multisyllable words." I guess strictly speaking, "multi" means more than one, but of all the "Multisyllable" offerings only one (butterfly) had *more* than two syllables, and one of the words (stairs) had only

Spelling Bee.

one. (I'm sorry, but no amount of facial contortions allows me to get more than one syllable out of that word without sounding like a throwback from the Beverly Hillbillies.)

Also, for some reason "magnet" and "pliers" are found in the unit called "Simple multisyllable words," while "apple" and "table" are considered "Complex multisyllable words." These are minor points and in no way devalue the program as a whole.

Documentation

Although the documentation for *Spelling Bee* was complete, it was contradictory in places and rather confusing in the sections describing how to enter the Learning Management Mode. I talked to the people at Edu-Ware and was advised that all of their documentation "is being rewritten to be easier to understand for the customer."

Spelling Bee is not a perfect product. If there were some way for the teacher to add words and pictures to the existing spelling lists in the program it would be improved markedly. It is, however, definitely a good spelling package for the money and any school which is lucky enough to have a computer would do well to include this program in its educational software library.

Math Competency Series

This program also goes a long way in permitting the teacher to vary the parameters of each of the math games. Since students are people and people are individuals it makes sense to be able to alter programs to fit the individual. Specifically the Zeitgeist package allows modification of Student's Required Response Time, Problem Type and Problem Difficulty, Duration of Game and Help Messages.

To make the practice of mathematical skills more inviting, the Zeitgeist people have attempted to appeal to the game player who dwells within every student. (Certainly a good idea, and bound to be more entertaining than flash cards.) In keeping with "the spirit of the times" they chose to model their programs after the hottest computer game genre: Space Games.

Before we delve into the specifics of these games, it should be noted that the descriptions given below do not match the visual display of the actual game, by any measure. Any child reading his student guide and preparing for a Star Wars-like space adventure is in for a cosmic disappointment.

According to my dictionary *Zeitgeist* means "spirit of the age, trend of thought and feeling." Perhaps the company's founders felt that they would christen their enterprise with a name which would describe their reason for existence, which, according to the cover of their documentation involves "creating a better world in which to learn" (using computers, I assume).

The four programs in the *Zeitgeist Math Competency Series* are designed for "drill, practice and enrichment." The intended audience is elementary and junior high school students, although the programs could certainly be used successfully for high school students or adults in need of math remediation.

These programs do not really *teach* mathematical concepts at all, and this should be clearly understood by anyone who is contemplating using them for this purpose. A child who does not understand the concept of addition is not going to succeed in solving "12 + 12=?" despite the presence of colorful space maps.

Math concepts are learned from discovery, manipulation of materials, visual demonstrations and determined teachers who are willing to try any and all combinations of the above until concepts become clear. Computer math programs are available in that they serve the function of *reinforcing* concepts and skills which the student already possesses.

Creative Computing
SOFTWARE PROFILE

Name: Math Competency Series
Type: CAI
System: 48K Apple II, Applesoft in ROM, DOS 3.2 or 3.3
Format: Disk
Language: Applesoft Basic
Summary: An average CAI math program
Price: $174.50 for 4 diskettes
49.50 single disk price
Manufacturer:
Zeitgeist
5150 North 6th St. #179
Fresno, CA 93710

Documentation

The documentation for the series is beautifully printed, complete and well organized for easy reference. The textured paper adds a touch of class. The student guide is excellent as it provides the learner with everything he needs to know about using the program (from turning on the TV to loading the diskette and rebooting if necessary). The inclusion of this kind of clearly written student instruction is rare among educational software packages, and yet what could be wiser?

Educational computer programs are, for the most part, designed for independent student use. If students don't know how to operate computers, they miss the opportunity to work on their own and teachers become overburdened. The more self-sufficient the student at the computer can be, the easier the use of computer-based instruction in terms of classroom logistics.

Another positive aspect of the Zeitgeist package is the Help Messages which accompany each of the games. These were written for the student to assist him in solving the type of problems with which he is currently working. They are composed of step-by-step procedures for the solution of certain math problems and the student must be able to generalize the rule to apply it to the specific problem with which he is having trouble. These Help Messages would serve well the student who simply needs to be reminded of a specific "how-to" portion of solving a problem. The student who is feeling confused and utterly lost probably needs more help than the Help Messages can offer.

Invader Round Up

The first game in this series is called Invader Round Up. Here the student must collect a certain number of invaders who have had the misfortune of wandering into a guarded quadrant.

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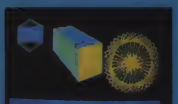

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and checks answers. The correct answer causes a laser beam to zap the invader off the screen (the instructions say he is being kept in a holding area for relocation). Miss the problem and the invader escapes. When all of the invaders have been captured, the screen displays a space transport that zooms off into nothingness, presumably carrying all of the aliens to a distant galaxy.

Space Scanner

Next we have Space Scanner in which the student is a navigator during an impending alien attack. In order to determine the correct intercept on a Battle Map the student must successfully multiply or divide whole numbers which are called warp and vector values. If the answer to the problem is correct, the enemy ship is destroyed.

After five correct answers the enemy battle star is attacked and demolished. If the intercept is not correct, however, the enemy fighter will fire at the student's ship and inflict 20% damage to the shields. Five wrong answers and that's the end of that interstellar vessel.

In the final two games of this package the student is rewarded with a game within a game. That is, when the math problems are successfully completed, he can use the computer keyboard to control objects on the screen in a similar manner to video arcade games.

Invader Attack

Game number three is Invader Attack in which the student commands a damaged star cruiser with an inoperative photon engine. The student must regulate

Math Competency.

the amount of fuel force by solving math problems which involve the addition or subtraction of fractions. When a problem is solved correctly the cruiser advances toward the star base. When one is missed, an encroaching enemy ship menaces forward.

The game is won by reaching the star base. If the student gets to the star base first, all is saved and a primitive video shoot-out commences. If the enemy arrives at the star base first it's all over for the good guys.

Space Mouse

The final game of the series is Space Mouse, the only one that does not involve defending oneself against attacking aliens. Instead, the student takes on the role of a space biologist trying to catch a rare space mouse, presumably for the purpose of observation and study.

The mouse trap is baited with molten cheese when the student successfully solves multiplication and division of fraction problems. When the mouse is caught the student is rewarded with a chance to race him through a maze, which is nerve-wracking but fun.

Playing space-oriented math games would probably serve as a high motivator only for a majority of male students. My four years of experience with thousands of students in free choice computer games situations leads me to the very definite conclusion that most girls do not care one ion about space games. So for girls (who might not be crazy about math to begin with), something needs to be created that would appeal to them as well.

The choice of space games might be a poor one for another reason. If Fried Chicken Supreme serves undeniably the best chicken in the world do you sell chicken when you open your new specialty restaurant next door? Only if you're incredibly naive (or maybe not too bright). Educational games manufacturers have some competition from video games that is tough to beat. If the competition is creating incomparable space games then the educational software people might be wise to create anything *but* space games.

Let's face it, drill and practice of any skill can be pure drudgery. Spending time with the *Zeitgeist Math Competency Series* is much more fun then flipping through a stack of flash cards. On the other hand, there must be a more creative way to involve students in the practice of math skills than what I presented here.

In spite of the superb documentation and clever game ideas, this package does not succeed because the execution of these ideas leaves much to be desired. If a programmer with superior skills in computer animation had tackled these games, the result would have been praiseworthy and priceworthy. □

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David D. Shochat

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SOFTWARE PROFILE

Name: muSimp/muMath-80
Type: Symbolic mathematics programs
System: CP/M, Apple, TRS-80 48K
Format: Disk
Language: Machine
Summary: "Lisp-like" math language
Price: $250
Manufacturer:
Microsoft
10700 Northup Way
Bellevue, WA 98004

The following is a revision of a review of muSIMP/muMATH-79 which originally appeared in SIGPC Notes vol. 4, no. 1/2.

About 20 years ago, I had the opportunity to see a real computer, an IBM 709. When I asked whether it could do calculus, I was told that a digital computer could do numerical differentiation and integration, but that symbolic manipulation of the function definition was inherently outside the domain of the computer.

The muMath software package, developed by Albert D. Rich and David Stoutemyer of the Soft Warehouse and available through Microsoft for 8080/Z-80 disk systems (and now Apple II as well), can do a surprising amount of calculus symbolically, the way you learn to do it in a calculus class. For example, *muMath* can integrate

```
(1 + X^2)*(1 2)
```

in about seven seconds (on my 2 MHz Z-80 CP/M system). *muMath* can also do exact rational arithmetic, with (up to) 254-byte integers in any number base to 36, a great deal of algebra, some symbolic trig and even matrix algebra: *muMath* will find the inverse of

```
{[1. 2].        or of        {[a. b].
 [3. 4]}                      [c. d]} .
```

Getting all of this to work on a microcomputer with only 64K (or less) is impressive, to say the least. The secret is modular construction. You load only part of *muMath* at a time. It is unlikely, for example, that you will need to do matrix inversion and integration at the same time. The precious memory resources must be used as efficiently as possible, a fact which reflected in the ritual of building and saving the system.

To get started, execute MUSIMP.COM. The muSimp interpreter is loaded in, a sign on message is printed, and the muSIMP "?" prompt appears.

muSimp is the Lisp "surface language" in which *muMath* is written. You may respond to the prompt in several ways.

1. You may make an assignment:

```
S:  13;        (cr)
```

muSimp's response here would be:

```
@: 13
?
```

2. You may use an existing function:

```
D: S * 4 ;        (cr)
@: 52
?
```

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3. You may define a new function. (Every line of user input is terminated with a carriage return):

```
FUNCTION COMBS (N, K),
  WHEN K = 0, 1 EXIT,
  N * COMBS (N-1, K-1) / K
ENDFUN $
? COMBS (D, 5);
@: 2598960
?
```

The definition of COMBS, which computes the number of combinations of N things K at a time, shows that recursion is allowed.

```
LISTEXAMPLE: '((1 ONE) (2 TWO)
  (3 THREE)) &
@: ((1 ONE) (2 TWO) (3 THREE))
? FIRST (LISTEXAMPLE) &
@: (1 ONE)
? REST (LISTEXAMPLE) &
@: ((2 TWO) (3 THREE))
? REST (FIRST (LISTEXAMPLE)) &
@: (ONE)
? REST (REST (FIRST (LISTEXAMPLE))) &
@: FALSE
```

(the name FALSE is equivalent to the empty list)

```
? FUNCTION MAPFIRST (LIS),
  WHEN EMPTY (LIS), FALSE EXIT,
  ADJOIN (FIRST (FIRST (LIS)),
    MAPFIRST (REST (LIS)))
  ENDFUN $
? MAPFIRST (LISTEXAMPLE) &
@: (1 2 3)
```

The use of the "&" as a termination symbol instead of ";" indicates to the DRIVER function, which contains the main interaction loop, that the result of the computation should be printed as a list, rather than as a mathematical expression in standard mathematical notation. A "$" means the result should not be printed at all.

```
EXPRESSION: X + Y $
? EXPRESSION ;
@: X + Y
? EXPRESSION &
@: (+ X Y)
```

Internally, only the latter (list) form really exists. But this is almost totally transparent to the user. The DRIVER function mentioned above gets its input through a function called PARSE, which normally expects all of *its* input to be in non-list notation. It is this PARSE function that really defines the difference between muSimp and normal Lisp.

For example, if PARSE sees FUNCTION in the input stream, it translates everything from there to the next occurrence of ENDFUN into a list, which is essentially the Lisp equivalent of that function definition.

In Lisp, everything is a list, including function definitions. In muSimp, PARSE translates both standard mathematical notation, and MuSimp syntax itself into list/Lisp form. So the difference between muSimp and normal Lisp exists only "at the surface."

When PARSE sees a single quotation mark, two things happen. First, it reads what follows in normal list notation. Second, it adds the QUOTE function name onto the expression, which causes the expression to be "taken literally," rather than being evaluated. Thus in the definition of LISTEXAMPLE above, even if we had previously made an assignment

```
ONE: UNO $ ,
```

LISTEXAMPLE would still contain only ONE, rather UNO.

Once a function definition has been made, it becomes a part of the system, which can then be called upon by other function definitions. And that's how you bring *muMath* into the picture, because new function definitions (and other kinds of valid muSimp input), can be read in from disk as well as from the keyboard. For example, if you type:

```
RDS (ARITH, MUS);
```

with the source file ARITH.MUS on the disk in drive A, all the muSimp source code constituting ARITH.MUS will be read in and made a part of the system just as COMBS and MAPFIRST were. Now you can do:

```
1/2 + 1/3 ;
@: 5 / 6
```

muMath is a collection of 15 muSimp source files, all but one of which depend on certain other source files being "in" at the same time. To do definite integrals, for example, you must load in five of these source files.

Any time you want you can save the state of the system on disk including (in internal form) all the muSimp code read in so far, just by typing

```
SAVE (<name>) $
```

(with a disk with enough free space in drive A), where <name> can be any available primary file name for your DOS. muSimp will create a special memory image file with primary name <name> and secondary name SYS. Then you can come back any time and just by typing (while in muSimp):

```
LOAD (<name>) $ ,
```

you will be right back where you were just before the SAVE. Or, another way to do it is to type:

```
MUSIMP <name>
```

as a DOS command, in which case muSimp will LOAD <name>.SYS for you before entering the DRIVER loop.

The package comes with ten other source files which are 90% comments. These are the lesson files, which are so well-written they make the process of learning to use the system a great deal of fun. The lesson files are read in like any muSimp source file, but they are echoed at the console and consist mostly of comments, delimited by matching percent signs. Every once in a while, the lesson gives you an exercise to do, ends the comment with a "%", and then makes the assignment:

```
RDS: FALSE $
```

That stops the input from the disk and gives you control of the system to do your exercise. When you're done, you type:

```
RDS: TRUE $
```

and the lesson takes over again. The lesson may also stop being a comment long enough to do an example, providing actual muSimp source to the system. This example may, in turn, depend upon function definitions which you added to the system while doing a previous exercise.

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muMath, continued...

It all works beautifully as long as you don't try to stop in the middle of a lesson and save what you have done so far. It is possible, but tricky: you must refer to the printed copy of the lesson to see what "finishing up" operations it would have done, do them through the keyboard, and finally SAVE a memory image as usual. When you come back, you will still have to run through the lesson file from the beginning, but now you can skip the exercises you have already done.

Five of the lessons teach the use of those features introduced to the system by the ARITH and ALGEBRA files of *muMath*. After completing them, you can use the other *muMath* files without much difficulty, with the aid of the printed documentation.

The remaining five lessons teach the muSimp language — to a point. The trouble is, they are so beautifully written, you will feel somewhat lost when, after the fifth lesson, you must start learning from the printed documentation, which is much more terse than the lessons. The lessons really "take you by the hand"; the printed material works in a way which is actually similar to the way the system is structured internally: defining itself in terms of itself.

It was a frightening experience at first, trying to learn from the printed discussion of muSimp, but I finally got used to it. After a year and a half, I think I can appreciate the concise style.

The documentation has been improved considerably, since the original muSimp-79 version, but there is still room for improvement. The function READ is not documented at all (probably an oversight).

Considerable information is included about the various property lists used by PARSE, but the definition of PARSE itself is missing—I had to dig out the internal (Lisp) form to see how it works. And it is only by seeing how PARSE works, that some of the documentation which *is* included becomes intelligible.

muMath can handle a wide variety of symbolic math problems, so whenever it fails to come up with an expected solution or simplification, it leaves you wondering why. The only way to find out *why* is to delve into the source files themselves and uncover the methods used by *muMath*. I've also found this to be one of the best ways to learn about important techniques which are not discussed in the lessons or in the printed documentation (such as storing function definitions on property lists).

Another interesting approach is simply to experiment with *muMath*. In the examples which follow, the symbol " → " will mean "simplifies to."

```
8^(1/2) → 2^(3/2),
```

but

```
343^(1/2) doesn't simplify.
```

This is because ARITH works with a very short list of primes: (2 3 5). If you reassign:

```
PRIMES: '(2 3 5 7) $
```

then,

```
343^(1/2) → 7^(3/2).
```

Some complex arithmetic is possible (#1 is i):

```
(1 + #1)^2 → 2*#1,
```

but

```
(2*#1)^(1/2)
```

appears to be too much to ask, even with both trig files loaded.

With the LOG file loaded,

```
LOG (2^X, 2) → X,
```

(the second argument is the base), and

CIRCLE 299 ON READER SERVICE CARD

LOG (8, 2) → 3

(an improvement in the latest version).

muMath forces the user to do a certain amount of crucial decision-making by setting what are called control variables. For example, if the control variable NUMNUM has the value 2,

2 * (X + 1) → 2 + 2*X,

and if NUMNUM is −2,

2 + 2*X → 2 * (1 + X).

If NUMNUM is 30,

(X + 2) * (X + 3) → 6 + 5*X + X^2,

but, and this is perhaps the biggest weakness of *muMath;* it cannot factor even a simple quadratic such as the one above. And yet, with the equation-solving files loaded,

SOLVE (X^2 + 5*X + 6 = = 0, X) →

{X= = −2,

X= = −3} .

even though the former task is easily reducible to the latter. The manufacturer says (in one of the lessons) that they are working on it for future releases.

You would expect:

X/(X*Y) → 1/Y,

but one day I couldn't seem to make it happen. I finally realized that the problem lay with the control variable EXBAS which needs must be a positive multiple of 2 in order for the cancellation to work. Now EXPBAS being a positive multiple of 2 is supposed to allow such things as:

(X*Y)^2 → X^2 * Y^2.

In order to make sense out of all this you must realize that internally, a fraction A/B is equivalent to A * B^-1 (actually the list: (* A (^B -1))), so the X*Y in the denominator of the cancellation example is really a factor of the form: (X*Y)^ 1, which explains why the state of EXPBAS is so crucial, in a problem which seems to have nothing to do with exponents.

The control variable DENNUM must be a negative multiple of 15 in order to get:

1/X + 1/(X + 1)→

(1 + 2*X) / (X * (1 + X)),

but then DENDEN must be a positive multiple of 3 if you want the denominator multiplied out, and so it goes.

Guiding *muMath* through a tricky problem of adding rational expressions sometimes seems to take as much skill as doing the problem yourself. Of course, *muMath* is especially impressive with a really tedious problem such as (1 + X)^20 (PWREXPD must be 2).

I have found the trig and calculus capabilities of *muMath* to be surprisingly good: *muMath* will differentiate just about any function you give it, since it knows all the standard rules. Integration is, of course, the real test.

INT (1/(X^2 + 5*X + 6), X)→

LN ((4 2*X)/(6 + 2*X)),

which can be further simplified only by a subsequent re-evaluation of the answer, with NUMNUM and DENDEN set to −2. A careful study of the two integration source files reveals that the above problem is done by completing the square. Since *muMath* can't factor quadratics, there is no way it could do the problem by partial fractions. But it is clear, even without examining the source files, that *muMath* really doesn't know anything about partial fractions, since it can't integrate

1 / (X^3 + 1),

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even if you do the factoring for it. *muMath* appears to be able to do integration by parts, sueeessfully integrating such things as

```
X^2 * #E^X
```

(#E is e), but if you look at the source code, what you find is that *muMath* knows many of the special reduction formulas, which one normally derives using parts. Surprisingly, *muMath* can't integrate

```
X * (1 + X)^(1/2),
```

which is easy using parts.

The latest version of *muMath* (MuSimp/muMath-80) includes three source files which were not in the previous version: TAYLOR.DIF, LIM.DIF, and SIGMA.ALG.

The file TAYLOR.DIF, which consists of a single function definition, generates Taylor polynomials. For example,

```
TAYLOR (TAN (X), X, 0, 5) →

X + X^3/3 + 2*X^5/15 .
```

Expansions about points other than 0 are "multiplied out" whether you like it or not. This turns out to be inherent in the algorithm used, but one can easily define:

```
FUNCTION TAYLOR1 (EX, VAR, POINT,
  ORDER) ,
  EVSUB (TAYLOR (EVSUB (EX, VAR,
  VAR+POINT), VAR, 0, ORDER), VAR,
  VAR-POINT)
ENDFUN $
```

Now,

```
TAYLOR1 (LN (X), X, 1, 5) →

-1/1 + X - (-1+X)^2/2 + (-1+X)^3/3
-(-1+X)^4/4 + (-1+X)^5/5.
```

LIM.DIF, as its name suggests, calculates limits, using the differentiation machinery of *muMath*. For example:

```
LIM ((X - SIN (X))/X^3, X, 0) →

1/6 .

LIM ((1 + 2*X)^(3/X), X, 0) →

#E^6 .

LIM (LN (X)/X, X, PINF) →

PZERO .
```

In the first two examples, the limit is understood to be from the right (otherwise an additional argument to LIM must be used). The last example shows the use of PINF, to denote positive infinity, and PZERO, to indicate that the limit of 0 is approached through positive values. If we ask *muMath* to do a more general example, e.g.

```
LIM ((1 + A*X)^(B/X), X, 0);
```

a curious thing happens: *muMath* starts asking for additional information.

```
@:

??? A ???

ENTER SIGN (0 + -)?
```

A single character response of "+" is accepted and the computation immediately resumes, finally producing the expected answer,

```
+E^(A*B) .
```

As you would guess, the file SIGMA.ALG does summations (and products too). For example:

```
SIGMA (K^2, K, 1, 100) →  338350

SIGMA (1/K^2, K, 1, 20) →

1729997573 1542641/1083847519 8270720
```

In some cases, it can even handle a sum with a variable number of terms:

```
SIGMA (K^2, K, 1, N) →

(1+N)*(1+N)^2+2*(1+N)^3)/6

SIGMA (1/2^K, K, 0, N-1) →

(2+2^(1+N))/2^N .
```

Incidentally, if you want the result in another form, you must *re*-evaluate the answer with appropriate flag settings. For example, the above result was obtained even with DENNUM = 3. But then,

```
EVAL (@) →  2/2^(1/N)
```

(The atom @ is always bound to the result of the previous computation.) If LIM.DIF is loaded along with SIGMA.ALG, the prospect of infinite series arises. As far as I can tell, this is limited to geometric and telescoping series (we can't expect miracles). Also, its best *not* to have LIM.DIF loaded unless you need it, as it interferes in an odd way with the finite sum activity of SIGMA, e.g. asking (twice!) for the sign of LN(2) during the evaluation of a finite geometric series with common ratio 1/2.

When I first started in with *muMath*, it was the symbolic math which fascinated me most. And it is indeed an amazing accomplishment, especially considering the limited memory space. Also, I understand that there are problems in physics and engineering which can be rendered tractable only by using a combination of numerical and symbolic methods.

I really don't know how useful *muMath* would be to a person who doesn't already know the relevant mathematics. I would love to see what would happen with *muMath* in the hands of my beginning algebra students, but I haven't yet had the opportunity. I really believe a person could learn some mathematics just by learning to use *muMath*, but this is only speculation.

What excites me most now is the muSimp language itself. Programming in muSimp involves using, in a very concrete way, the same techniques of inductive definition, building complex structures from simple ones, and then analyzing and operating on those structures inductively, that are fundamental to theoretical work in set theory and logic. It also turns out to be much more useful as a general purpose language than I originally suspected, particularly now that you can easily link muSimp to your own machine language routines.

muSimp is also an exeellent bridge between "traditional" programming languages and Lisp. Based on my own experience, I think it would be very easy and natural for anyone accustomed to Pascal or PL/I to start right in with muSimp, but then when he subsequently (I would say inevitably) discovers Lisp, it will seem natural too. I feel, however, that any further discussion of the muSimp language should be conducted in the context of Lisp itself and Lisp surface languages generally.

The *muMath* package is certainly an impressive piece of work. Although I am particularly interested in its potential as a teaching tool, it will undoubtedly find uses in other areas as well. But at any rate, the time I have spent with *muMath* and muSimp has been challenging and a great deal of fun. □

creative computing software evaluation

Writing Courseware on the TRS-80

R. Reed Hardy and Eliot S. Elfner

creative computing

SOFTWARE PROFILE

Name: TRS-80 MicroPilot

Type: Programming Language

System: TRS-80 Model I, III, 32K

Format: Disk

Language: Machine

Summary: Easy and direct route to custom C.A.I. software

Price: $79.95

Manufacturer:

Radio Shack
1800 One Tandy Center
Ft. Worth, TX 76102

After using Radio Shack's *MicroPilot* (formerly known as Pilot Plus) to write about 5000 lines of tutorial software, we feel qualified to praise and criticize this version of Pilot.

Pilot has become the generic name for a programming language that is especially well suited for authoring and executing CAI educational programming. There are now several versions of Pilot in fairly common use, each of which has its own strengths and weaknesses.

This review is not intended to be a complete comparison of *MicroPilot* with other versions of Pilot. It is simply a description of the authors' experience with *MicroPilot*.

Let me begin by praising Radio Shack for their initiative in developing *MicroPilot* and thanking them for allowing us to use a pre-publication version so that we could begin authoring programs at least six months earlier than would otherwise have been possible.

Strengths

The strengths of *MicroPilot* lie in its efficiency for educational/interactive programming. With *MicroPilot* you can ask a question, get an answer, evaluate the answer and appropriate feedback with three or four simple commands. You can keep track of a student's progress so that you can automatically start him where he left off when he logs onto the system. All of these characteristics are common to most forms of Pilot.

The features that make *MicroPilot* shine are its edit/run capability, its graphics, its sound generation capability, and its record keeping commands.

There is also a graphics screen generation utility (Graphics/QLT) that allows the user to "draw" a screen and store it on disk for use in programs. These screens are developed during both programming and execution, much more quickly than screens developed using graphics commands in most cases. (Note: this utility will not run on machines without lower case capability.) This screen generation utility can also be used to allow the student to "draw" a screen which can then be saved for later evaluation or simply dumped.

Another *MicroPilot* strength is the editor that is included with the software. The editor is essentially the same as that used for Level II Basic which makes it very convenient for those who are accustomed to using Radio Shack Basic.

During program authoring, *MicroPilot* allows the author to run a program starting with any specified line number, execute any valid *MicroPilot* command directly, break into a program and then re-enter the program where it was interrupted by typing "continue." Lines and characters can be edited with ease.

There are other strengths that those who aren't familiar with other versions of Pilot may not appreciate. For example, there are commands to clear the screen and home the cursor (N:), delay program execution for any specified number of seconds (D:N), pause until a key is pressed (W:), and print text on the printer instead of the screen (P:).

These are functions that can be accomplished with other versions of Pilot by using ASCII codes or other roundabout methods, but *MicroPilot* makes their use a breeze. Another advantage relative to other versions of Pilot is that the author can run a program without loading special execution software. This makes editing and general debugging much faster.

Given all of the above praises, you may

Dr. R. Reed Hardy, Associate Professor of Pyschology, St. Norbert College, De Pere, WI 54115.

Dr. Eliot S. Elfner, Associate Professor of Business Administration, St. Norbert College, De Pere, WI 54115.

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be beginning to think that *MicroPilot* is nearly perfect. Well, don't run out and buy it without finishing this article. Along with its strenths, *MicroPilot* has several significant weaknesses.

Weakness

Probably the single most damaging weakness in *MicroPilot* is the fact that the student user has very easy access to the program. Any student with elementary programming ability can list a program, change it, and save it with little difficulty.

These operations can be done only while the user is in "command" mode, and when a *MicroPilot* program is running, the student would not normally be able to do any of the above dastardly deeds. However, there are several ways a student can find himself in command mode. The following is a list of some of these:

1) Since the Model I version of *MicroPilot* does not come with an Initial Program Load utility (I.P.L. utilities automatically begin the execution of a specified program when the computer is turned on), the student must either be supervised during initial program load or he must load and run his own program from the *command mode*.

2) Since *MicroPilot* has no ON ERROR GO TO command or its equivalent, *any error* (e.g., the student enters an O when the program expects 0, or makes an error in giving his log-on file code) will cause the program to crash and come down in *command mode*.

3) In addition to the above problems, there is no easy way to disable the Break key which halts execution and puts the user in *command mode*.

Before *MicroPilot* can be considered a serious educational tool, this easy access to command mode must be corrected. In other versions of Pilot, this has been done by separating the program execution software from the authoring software. This effectively prevents the listing or modification of programs by the student. If a program crashes under such circumstances, the student user can usually do only one of two things: 1) seek help from an assistant, or 2) type run and start again. This is as it should be.

As things stand with *MicroPilot*, a reasonably competent programmer could list test items and, by interpreting the program, get the correct answers before taking the test. An even more insidious possibility is that the student could directly modify his disk file indicating perfect performance on all unit quizzes without ever going through the course. This characteristic of *MicroPilot* makes it unsuited to some CAI applications.

While the easy access to command mode is the major problem with this version of TRS-80 *MicroPilot*, there are a few other software characteristics that make for programming difficulties:

The programmer cannot POKE a value into a memory location in MicroPilot, nor can he call and execute a machine language program.

There is no way to check the DOS Directory from *MicroPilot*, or to specify the drive number when loading and saving programs and/or student records.

The documentation of the record keeping command is so unclear and incomplete that the programmer literally has to find out for himself by trial and error how the commands work and what they do. (Note: *Always* be sure you close a file immediately after reading or writing, or you could clobber the directory on your disk and lose access to all the programs on that disk.)

The general documentation that is sold with MicroPilot assumes no former programming on the part of the user.

The general documentation that is sold with *MicroPilot* assumes no prior programming experience on the part of the user. Thus, it is very awkward and inefficient for the user who already has a programming background.

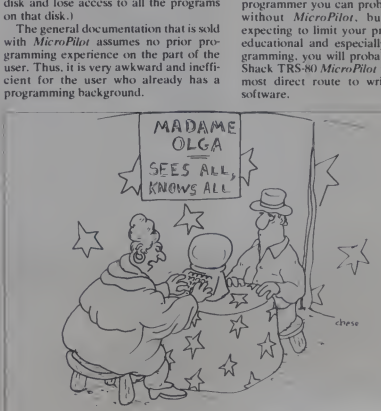
A disadvantage of *MicroPilot* relative to Basic is that it is limited to 32K, disk configurations of the TRS-80 Model I, or Model III. Thus, those with 16K, level II machines cannot use courseware developed in *MicroPilot*. However, courseware programmed in Level II Basic could be used in such configurations.

MicroPilot vs. Basic

Some comments are appropriate on the relative merits of *MicroPilot* and Basic as CAI courseware authoring languages. Basic is a full-fledged, flexible, programming language, capable of a wide variety of programming applications, including the development of CAI courseware. However, mastering Basic requires a great deal of programming skill, and expertise.

MicroPilot, on the other hand, can be implemented in simple applications quite easily. Almost anyone wishing simply to present some material, and check for understanding, could pick up the *MicroPilot* syntax quickly. However, taking advantage of the complete range of *MicroPilot* commands, and linking contingent feedback and progress skillfully, as required in good CAI courseware, demands the same level of ability and skill required of a Basic programmer. It seems that intricate CAI courseware would be equally difficult to program with either *MicroPilot* or Basic.

So if you are already a hot-shot Basic programmer you can probably get along without *MicroPilot*, but if you are expecting to limit your programming to educational and especially tutorial programming, you will probably find Radio Shack TRS-80 *MicroPilot* the easiest and most direct route to writing excellent software. □



"Just hang on, I'm running a search!"

creative computing software evaluation

It's Academic

Patricia D. Glenn

Did you buy an Apple II because "The kids can learn with it?" Or do you have an Apple or two in your classroom for Computer Assisted Instruction? Have you discovered that existing CAI courseware is either too expensive or not available for the courses you want to teach? Are your programming skills too limited to allow you to write your own lessons?

If you answered yes to most of these questions, then DataTech has a *partial* solution for you. This company has created an authoring system for courseware development to be used by the parent or teacher with limited computer experience. The program is called *Mentor*. *Mentor* should not be confused with Pilot, Logo or Ticcit as it is not a CAI authoring language. It is, instead, a programmed template that allows an educator to prepare instructional units composed of text, questions and graphics.

Structure

The *Mentor* user needs to know only how to insert a disk in the drive, turn on the Apple and type. The program is self-instructing. However, because the program uses a unique DOS, it *is* necessary to insert the disk before turning on the computer. This is clearly indicated on the first page of the documentation.

Patricia D. Glenn, 1599 Melrose Ave., Columbus, OH 43224.

creative computing

SOFTWARE PROFILE

Name: Mentor Master and The Game Show

Type: CAI Authoring and playback system

System: Apple II+, 48K

Format: Disk (Apple DOS 3.3)

Language: Applesoft

Summary: Of its type, good for the price

Price: Mentor Master diskette and manual $39.50
Mentor Master and The Game Show diskette and manual $62.00
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Manufacturer:
DataTech Software Systems
19312 East Eldorado Dr.
Aurora, CO 80013

The copy-protected program disk is called the *Mentor* Master and is used to create student diskettes. When the *Mentor* Master disk is booted, you are greeted by several text pages describing what you are about to do. This is followed by the *Mentor* Master Index consisting of nine options numbered 0 to 8 (see Figure 1).

Figure 1.

Mentor Master Index

0 - Run the Demonstration *Mentor* Program
1 - How to Construct a Complete Student Diskette
2 - Copy the Mentor Program onto a Blank Diskette
3 - Write a New Instructional Unit to be Added to a Student Diskette
4 - Read, Edit or Add to an Existing Instructional Unit
5 - Copy a Picture From One Diskette Onto Another
6 - Create, Change or Verify Table of Contents
7 - Read the Catalog of a Diskette
8 - The Game Show Index (only on disk containing The Game Show)

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LLIST
A
S
D
F
G
H
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16K Memory Module

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It comes with connectors for your TV and cassette recorder, an AC adaptor, and a free programming guide and operating manual that completely documents the capabilities of the ZX81.

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Sinclair has also published pre-recorded programs on cassettes for your ZX81. We're constantly coming out with new programs, so we'll send you our latest software catalog when you order your computer.

How did we do it? The question most often asked about the ZX81 is, "How can so much computer power cost so little money?"

The answer is that Sinclair Research simply took a different approach. Our only goal was to make programming power as affordable as possible. So we developed a radical new design that cuts costs dramatically without cutting computer power. For example, our unique Master Chip replaces as many as 18 chips used in other personal computers.

The success of the ZX81 speaks for itself. It is now the fastest-selling personal computer in the world. And we stand behind our product. If anything goes wrong in the first 90 days, we'll repair or replace your unit free of charge. Even after that, you can take advantage of our national service-by-mail facilities for a minimum fee.

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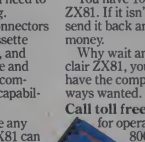

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Lesson Development

The Index suggests "If this is your first time, select #0 then #1." Selecting Option #0 provides you with a rather uninspiring demonstration program. Next, you select Option #1: "How to Construct a Complete Student Diskette." This option is four pages of text referring to four other options, giving some cautions and eventually referring you to Option #2: "Copy the *Mentor* program onto a blank diskette."

If you are still undaunted, you select Option #2 when you are returned to the Index. There, you are presented with two more pages of explanatory text and a list of directions to follow. If you follow the directions faithfully, you will have a student diskette at the end of the process.

Returning to the Index, you decide to try Option #3: "Write a New Instructional Unit." A word of caution: plan your lesson on paper first. *Mentor* lessons are tutorials and have the following form:

1. Information.
2. Question.
3. Student Response.
4. Feedback.
5. Explanatory text for the next question.

If the teacher has not structured the lessons adequately, the result will be worse than useless. Tutorial lessons of the type produced by *Mentor* will only be as interesting as the thought put into their preparation make them. Creativity of presentation lies with the teacher, not the program. This process is time-consuming, but ultimately worthwhile.

Finally, in Option #3, you begin writing your instructional unit. First, you will be asked the title of your unit. As instructed, write down the *exact* title of your instructional unit, as you will need it later when preparing the table of contents. Each student diskette can contain up to eight instructional units, depending on the number of pictures used and the length of the question.

Next, you are asked to type in the name of the picture to be used with the unit. Inserting the picture itself is a separate operation under Option #5. Units may be prepared without pictures, and there can be only one picture per unit.

Following the picture name, you are instructed to write an introduction to the unit. This introduction can be review, discussion or any text that will fit into the eight text "pages" of up to seven lines provided for by the program.

Following the introduction, there is room for up to 97 true/false, multiple choice or fill-in (one word only, exactly as spelled by the teacher) questions which can refer to the picture for the unit. Only those questions coded for a picture will offer it and students can toggle back and forth between the picture and the text.

After each question, there is a provision for eight to twelve further lines of text. This text can be an explanation of the question, discussion, new material or whatever you wish. Normally, the test is immediately followed by a question about the material. After the unit is completed and the picture added, the table of contents is created and the unit is complete. Not bad for $39.95. But there's more....

Editing Completed Units

As the teacher is entering the questions and text when preparing an instructional unit, there is no need to worry about hyphenation or truncation of words as text arrangement is taken care of by a word processing sub-routine within the program. This allows text to be entered without concern for margins, which is a nice touch.

If, in spite of the self-instructing features of *Mentor*, you make a mistake in your instructional unit, you can correct it with the editor (see Figure 2), which allows you to make changes in questions or text, add questions, or delete entire instructional units.

Figure 2.

Editor Menu

1 - Transfer Existing Unit From Diskette Into the Computer's Memory
2 - Add More Questions to the Unit Now in the Computer's Memory
3 - Scan Entire Unit Now in Computer's Memory
4 - Edit Unit Now in Computer's Memory
5 - Change in Use/Standby Status of Questions in Computer's Memory
6 - Transfer Unit to Permanent Storage on Diskette
7 - Return to *Mentor* Master Index
8 - Delete a Picture or Instructional Unit

The Game Show

What about The Game show? The $62.00 version of the *Mentor* disk includes a program called The Game Show. This is an animated hi-res graphic shoot-'em-up loosely based on video games of the same type. It is intended for two players or two groups of players and shows an

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Description of memory
0-8K . . . Sinclair ROM
8-16K . . . This section of memory switches in or out in 4K blocks to leave space for memory mapping, holds its contents during cassette loads, allows communication between programs, and can be used to run assembly language routines.
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☐ Visa	Memopak 16k RAM	$ 59.95		
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CC-10

CIRCLE 200 ON READER SERVICE CARD

alien starship shooting missiles at the players' shuttle craft. It is operated entirely from the keyboard, using the #1 key and the #0 key to fire at the missiles.

Each player tries to shoot down the alien missile on the opposite side of the screen. The first player to hit an alien missile gets four points for a direct hit, or two points for a disabling hit. In order to keep the points gained, the player must immediately give the correct answer to a question. The questions are the true/false and multiple choice questions from the instructional units, and include the pictures used in the units.

Different units may be combined to make up the question set for The Game Show although there can still be only one picture per unit. The instructional units are easily converted for use in The Game Show through the options included in the Game Show Index.

Educational Value

How you feel about the educational value of the *Mentor* progam will depend to a great extent on your philosophy of the proper uses of CAI. If you feel that CAI should deal exclusively with "microworlds," extensive hypothesis testing, variable manipulations and education-oriented languages such as Logo, then *Mentor* is clearly destined to be a disappointment. Frankly, *Mentor*-authored tutorials are of the "electronic page turner" variety.

However, for $39.95 it is probably unreasonable to expect much more than that from the program. But what it does, it does very well. It allows a teacher to present specific information to the student, and to be reasonably certain that the student understands it.

Currently, and in the forseeable future, there is a place for such a program within the educational establishment. If tutorials and drill and practice programs are a means for increasing the acceptance of computers in the schools, then they should be used.

The Mentor program tries very hard to be user-friendly to the inexperienced computer user.

Program Design

The *Mentor* program tries very hard to be user-friendly to the inexperienced computer user. In fact, it tries so hard that it is decidedly *unfriendly* to anyone with even basic computer skills. For example, in trying to meet the needs of a user with only one disk drive, the program makes no provision for using two drives. Considering the amount of disk swapping that is necessary simply to prepare a student diskette, it would be desirable to have the capacity to use two drives if they were available.

The disk is copy-protected and unlistable, so it is impossible to modify the program. This copy protection is probably responsible for most of the program design problems I have found.

The program has two responses to the student's input: "You're right," and "Sorry, try again." This, I think, ignores one of the strengths of CAI—the use of varied motivational techniques—and there is no way for the teacher to change these responses.

When I prepared my first instructional unit, I didn't know the program would accept only one-word fill-in answers. My question required two words. When the student diskette was run, the program crashed when it came to the fill-in and refused to go any further. No matter what I entered, it endlessly repeated "Sorry, try again." The only escape was the RESET key.

Beginning to study a *Mentor* unit is a lot like going down the first hill on a roller coaster. The only way to get off is to ride it to the end. Once a student has begun a unit, the only exits are completing the unit or hitting the RESET key. If you must stop, you will have to begin the unit again.

Students are given three opportunities to answer, and are then given the correct answer, which must be entered before the program will proceed. The learning process could probably have been better served by having the program branch to an explanation of the troublesome material after two or three incorrect answers. If this is too complex, perhaps it could at least return to the explanatory material presented earlier.

Mentor makes no provision for class management. The teacher has no way of knowing who has used the unit, what units they studied, how well they did, or what their problem areas were. This kind of feedback is essential. It is through a knowledge of how course material is being used that a teacher is able to refine the presentation. I suspect this lack is caused by the author's determination to get the entire program and all the instructions on one disk. I would rather have had a management system with the instructions in the printed documentation. Still, for the price, I am probably asking for too much. *Mentor* is not a bad program although it could be less "author-friendly" and more "student-friendly."

The Picture Disks

DataTech has prepared a series of seven Picture File Diskettes, all in the natural sciences (see Figure 3). These disks contain generally good, clear hi-res graphics of common textbook diagrams (see Figure 4). Each diagram has the important points marked by either a letter or a number for ease of reference. Occasionally, it is difficult to determine what a letter is referring to, unless the student is familiar with a line drawing of the object (see Figure 5).

The Picture Files would be useful from middle school through introductory college courses.

The Picture Files would be useful from middle school through introductory college courses. The graphics are in full color, but are understandable in black and white. If you are teaching a course for which Picture Disks are available, and do not have the capability to do your own graphics, the DataTech disks will do much to enhance your *Mentor* presentation, and at a reasonable price. They are one of the best features of the program.

If you can do your own graphics, *Mentor* has made provision for you to use them in the instructional units. You draw your graphic on hi-res page 1, save it, and then use the saved picture as you would a graphic from a picture file diskette.

Ease Of Use

As I pointed out earlier, *Mentor* is an *extremely* user-friendly program. The author, Peter E. Holden, has tried to anticipate every mistake an inexperienced user might make (except for two word fill-in questions). Invalid input is either not accepted, or causes an error message to be displayed telling you what may be wrong. *All* instructions are displayed on the screen so there is very little need to refer to the printed documentation. The lone exception to this is The Game Show program. There was not enough room on

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They're speaking to a group as interested as anyone else in the future of computers: the people who buy stock in the companies that make computers.

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The value of a computer is determined by what it can do. What it can do is largely determined by its memory.

The Commodore 64's basic RAM is 64K. This amount of power is unusual enough in a micro at any price.

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Because the basic cost of the 64 is so low, you can afford to buy more peripherals for it. Like disk drives, printers, and a telephone modem that's priced at around $100.

This means you can own the 64, disk drive, printer and modem for a little more than an Apple II+ computer alone.

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The Commodore 64 will have a broad range of custom software packages including an electronic spreadsheet; business graphics (including printout); a user-definable diary/calendar; word processing; mailing lists, and more.

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Figure 3. Subject Content of Picture File Diskettes.

Geology
Glaciers
River Maturation
Rock Cycle
Water Cycle
Earth's Cross-Section
Volcanoes
Earthquakes
Tectonic Plates
Tectonic Plate Cross-Section
Island Chain Cross-Section
Mountain Types
Relative Age
Igneous Intrusions
Types of Wells

Space Science
Refracting/Reflecting Telescopes
Electromagnetic Spectrum
Stellar Evolution
H-R Diagram
Solar System
Distance by Parallax
Tides
Comets
Phases of the Moon
Eclipses
Rotation (time of day)
Earth Orbit (angle of axis, seasons)
Angle of Incidence

Oceanography
Winds and Currents
Surface Currents
Echo Sounding
Ocean Floor Features
Salinity Changes
Density Currents (Mediterranean)
Deep Bottom Currents
Waves
Breakers

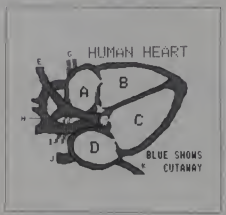
Meteorology
Humidity Graph
Temperature Layer Graph
Cloud Formation Over Mountains
Weather Map
Isobar Map
Air Mass Source Regions
Fronts
Low Pressure Air Mass Development
Change of State
Radiation Balance
Convection Winds
Convection Cells
Global Wind Belts

Human Anatomy
Heart
Brain
Eye
Ear
Respiratory System
Kidney
Endocrine System
Neuron
Circulatory System Schematic
Digestive System

Plant Anatomy
Roots (microsection)
Stem Cross-Section
Leaf Cross-Section
Photosynthesis
Flowers
Seeds
Germination

Cells/Genetics
Animal Cell
Plant Cell
Mitosis
Meiosis
Punnett Square
Sex Linked Traits
DNA
Protozoa
Energy Reactions
Pedigree

Figure 4.



the single disk for The Game Show instructions, so they are on a separate printed sheet. Mr. Holden has thoughtfully provided extra copies of these instructions. However, this illustrates my point about student-friendliness versus teacher-friendliness.

Documentation

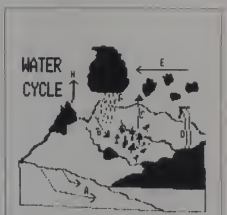
Mentor needs little documentation. However, it is there. The teacher's manual begins with the assumption that the teacher knows little more than how to turn the computer on. In a conversational tone, it explains the basics of the program and leads the reader through the creation of a sample instructional unit. It does not repeat the instructions found on the disk, but rather expands and explains them.

Included as part of the documentation is a print-out of the instruction sets found on the disk. This is convenient, as it is sometimes possible to forget where you are, and then discover that the instructions have disappeared from the screen. It is also a good way to get an overview of the way in which the program parts mesh.

Summary

In all, *Mentor* is a good program, and a good dollar value. It is not a perfect program, but few are. Mr. Holden is to be thanked for providing a program that recognizes current thinking of the educational community, and one which attempts to ease the passage of computers into the classroom. This is a *good* program. With just a few minor changes, it would be an excellent one. □

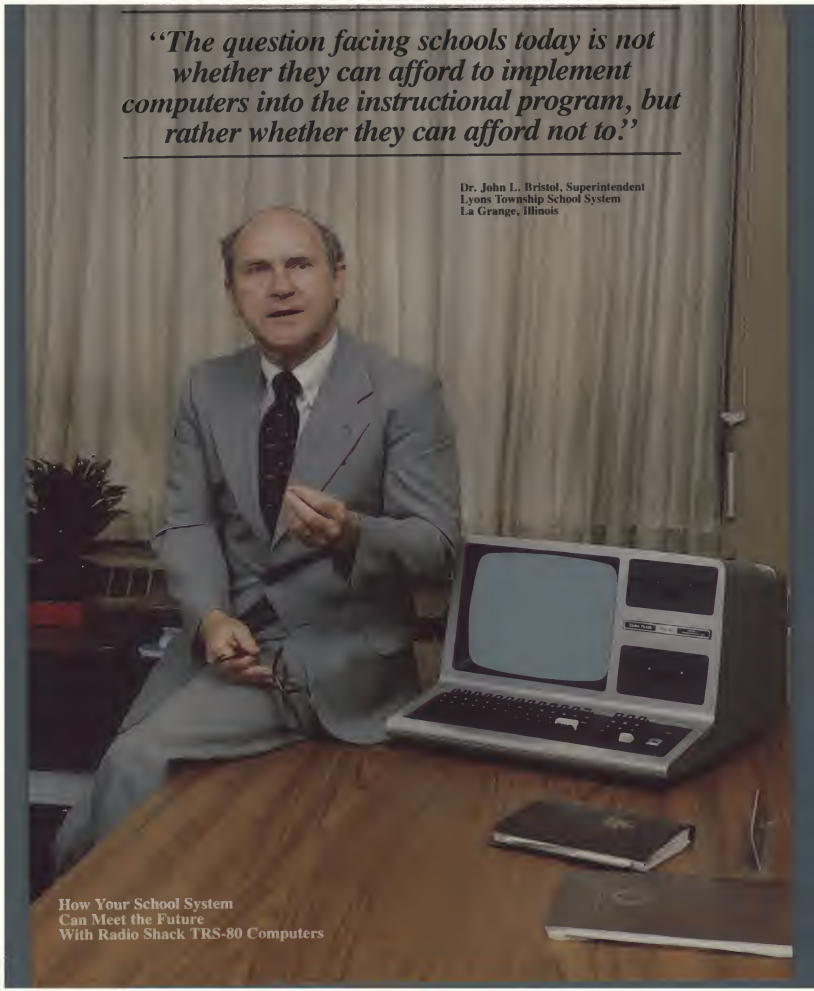
Figure 5.



CIRCLE 253 ON READER SERVICE CARD→

"The question facing schools today is not whether they can afford to implement computers into the instructional program, but rather whether they can afford not to."

Dr. John L. Bristol, Superintendent
Lyons Township School System
La Grange, Illinois



How Your School System Can Meet the Future With Radio Shack TRS-80 Computers

LA GRANGE, Ill. — The man behind one of the most successful computer-education programs in the nation has said flatly that schools must face the growing need for both computer-assisted instruction (CAI) and computer literacy as an educational fundamental.

Speaking before a meeting of the Midwest Suburban Superintendents Association, Dr. John L. Bristol, Superintendent of the Lyons Township School System in La Grange, also said, "Computers so pervade our society — they're in homes, cars, industry — that knowing how to use them is as important as knowing how to read and write."

Indeed, such important groups as the President's Science Advisory Committee have urged that all high school students be taught about computers.

But the question that most people — educators and taxpayers alike — wonder about is how can a district reach a computer-education goal without breaking an already overstrained budget.

If you ask Dr. Bristol, he will describe how the Lyons District has achieved 100 per cent computer literacy in its faculty and high school student body in the course of just two years with an investment, on a per student basis, of less than the average textbook.

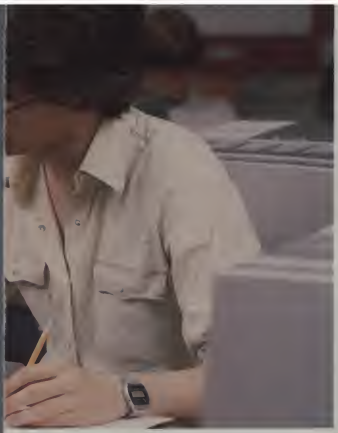
How did they do it?

"We committed ourselves," Dr. Bristol explains, "first to defining the role of computers in the education of all students and then to developing and implementing a plan in a rapid systematic manner."

"All" is the key word here.

According to Dr. Bristol, the first two principles that their plan was to be based on were that all 3900 La Grange highschool students — not just gifted or math-oriented ones — were to learn to use computers, and that all teachers would, too.

"We committed ourselves . . . to defining the role of computers in the education of all students and then to developing and implementing a plan . . ."



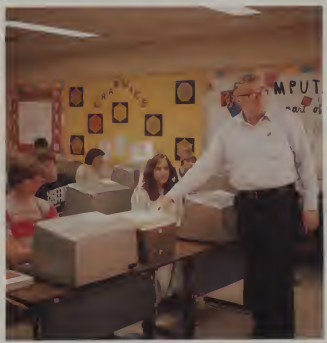
"Teachers are the implementors of curriculum changes," he says, "but how could they design ways to use computers in their courses, and regularly give students 'hands-on' experience in 'course-specific' computer drills and programming, when they themselves were educated in a non-computerized era?"

However, once the faculty had attained a basic familiarity with computers, Dr. Bristol says, they were ready to begin making specific suggestions for how the computers could be used in courses they were familiar with.

From the expected math programs and spelling drills to the unexpected courses like health, music and home economics, La Grange teachers proposed ways they saw for the computers to help their students learn.

A home economics proposal described how students could use the computers to help pick the proper textiles for clothing projects.

"We had those who would implement the programs working on them, giving them a sense of both participation and control."



In a health course, a student would be able to find out the effect of alcohol abuse on various parts of the body — or how many calories are allowed to maintain an ideal weight.

Music teachers worked up an idea whereby computers could help teach basic chords and fingerings for a beginning guitar course.

All these, and many others, have since been put in the curriculum, balanced out among the various departments so that at least 50 per cent of the students at the two high schools will be taking computer-assisted courses at any time.

Lyons accomplished this by setting up teams to evaluate the proposals and then to work with college student programmers and "teacher coordinators" from within the faculty in developing them.

In using programmers to write the software, but not to run the system, Dr. Bristol says, the district accomplished two things.

"We got programs that were designed specifically to meet the needs of our students and curriculum. And we had those who would implement the programs working on them, giving them a sense of both participation and control."

"The first priority is computer literacy on the part of all students. That requires that they all be taking courses that involve computers. They shouldn't be forced to make a choice between physics and computers . . ."

Dr. Bristol sees several advantages to following a pattern like that used in La Grange.

"The first priority is computer literacy on the part of all students. That requires that they all be taking courses that involve computers. They shouldn't be forced to make a choice between Physics 1 and Computers 1 in order to gain a basic knowledge of computers."

"But it also requires that there be situations where there is one computer for each student in a laboratory taught by someone who is already computer literate."

"What is more logical than having teachers bring their classes to the lab periodically and teach them using the computers? The computer is then an integral part of all existing programs . . . not something for others or to be done by others."

"The cost per student was well below that of the average textbook . . ."

"The students gain two ways: they learn about the subject and they learn about computers."

"And we gain as well. We do a better job preparing them for the computerized future. And we improve our teaching by making use of an aid that students always find interesting."

Nevertheless, the cost of setting up a program like that found in La Grange was surprisingly low when viewed on a cost-per-student basis.

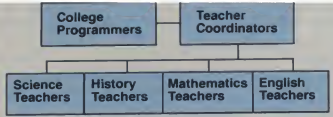
As Dr. Bristol says, the Lyons district instituted computer-assisted instruction in a big way—it is currently using over 250 TRS-80 computers. This insured not only that all La Grange students both can and will take advantage of the computers, but that the district can show an excellent cost-per-pupil ratio.

Assuming a cost extension of five years and use by approximately 8,000 students per year, the cost per student is $4.78 for the hardware and $2.25 for the programs, or a total of a little more than $7.00.

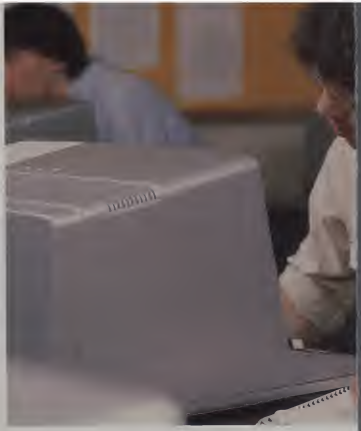
As Dr. Bristol notes, this figure is "well below that of the average textbook or library book." Yet not a single extra staff person was added to implement the program.

"The cost is a pretty small portion of the average district's $1600 annual per pupil expenditures," Dr. Bristol concludes. "Yet it may yield more in . . . preparing youth for tomorrow than 10 other ways those dollars might be spent."

"The students gain two ways: they learn about the subject and they learn about computers. And we do a better job preparing them for the . . . future."



At La Grange, it was the teachers themselves who decided what courseware was needed. Their requirements were then translated by teacher coordinators to programming students of a nearby college.



Having established these principles, Dr. Bristol says, the district proceeded to implement its plan: select hardware, give all the faculty literacy instruction, let the staff determine appropriate applications for instruction, and develop programs to meet those applications.

To make the hardware selection, they first established their selection criteria, then invited suppliers to make presentations.

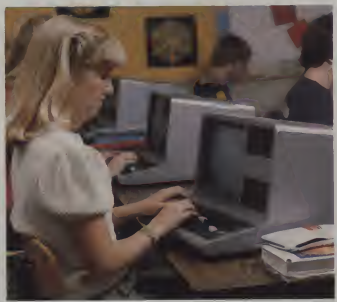
The criteria were "sophistication, easy repair, ability to upgrade, dependability, networking capability and flexibility in use."

After surveying the available offerings, the district picked the Radio Shack TRS-80 Model III in two forms, 2-disk 48K "teacher's computers" and 16K "student computers," connected by a Radio Shack network system.

"Teachers are the implementors of curriculum changes, but how could they design ways to use computers in their courses . . . when they themselves were educated in a noncomputerized era?"

One teacher's computer and 26 student computers, plus a printer, were purchased for each of eight high school computer labs.

The next stage was to gain computer literacy, the ability to use computers with pre-developed programs, among the faculty. In La Grange, eight teachers, who had previously been instructed by outside experts, taught the rest of the district faculty during special summer training sessions.



The Lyons district felt that 100 per cent literacy among teachers was essential for proper use of the computers, and Dr. Bristol feels this conclusion has been proved correct.

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The Friendly Computer Languages

Jim Muller

They're everywhere these days: in homes, offices, laboratories, cars, industrial controls, kitchen appliances, radios and TV sets, security systems, and children's toys. "They" are, of course, the ubiquitous microcomputer, the millions of single chip devices controlling a host of consumer products, the board-level systems controlling industrial processes, and, of course, the desktop computer through which a rapidly increasing number of laypeople are becoming involved in the microcomputer revolution.

To some, this proliferation of computer technology heralds an exciting new revolution. To others, it is simply revolting.

Recently, however, that negative opinion has begun to change, as new user-friendly languages are introduced for personal computers. No longer does the newcomer to the world of computers have to cope with such alien words as INIT, CHR$, GOSUB, STR$, REM, and DIM. A rapidly growing number of young people and the young-at-heart are entering the world of microcomputers riding on the back of a turtle.

Not long ago, the turtle was an electromechanical pet that roamed the floor, controlled by a sizable computer and a simple child-oriented keyboard. Youngsters could manipulate the turtle through the keyboard to make it draw pictures on large sheets of paper. The turtle had a unique pen that it could raise or lower to draw figures.

In drawing pictures of houses, animals, or just geometric shapes, youngsters gained valuable experience in logical thought and problem-solving. Each task had to be broken down into the simplest steps, and then assembled in a structured procedure to accomplish that task. If the drawing was not correct, they went back and refined the procedure until it was drawn the way they wanted.

Jim Muller, President, Young Peoples' LOGO Association, Richardson, TX 75081.

Now the turtle resides on the computer display screen in the shape of a small triangle. But it will still draw pictures, responding to simple commands to go FORWARD, BACK, LEFT, or RIGHT. These turtle graphics commands were first introduced to microcomputers through the Logo language, but are now being incorporated into an increasing number of languages and personal computers.

Just as you select a car to suit your own personal tastes, so you should select a turtle graphics language.

Last summer, while watching a group of youngsters manipulate the cybernetic turtle around the screen to create some dazzling graphics, it struck me that these young people needed a place in which they could fully explore the world of microcomputers and microelectronic technology. They needed their own organization through which they could come to know what different computers could do, what languages such as Logo, Pilot, Basic and Pascal were all about. They not only needed the chance to explore the computer, they needed the challenge to excel. From this, the Young Peoples' Logo Association has evolved with a membership of Turtles that span all 50 states, and a growing number of foreign countries.

At first the choices were easy. Throughout 1981, Logo was available only on the TI 99/4 computer. And, through turtle graphics and the sprite mode our young Turtles were soon developing procedures to accomplish all sorts of colorful things. We occasionally used Big Trak, the programmable truck from Milton Bradley, to help demonstrate the Turtle commands of FORWARD, RIGHT, LEFT, and REPEAT to show how a picture had to be broken down into each step the turtle was to take.

By programming Big Trak to go around the Ping Pong table and under the bench, and to fire its phaser at the dog, for example, youngsters were able to visualize the steps needed to guide the Turtles around the screen to accomplish complex geometric tasks.

Atari Pilot

Then came Atari Pilot with turtle graphics, followed quickly by two versions

```
T: "Please enter a distance."          T(ype): "Please enter a distance."
A: #A                                  A(ccept): #A (#A is a variable)
GR: *HERE                              GR(aphics): *HERE (Sets up the Label,
                                       *HERE."
GR: PEN RED                            Tells the pen to draw in red "ink."
GR: 4(DRAW #A; TURN 90)                GR(aphics): 4(DRAW #A; TURN 90) Repeat
                                       the operations within the brackets four
                                       times.~~the turtle will draw a red
                                       line #A units long and then turn right
                                       90º, putting a red box on the screen.
C: #A = #A + 2                         C(ompute): The value of #A = The value
                                       of #A plus 2.
J: *HERE                               J(ump to): *HERE, or to the Label, "
                                       HERE," and repeat the process.
```

Figure 1.

CIRCLE 253 ON READER SERVICE CARD

of MIT Logo for the Apple II, and then Apple Logo. Turtle graphics is also available through other languages and systems in one form or another. Of course, Big Trak has been available for a few years, offering a rudimentary introduction to turtle graphics. This makes it increasingly difficult to recommend what parents and teachers should buy for their own Turtles.

Just as you select a car to suit your own personal tastes, so you should select a turtle graphics language. For example, for the novice driver, the simpler, economy model may be the best vehicle. For under $500, an Atari 400 computer and a colorful, easy-to-use language, Atari Pilot with turtle graphics, is made readily available to youngsters from primary grades up.

In addition to offering enjoyable turtle graphics features and advantages, Atari Pilot offers the unique feature of an easy transition to Basic and other common microcomputer languages. For example, it shares some common format and editing features with Basic.

Pilot, for Programmed Inquiry, Learning, Or Teaching, is a very conversational language which uses simple line abbreviations to prescribe the function of that line. It was developed initially as an easy-to-use authoring system for educators, and Atari has added turtle graphics features to the language to make it more user-friendly. (See Figure 1.)

If I choose to retain this short program for drawing a box, I can do so by simply entering the command AUTO followed by the label *BOX and the program. To mark the end of the program, enter E: When listed, the program would look like this:

```
10 *BOX
20 T: PLEASE ENTER DISTANCE.
30 A: #A
40 *HERE
50 GR: PEN RED
60 GR: #(DRAW #A; TURN 90)
70 C: #A = #A + 2
80 J: *HERE
90 E:
```

The program is run by first clearing the screen to set up the graphics mode with GR:CLEAR. Then the Use command is entered "U: *BOX. An endless series of red boxes will be drawn on the screen. However, that can be limited by simply changing line 80 to read:

J(#A 45): *HERE

Now, boxes will be drawn until the dimension of a side equals 5.

Boxes and other figures can be placed at any coordinates on the screen. The turtle can draw in yellow and blue, as well as red. There is also a command to FILL a box or a house, so you can make a city of little boxes or colorful skyscrapers.

The language offers sound effects and assembly language access to add some truly spectacular effects. It is also recursive in that commands such as *BOX can be used in other procedures. It also offers some very interesting text manipulation capabilities for easy lesson programming, as well for developing word games.

The greatest asset of the language is spectacular documentation that is heavily illustrated, thorough, and very easy to understand. Also included are two well-done demonstration tapes that orient the user to the capabilities of the language.

However, Atari Pilot has some distinct limitations when compared to the various implementations of Logo. The language is much smaller in size and in scope. But, when it comes to the practical real-world situation of economically providing youngsters with the opportunity to explore the fun and excitement of personal computing, Atari Pilot is an excellent choice and an excellent introduction to the Atari computers. The books that accompany the language do as much to make the computer user-friendly as does the language itself.

The sprite mode is especially useful for elementary grade youngsters.

Three Versions

There are currently three versions of Logo available through four companies: TI Logo from Texas Instruments, MIT Logo for the Apple computer from Terrapin, Inc. and Krell Software Inc., and Apple Logo developed by Logo Computer Systems, Inc. of Canada, and distributed by Apple Computer Inc.

TI Logo requires the basic TI 99/4A console plus Extended Memory and the TI Logo command module. The suggested retail price for the minimum system is just under $1000. The versions of Logo for the Apple II computer require at least one disk drive, extension of the basic memory to 64K, and the language, bringing the suggested retail price for the complete system to around $2400. The language alone is available from Terrapin, Inc. at $149.95 and from Krell Software for $179.95. The Krell version includes an extra demonstration disk called "Alice in Logoland," which takes the user through examples of virtually all of the capabilities of the language. Apple Logo is available for $175 and comes with two excellent, heavily-illustrated books. In terms of documentation, Apple Logo and Atari Pilot are the two very clear-cut standouts.

All of the versions of Logo offer a turtle graphics mode which moves the turtle around the screen to draw geometric shapes and patterns. The Apple versions each offer five pen and background colors whereas TI Logo offers sixteen colors. In the MIT versions of Logo, the shape of the turtle may be redefined and moved around the screen to create animated procedures. TI Logo, however, offers 32 Sprites which may carry or look like 27 shapes. These shapes may be any of five predefined shapes in the language, or they may be defined by the user. The shapes will not, however, draw lines.

Sprites

The sprite mode is especially useful for elementary grade youngsters in that it provides a very colorful means for them to become actively involved with the computer right away. It also provides the means for demonstrating what might otherwise be incomprehensible mathematical concepts.

For example, it is extremely difficult to explain the numerical concept of "zero" to young children. They have no knowledge of what "nothing" is. However, this abstraction becomes very real when they TELL:ALL (of the sprites to) CARRY 0. Those sprites that are on the screen will then disappear.

There is, however, an inconsistency in TI Logo that can be quite confusing to young programmers. In the Turtle Mode, it is possible to SETCOLOR |6 15| and have the Turtle draw a red line on a white background. However, in the Sprite Mode, the computer will not accept this as an input. Only the pencolor can be specified with the SETCOLOR command.

A graphics board that provides animation capabilities for Apple Logo was demonstrated at the West Coast Computer Faire in March. This board allows 32 turtles to assume shapes designed into the language or by the user, allows for the use of 16 colors, and sets the turtles in motion with or without the pen drawing a line.

A valuable feature of the versions of Logo for the Apple Computer is the ability to select full screen or partial screen graphics. This can be done even while a procedure is in process. In the Turtle Mode, TI Logo reserves the bottom portion of the screen for text. In the Sprite Mode, the full screen is used with text written from the top of the screen.

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Apple Logo allows the user to select the option of having the Turtle "wrap" or not. Simple commands direct the turtle to reverse direction when it comes to the edge of the screen, or simply to disappear off the screen. In TI Logo, the turtle and the sprite always wrap around.

Logo for the Apple offers considerably more flexibility in both graphic and arithmetic operations through the use of floating point math. This allows for trigonometric, logical, square roots, and other math functions not possible through the TI integer-only system. In addition to the numerical flexibility, the Apple versions of Logo offer more graphic flexibility.

For example, consider the following simple procedure:

```
TO SPIRAL :DISTANCE :ANGLE
FORWARD :DISTANCE
RIGHT: ANGLE
MAKE "D :D + 1
SPIRAL :DISTANCE :ANGLE
END
```

Running this simple procedure on the Apple computer will result in the drawing of an ever-increasing spiral. By entering SPIRAL 1 144, a star will be drawn that will increase in size each time it is drawn. The screen will eventually become totally white with only the turtle visible as it continues to draw. In TI Logo, however, the computer will signal OUT OF INK after about 25 repetitions of the procedure.

Apple versions of Logo provide interfacing to printers and other peripherals through assembly language access. The MIT versions of Logo for the Apple offer SAVEPICT and READPICT commands for saving and reading the contents of the screen into and from memory. The screen can also be printed out, a feature that is especially useful for showing screen graphics. Apple Logo does not offer these commands but they can be programmed. TI Logo offers no interfacing capability. Procedures can be printed on the TI Thermal Printer, and programs can be stored on tape or disk.

Logo and the Handicapped

Imagine the use of Logo by the physically handicapped wherein they have access to single-key commands that print out phrases and sentences. People with severe arthritis or other problems that limit their ability to type could still use the computer to communicate by entering a single key command.

For example:

```
TO G
CLEARSCREEN
PRINTER
PRINT [YOUNG PEOPLES' LOGO ASSOCIATION]
PRINT [1208 HILLSDALE DRIVE]
PRINT [RICHARDSON, TEXAS 75081]
PRINT [ ]
PRINT [DEAR YPLA:]
END:
```

By simply typing the letter G and enter, the address of the YPLA and opening of the letter would be printed out on the printer. With a menu of useful phrases and sentences, the handicapped have a new means of communication readily available to them. And this list can be altered very easily to serve new requirements.

Another benefit of assembly language access through Apple versions of Logo is the ability to create new features in the language, such as music and sound effects. This also gives the user access to

The real power of Logo for the Apple computer becomes evident with the list processing capabilities offered by each.

16-color low-resolution graphics and the chance to alter the character set. TI Logo allows direct access to the character set by which youngsters have created their own alphabets and codes. There is no access to music or sound capability in this version, however.

The value of TI Logo is in its graphic capabilities and its user-friendliness for very young children. When the idea for the YPLA was being formulated last summer, junior high students and first graders used to get together around a few computers on a Ping-Pong table with the intent of duplicating their favorite arcade games through the computer or simply drawing colorful flowers. Not only did they all find the TI 99/4 exceptionally easy to use, they found that TI Logo offers very easy access to some exciting graphic and game programming capabilities.

We have had a variety of games developed including versions of lunar lander, flight control, crossing the asteroid belt, and similar exercises. Primary grade youngsters have developed some very interesting pictures, not to mention our first computerized Christmas card. The "human factors" designed into the language make it an excellent choice for elementary and junior high schools, and for those age groups at home. Unfortunately, the documentation that accompanies the language leaves a lot to be desired.

For example, a variety of undocumented commands have been found in TI Logo. FPUT, LPUT, THING, NUMBER?, WORD?, THING? are among these. The manual accompanying TI Logo was supposedly written for middle school age children, which makes it difficult to understand why the joystick commands, JOY1 and JOY2, were omitted.

Not only do these commands make the language competitive with several other child-oriented software packages, they offer some very interesting opportunities for using TI Logo with the handicapped. Each position of the joystick represents a different numerical input, and a simple rewiring or rebuilding of the joystick would offer the physically handicapped access to the computer.

Documentation

The documentation problems with TI Logo are reportedly being corrected, and a TI Logo Curriculum Guide is being published. In addition, several authors are preparing books on TI Logo for various age groups. Thus, this problem should disappear, hopefully as this article is being published.

The real power of Logo for the Apple computer becomes evident with the list processing capabilities offered by each. These capabilities tend to make these versions more complete computer languages. However, there are some differences worth noting. The MIT versions offer some editing and debugging commands which have to be programmed into Apple Logo. On the other hand, error handling in Apple Logo is generally more efficient in that error handling commands can be defined by the user.

The MIT versions of Logo for the Apple and the TI 99/4 were experimental developments. It would appear that Logo Computer Systems, Inc. learned from these experiments and has come up with a more complete language. Of course, it is reasonable to assume that all of the Logo developers are looking at improvements in the language. Thus, it will take more time to determine which version is going to become the "standard."

For the parent and teacher, there are, indeed, some tough choices. For the economy-minded, Atari Pilot is an excellent choice, the subcompact model that

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Friendly Computer, continued...

offers excellent economy combined with efficient performance. This is not only because of the user-friendly benefits but because of its similarities to other more readily available programming languages. TI Logo is an expensive version of Logo, the intermediate model offering some unique benefits that will undoubtedly be improved and expanded in time. The TI computer is gaining rapidly in popularity and is being more actively supported by third parties, a good indication of the viability of the product.

The top-of-the-line resides within the Apple computer. To carry the analogy a step further, consider the version of Logo offered by Terrapin, Inc. as the solid, comfortable, efficient, four-door sedan. It is an excellent, long term investment backed by an experienced company. But would you teach a first time driver in a Mercedes or Cadillac El Dorado?

The Krell Software version appears to have more of a "luxury sports car" approach. It is a lean, dramatic package that offers comprehensive and colorful demonstration procedures. But in total, it is the model that requires some prior experience to use most efficiently.

Apple Logo is the Grand Touring model—solid, comfortable, dramatic, luxurious, well-documented, with outstanding performance. It stands out because of its thorough attention to detail.

In our Turtle Learning Centers in Irving and Richardson, TX, we use them all. Each has its own followers and supporters. Each language has its own advantages. But, most important, there is something for everyone.

Many computer owners may find it hard to relate to that statement. This is why the analogy of languages to automobiles goes far beyond selection in a showroom. A few years ago, I was actively involved in promoting an employer's products to the road racing field. Race drivers, the hobbyists of the auto industry, were no more fiercely loyal to their favorite manufacturers than are computer owners.

It is from the development work of the hobbyists that many consumer products have evolved—cars, radios, TV, hi-fi, stereo, and now the computer. Hopefully, the new friendly languages will be the development to make consumer products out of computers. □

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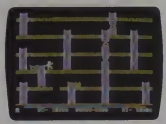

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creative computing software evaluation

A Maze Muncher for TI

Robert W. Cashman

creative computing

SOFTWARE PROFILE

Name: Munch Man
Type: Arcade game
System: TI-99/4 or TI-99/4A
Format: Command Module
Summary: Excellent
Price: $39.95
Manufacturer:
Texas Instruments Inc.
P.O. Box 53
Lubbock, TX 79408

Texas Instruments has developed a series of games for the 99/4 and 99/4A that rival those found in arcade centers. Their latest, *Munch Man*, is a perfect example. It is very similar although not identical, to Pac-Man, and the level of competition that *Munch Man* offers will give the seasoned player all he can handle.

The object of the game is to connect the passages of a maze with the continuous chain that your Munch Man leaves behind as a trail. For every link of the chain that is joined together, the player receives 10 points.

While you are trying to connect your chain together, however, four creatures called "Hoonos" are pursuing you. They are bent on gobbling you up before you can complete your mission. Each one has a different level of intelligence so you must be careful in out-maneuvering them.

Robert W. Cashman, 11 Hallenan Ave., Lawrence, MA 01841.

What can you do to combat this onslaught of creatures? You can locate and eat one of four energizers situated in the corners of the maze. You can't miss these. They look just like the state of Texas. The energizers give you the strength to capture the Hoonos and imprison them in the center of the maze.

You receive 70 points for eating an energizer and 100 for the first Hoono that you catch. Every subsequent Hoono captured doubles the number of points received from the previous capture.

How long can you remain energized? Not long. After a short period of time, the maze begins to flash from blue to red while the captured Hoonos escape. This indicates that your strength is returning to normal.

A player starts each game with three Munch Men, and the game ends, of course, when all of them are eaten. Should a player complete the chain while he still has Munch Men left, the game continues with an empty maze, four more energizers and four different Hoonos.

Munch Man can be played from the keyboard or with joysticks. Use the joysticks. They respond faster, and you will obtain much higher scores.

As is always the case with TI's Solid State Software Command Modules, a well written instruction manual is included.

As far as the quality of the game is concerned, the layout of the maze is terrific. It is three-dimensional and well thought out. Excellent graphics and some really imaginative sounds will keep you going for hours at a time.

I have two daughters and three nephews who are video addicts and range in age from six to fourteen; a better cross section of critics would be hard to find. These kids have played about 100 games on my 99/4 and no other has held their attention as long as this one. □

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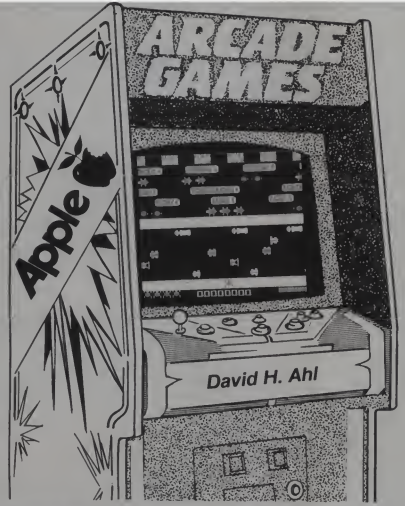

creative computing software evaluation

Eleven for the Apple in One Basket

Kamikaze

Mention Hayden Software and what does it bring to mind? Probably *Sargon* or a bunch of boring business packages. Well, along with a change in location from Rochelle Park, NJ to Lowell, MA, Hayden Software is making a change in product direction. *Kamikaze* is the first in a series of arcade games planned for release over the next six months.

creative computing

SOFTWARE PROFILE

Name: Kamikaze

Type: Arcade game

System: 48K Apple, Disk Drive, Paddles

Format: Disk

Language: Machine

Summary: Tough challenge against a relentless enemy.

Price: $34.95

Manufacturer:
Hayden Software
50 Essex St.
Rochelle Park, NJ 07662

The theme is simple. You, the player, control a ship on patrol, presumably in the South China Sea. Paddle 0 controls the position of the ship from left to right on the screen. Your enemy takes the form of two torpedo planes flying overhead, one from left to right and the other from right to left at two different altitudes. They constantly drop torpedoes (or bombs) on your patrol boat. At your disposal you have a missile launcher (controlled by the paddle button) with which you can launch high speed surface-to-air missiles against your relentless enemy. But don't take time to congratulate yourself for shooting down a plane because a new one takes its place virtually immediately.

Shooting the high flying plane is worth 50 points whereas the lower flying plane is worth 25 points. You have five ships to start. For each 1000 points accumulated, you earn an extra ship. However, earning 1000 points also brings you face to face with the fearless (and foolish) Kamikaze pilots. Rather than fly from side to side, these insane pilots swoop down from the top of the screen, changing course as you do, ever heading toward your vulnerable patrol boat. Your missiles are effective against the Kamikaze planes, but in order to use them you must get under the plane first. It's not easy! Indeed, it's nearly

Kamikaze.

impossible. Not that you will have to worry about it very often! Reaching 1000 points is anything but easy.

We found one possible strategy was to linger near the right side of the screen, get into sort of a rhythm to hit the lower flying green plane on each pass from the left side. On the other hand, this yields only 25 points per hit so it takes far longer to amass 1000 points. Another successful strategy employed by one of the members of our playing panel was to maneuver toward the center of the screen which subjects you to more enemy fire but also affords you the opportunity of hitting one or both planes.

Although *Kamikaze* has only one central theme with no variations that we were able to discern, our panelists found it

Step right up! It's new, it's fun, it's aMAZing! It's WAYOUT, a game so exciting it can make a blind man talk, a deaf man see! Step right up and put on these wayout protective goggles. Good! Now take this compass and mapmaker and step inside this hallway. Excellent! OK now, I'm gonna lock you inside and see if you can find your WAYOUT!

See those fireflies? They'll show ya which way the wind is comin' from — if you don't get blown over first. Oh, and beware the Cleptangle. He loves to sneak off with your mapmaker and compass. Whadya think? Pretty WAYOUT, eh?

Yes, people everywhere are going out of their way to play WAYOUT from Sirius. The first 3-dimensional maze game of its kind with 26 different adventures to lose yourself in. WAYOUT requires an Apple II or II+ Computer with 48K and one Apple disk drive and is playable with keyboard, Apple-compatible paddles or joystick or with an Atari-type joystick attached to a Sirius Joyport.

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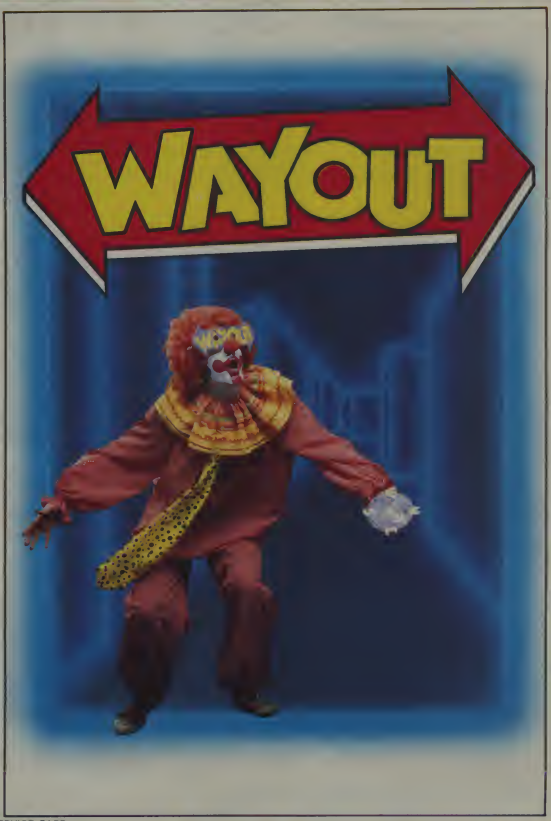

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CIRCLE 241 ON READER SERVICE CARD

quite challenging, some to the point of frustration. Nevertheless, we applaud Hayden for entering the exciting field of arcade games.

Rear Guard

Rear Guard is loosely based on the arcade game, *Defender*. In it, you are flying a spaceship from left to right across the screen (actually the ground and other objects are scrolling from right to left giving the illusion of flight). In the game, it's you against an armada of alien ships of different types. Five ships come at you from the right and are worth between 25 and 200 points. A freighter flies in the same direction as you (left to right) and is worth 300 points. In addition, a satellite identified by an F on its side that later changes to an S flies by. Hitting the satellite while it displays an F gives you a fuel recharge, while hitting it with an S gives you a shield recharge. The level of your fuel and shields is shown at the top of the screen along with the score and the number of LGG's remaining.

LGG's? Yep. The object of the game is to survive by preventing the ground-based LGG's (Little Green Guys) from collecting the orange energy pods that are dropped by destroyed alien fighters. These pods are vital because they can be traded in at the end of each game level for fuel, shields and/or bonus points. If you are like me, and constantly run out of fuel, you will want to trade your pods for additional fuel. The players on our panel tried different strategies, but whatever strategy you employ, the important thing is to eliminate the LGG's. This is done by swooping down close to the surface of the planet and shooting them as they speed by from left to right. The danger, of course, is swooping too low and hitting the surface of the planet, and missing out

Rear Guard.

on a passing fuel or shield satellite.

Although it is theoretically possible to play the game with the keyboard or paddles, we felt that to maintain your sanity, a joystick was necessary. In summary, *Rear Guard* is a fast-moving, colorful game that brings *Defender* home to the Apple. The game saves the top ten scores and player names, a thoughtful touch that we applaud. Also thoughtful is the policy of Adventure International to furnish a backup disk at the cost of $3.99.

creative computing

SOFTWARE PROFILE

Name: Rear Guard
Type: Arcade game
Author: John Anderson
System: 48K Apple, Disk Drive, Joystick
Format: Disk
Language: Machine language
Summary: Fast-paced and tough
Price: $29.95
Manufacturer:
Adventure International
P.O. Box 3435
Longwood, FL 32750

Fly Wars

Looking at the *Fly Wars* package, one can't help but be taken by the marvelous 3-D graphic effect. The software jacket is printed on a plastic card with narrow vertical stripes in which you see a different picture depending upon the angle of viewing. In this case, the title, *Fly Wars*, flits around like a pesky fly. You can almost hear the buzzing.

Our temptation is to relate new Apple arcade-type games to their coin-op counterpart in the arcades. Okay, so this relates to *Qix* and *Amidar*, but that is being unfair! *Fly Wars* is different and quite original.

In the game, you are a spider. You are able to leave an etch-a-sketch type of trail on the screen: up, down, right, and left are the directions you may move and leave your trail. The flies flit about the screen from left to right and right to left. Your object is to trap these flies in an enclosed space which can "loosely" be thought of as your web. Each fly you trap is worth 20 points.

Trap a fly, gobble him up and, lo-and-behold, a caterpillar appears. Devour this little creature and he leaves a colorful cocoon at the bottom of the screen. Head down quickly, and push the cocoon from the bottom of your web to the top and you get a 200-point bonus.

At the beginning skill level, 200 points is enough to advance you to Level 2. Level 3 begins at 800 points and the next five levels begin at 800 point increments. But beware, it's not easy to reach them. Increasingly, you'll find showers of bug spray coming after you. Unlike nasty aliens, in shoot-'em-up games, the bug spray can't be eliminated; your only defense is to avoid it.

Fly Wars.

As you enlarge your web, the screen becomes crowded and empty space for trapping new insects is scarce. When this happens, you can "turn off" the web with your joystick button or the "P" key and simply crawl off the right or left edge of the screen to a new play area.

Fly Wars can be played with an Atari-type joystick connected to a Sirius Joyport. If you have five fingers which reliably do what your brain asks them to do, you can play *Fly Wars* from the keyboard.

If you want an exercise in unbelievable frustration, try playing *Fly Wars* with a paddle. Different points in the rotation correspond to different directions of spider movement. Sirius Software claims that some people like this method of control. We haven't found any (although, I confess, I have not visited Greystone Park, our local psychiatric hospital recently).

Seriously folks, *Fly Wars* is wonderful fun, but if you really want to be serious about it, you ought to have a Sirius Joyport to use as your electronic fly-swatter.

creative computing

SOFTWARE PROFILE

Name: Fly Wars
Type: Arcade game
Author: Duane Later
System: 48K Apple, Disk Drive, Sirius Joyport recommended
Format: Disk
Language: Machine Language
Summary: Trap bugs with etch-a-sketch
Price: $29.95
Manufacturer:
Sirius Software
10364 Rockingham Dr.
Sacramento, CA 95827

Procyon Warrior

This disk contains two games, the first of which is *Procyon Warrior*. The scenario makes you the commander of a space station which is under attack from planet earth. You have two weapons with which to defend your space station: small plasma bombs (useful against drones) and a remote controlled neutrino missile that is effective against the modest ship. The instructions tell us that "You will have only one neutrino missile available for use against each attacking fleet, so make it count."

Sound different? It is and it isn't. It's different in that you have two weapons on the screen at once, one controlled by paddle 0, and the other by paddle 1. From there on, the differences end. Each ship can move from side to side across the bottom of the screen. The smaller weapon can fire repeatedly although only two bombs may be on the screen at one time. As the instructions say, the larger missile must be saved for the attacking mother ship and must be aimed with care. In the first wave of attackers, there are three drone ships before the mother ship appears. On higher waves, there are more drone ships before the mother ship makes her appearance.

If you can anchor your paddles to the table top, you may be able to play this game single-handedly. Frankly, our playing panel found the only reasonable way to play was in teams of two, with one player firing the small plasma bombs and the other keeping the neutrino missile out of the way until the mother ship appeared. Even with this strategy, however, we found that the somewhat erratic motion of the drone ships made high scores as much a matter of chance as skill. Indeed, one team of players after scores of games, did not achieve as high a score as they did on their second game when they were simply "feeling their way around the controls."

Procyon Warrior.

In the second game on the disk, *Appointment at Aldebran*, you must navigate through a field of asteroids and space pirates toward your home planet. You have a shield which affords you some measure of protection from collisions with asteroids and blasts from the space pirates, however, you'll have better luck if you attempt to avoid such collisions. In addition, you have 15 missiles which may be fired at the space pirates.

We found a joystick necessary to play this game. With it, it was a relatively simple matter to navigate through the asteroid field, though getting the space pirates was something else entirely! Two or three was usually the best we could do.

If shooting the space pirates was difficult, landing on the planet was nearly impossible. If you approach at too steep an angle you burn up in the atmosphere, whereas a shallow approach causes your ship to skip off into deep space and become lost. As the instructions say, "you must follow the fine line just short of overheating." Unfortunately, we never found it.

creative computing
SOFTWARE PROFILE

Name: Procyon Warrior
Type: Arcade game
System: 48K Apple, Disk Drive, Paddles and Joysticks
Format: Disk
Language: Machine language
Summary: Nice graphics, frustratingly tough
Price: $24.95
Manufacturer:
Synergistic Software
5221 120th Ave., S.E.
Bellevue, WA 98006
(206) 226-3216

Jellyfish

The instructions tell us that, "your submarine, Dogstar, is on a dangerous mission to recover several discarded nuclear waste capsules from the ocean floor. The Dogstar has been equipped with a special mechanical arm for this purpose. It has also been outfitted with plenty of torpedoes used to blast belligerent Jellyfish, octopuses, and squid that seem intent on cutting your mission short. While torpedoing the sea creatures will rack up points, it also causes these underwater wonders to break up into smaller units that keep coming at you."

Jellyfish may be played with either the keyboard, Apple paddles (or joystick), or Atari-type joystick through a Sirius Joyport. We found these three modes of play quite different. The keyboard mode uses four keys that are adjacent to one another for up, down, left, and right movement as well as for lowering the mechanical arm and firing. Since *Jellyfish* can be played by either one or two players there is one cluster of five control keys on the left and another on the right side of the keyboard, one for each player. While this particular method of controlling the submarines was relatively straightforward, most of our players were not particularly keen about it.

But if they were less than enthusiastic about keyboard control, they were downright hostile about Apple paddles or joystick control. The method of control is most unusual: rotating the paddle or pushing the joystick a different distance will move the submarine up, down, right, and left in a clockwise or counter-clockwise direction. This was a totally alien feeling and none of our players ever got the hang of it.

On the other hand, everyone agreed that an Atari-type joystick used with the Sirius Joyport provided natural movement and control, i.e., when you move the joystick left, the submarine moves left and so on. We don't see why a similar pattern of control could not be provided for a standard Apple joystick. However, as we have commented once before, that does not sell Joyports. Lest we be accused of cynicism, on with the evaluation.

All of our players agreed that the game was great fun when played with Atari-type joysticks through Sirius Joyport. Furthermore, most of them agreed that the two-player version was more fun than playing the game solo.

With two players, many offensive and defensive strategies can be employed. For example, when a player's torpedo destroys a jellyfish or other sea creature, it splits into many fragments which float up toward the surface of the water. These fragments are lethal to a submarine. Hence, after your torpedo hits a sea creature it is vital to get out of the way

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SOFTWARE PROFILE

Name: Jellyfish
Type: Arcade game
System: 48K Apple, Disk Drive, Sirius Joyport recommended
Format: Disk
Language: Machine Language
Summary: Your own submarine; best for two players
Price: $29.95
Manufacturer:
Sirius Software
10364 Rockingham Drive
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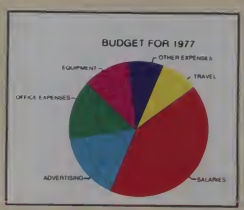

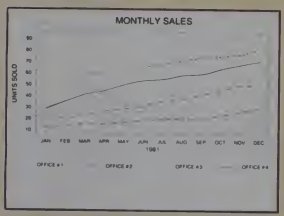

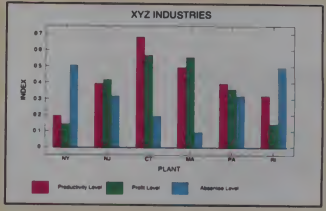

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Jellyfish.

quickly. On the other hand, if you can hit a sea creature which is immediately under your opponent, it is generally a sure-fire method of destroying him.

Since the sea creatures attempt to follow a submarine around, another popular strategy is to lure some sea creatures in the direction of your opponent while he is attempting to collect the discarded nuclear waste capsules from the ocean floor. During the collection process, submarines are particularly vulnerable as they cannot shoot and they move at a less-than-normal speed. Attacking your opponent in this way is also likely to cause him to be careless in picking up the capsule which can be disastrous. In particular, if you fail to line up the mechanical pick-up arm correctly, your ship will break open the capsule and you will be destroyed by the deadly nuclear waste.

Jellyfish provides three levels of responsiveness of the submarines and eight skill levels, more than enough for the most fanatic and dedicated players.

The game is great fun and a marvelous diversion from the more-or-less standard space ship shoot-'em-ups and *Pac-Man* offspring.

In short order, *Jellyfish* became one of the all-time favorites of our playing panel.

Oil Rig

We read in the instructions that "*Oil Rig* combines the strategy requirements of a board game with the fast action of an arcade game. Your strategy is to gain enough money through the oil products market to be able to afford the costs of prospecting, oil rigs, and drilling rigs. You also need enough cash to carry you through should you not hit oil."

The display on the screen at all times shows six oil products and eight pieces of equipment along with the quantity that you own, the current value (or price) and your total investment in that particular item. Prices of all of these items change month by month along with your cash, income, and net worth. Initially when you fire up the game, you will be alarmed by the speed of the price changes. The cursor relentlessly plows from the top to the bottom of the screen changing each of the fourteen prices in turn. As soon as one month is completed, the process starts over.

Price changes are affected by three separate variables:

1) Market factors. These are general trends in the market that affect items on the master board. For example, an OPEC price increase would force oil market prices up while off-season travel would cause a general decrease in prices.

2) Individual traits. Each item on the board has a growth rate unique to that item. This may be in the same direction or counter to the overall market.

3) Inflation-deflation. A general trend either up or down is quite distinct from either of the other factors.

At the beginning of the game you select how many years you wish to play from 10 to 40; the longer the game the easier it is. You also select the level of difficulty from 1 (novice) through 9 (pro).

After bootup, the game immediately starts and you must be ready to make some quick decisions. Since you start with just $1000 of cash and no equipment or product (gasoline, crude oil, etc.) these decisions are relatively simple. In particular you must buy some product so that you can sell it later on.

Oil Rig.

Since you must scan 14 items rather hurriedly, I initially adopted a rather simple playing convention, which was to buy products when their value was a single digit and to buy equipment when its value was under $300, assuming I had enough money. In general, this got me going (although not always!). Then I could start keeping an eye on whether prices were going up or down.

I also found it easier to buy in multiples of 10 or 100. By so doing I could check my total value to the left against the individual value of items in the center column and, at a glance, tell if I could easily make money by selling or if I was behind. Multiples other than 1, 10, or 100 I found nearly impossible to check fast enough in my head to make intelligent sell decisions.

Be sure to read the instructions under the heading "Prospecting" carefully. The instructions admonish you to remember the location from which your core sample was taken (such as 18-12). The first few times I went prospecting, I was so excited that I forgot to remember from where my sample was taken and, when I returned to drill later on, I sunk a dry hole. Also,

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SOFTWARE PROFILE

Name: Oil Rig

Type: Rigged simulation game

Author: Kevin Bagley

System: 48K Apple, Disk Drive, Paddles

Format: Disk

Language: Compiled Basic

Summary: Make business decisions quickly

Price: $29.95

Manufacturer:
Computer Programs Unlimited
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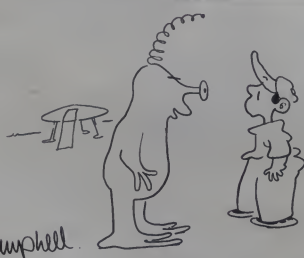

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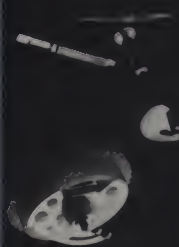

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beware of drilling too soon! You'll need a reserve of at least $8-10,000 for sinking a hole.

As you get deeper into the game, you'll find you are spending more and more money. Be sure to heed the instruction that advises keeping at least $20,000 but not more than $100,000 cash on hand (to avoid being taxed to death).

Don't be discouraged if the first half dozen or even dozen times that you play you quickly go bankrupt. I did. But eventually I got the hang of it. Then I convinced myself that I was playing with someone else's money and really got into the swing of things. No, I'm not ready to take on Exxon or even Brock Petroleum, but I sure had a good time trying to get into C.P.U. Software's Tycoon Club in which they will refund the cost of the disk if you hit a gusher on your final score. I never did, but I had fun trying.

Star Base Gunner

The instructions tell us that *Star Base Gunner* "is a 3-D type game where you will be shooting into the screen at enemy ships located mathematically a great distance behind the screen." In other words, ships that are further away appear to be smaller and appear to move more slowly. In the lower levels of play (there are ten levels), you have a range finder. Using the joystick, all you have to do is line up the target ship between two horizontal marks on the side of the screen and below an arrow on the top. When the target is lined up, you may use one of three weapons: a laser beam (fired by button 1), a photon torpedo (fired by button 0), or a neutrino pulsar (fired by the Escape key). This third weapon may not be fired until you have achieved a score of over 2000. On the lower levels, the rangefinder will automatically shoot your weapon the correct distance.

creative computing

SOFTWARE PROFILE

Name: Star Base Gunner
Type: Arcade game
System: 48K Apple, Disk Drive, Joystick
Format: Disk
Language: Machine language
Summary: Easy to play, nice 3-D graphics effects
Price: $29.95
Manufacturer: Apple-Jack Software
P.O. Box 269
Auburn, MA 01501

Your goal is to keep your three solar arrays two energy storage units behind each array intact. They are the source of your power, so should they suffer damage, you will run out of power and the game is over. You are protected as long as your shield power is above 200.

As the game progresses you may find it necessary to put energy in the shields from your weapons system. This is done with the right arrow key. You may also get energy from the shields with the left arrow key.

While the instructions tell us that it is possible to play with paddle controls, we found that a non-centering joystick was vastly preferable.

The instructions spend many paragraphs talking about depth and perception relating it to the size of the target and the angular position of the gun site. While this was all very interesting, we found there was nothing like three or four rounds of play to get a good feel for the game. Once we did, we had no trouble progressing up through the lower levels. But eventually, kaboom! we got wiped out.

Star Base Gunner.

We found it curious that once we had aimed and fired our weapon the target obligingly stood still waiting for either a hit or miss. In most games, you have to anticipate where a target is going to be when your weapon hits and fire at that spot. However, in *Star Base Gunner* you simply have to get the target between your gun sights, fire and, if you were accurate in your sighting, you will get a hit. (This is reminiscent of the *Star Wars* game written by Bob Bishop, oh, so many years ago and now available on Apple Games Pak from *Creative Computing Software*. We can't help but feel that if joysticks were widely available three or four years ago, that *Star Wars* would have been one of the most popular arcade games of all time. As it was, perhaps it was too much and too soon).

Although *Star Base Gunner* was an interesting game, we think that it is probably a far better demonstration of the excellent Designer Graphics System by Apple Jack Software than it is a game in its own right. On the other hand, if you are looking for an up-to-date version of *Star Wars* with color and sound, perhaps this is your cup of tea.

Neptune

In *Neptune*, you are the Commander-In-Chief of the naval vessel, Neptune. Your mission is to seek and destroy enemy robot amphibians that have inhabited neutral waters.

Although you are commanding a submarine and the theme is nautical, *Neptune*, in reality, is another version of the arcade game, *Defenders*.

Your submarine is traveling from left to right (actually the underwater terrain is scrolling by from right to left). As you travel along, small purple robots bounce from the top to the bottom of the screen and back again. In addition, cute little white faces with large red bow-ties bob about on the ocean floor.

Purple robots may be shot with your laser beam while the bobbing creatures must be trapped with depth charges dropped on top of them. After going through a group of these nasties, you come upon some "flying" saucer type of underwater vessels moving rapidly from right to left. These can be either avoided or shot (for 80 points each).

You then encounter a large cave (no nasty creatures). Unfortuntely there is only one way through the cave and you must choose it long before you can see whether it is the right one. A little ESP, or just plain guess work is helpful here.

Following this, you enter a narrow cave containing vessels that cannot be shot. Here, you need quick reflexes and peripheral vision to see what's coming on the screen from the right both in terrain and enemy vessels as you stay toward the left center of the screen.

Get through the cave, and you can finally dock at your fuel station. Whew! Move your ship downward and to the

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SOFTWARE PROFILE

Name: Neptune
Type: Arcade game
Author: Nasir
System: 48K Apple, Disk Drive, Joystick
Format: Disk
Language: Machine language
Summary: Challenge, excellent graphics
Price: $29.95
Manufacturer:
Gebelli Software Inc.
1771 Tribute Rd., Suite A
Sacramento, CA 95816

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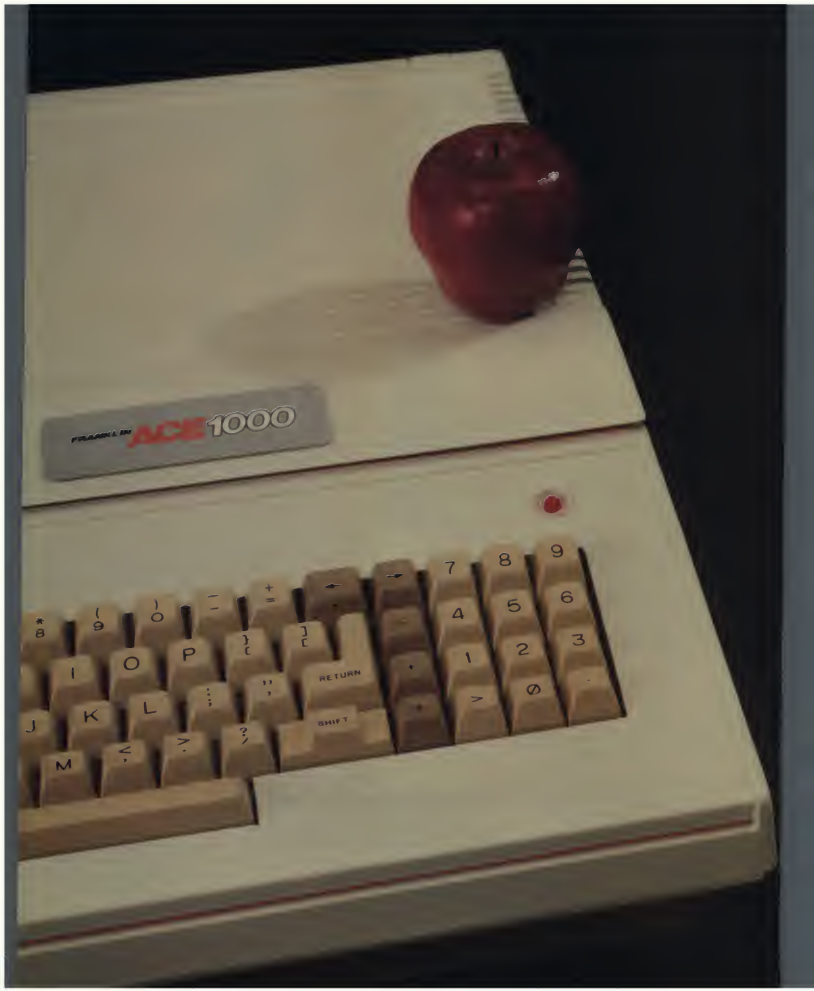
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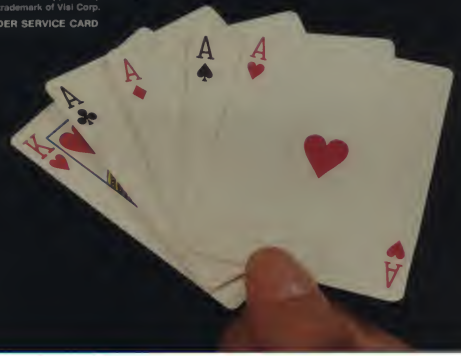

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Neptune.

right, and you're on way to a higher level, which is characterized by less maneuverability, changes in the underwater environment and aquatic life, and a faster pace.

The high score after each boot-up is saved, but high scores are not saved to the disk. All the members of our playing panel strongly preferred the joystick option. Incidentally, you will need a joystick with two quick fire buttons; the Apple Peripherals division (formerly the Keyboard Company) joystick just won't do for this game.

In summary, *Neptune* employs the spectacular graphics and excellence of execution that we've come to expect from Nasir in his years of producing games for Sirius Software. There's no question, that *Neptune* has all the makings of another big winner!

Bandits

Although nestled in a corner booth at the West Coast Computer Faire, Sirius Software was drawing huge crowds of people to watch the play of a new arcade game. They had a full-sized video arcade game, the interior of which had been gutted and replaced with an Apple computer and color monitor. In addition, the game play was being shown on a large-screen projection TV set. The game they picked to show—Bandits. The effort was worth it; the game created quite a sensation!

Now, away from the hoopla,our playing panel has had a chance to evaluate Bandits in the comfort of our game room. The verdict: sensational!

At the start of play, you have a group of five items (fruits, vegetables, etc.) clustered at the right side of the screen. Alien bandits then come in and assemble at the left side of the screen outside the reach of your laser cannon. After they have assembled, they take off in various formations, flying and swooping about the screen, raining bombs upon your base at the bottom and making for your goods at the right.

At your disposal, you have a laser cannon which can blast the aliens into smithereens and you have shields which can protect you from their bombs.

Bandits has 28 levels of play; each level has a different group of items on the right and features a different combination of bandits that go after your goods.

You score 100 points for each supply item remaining after obliterating all of the bandits in an attacking wave. For each level you advance, you pick up an additional 100 points for each remaining supply item (maximum 500). If the bandits steal all of your supplies, the game is over.

You begin with five ships and are awarded a bonus ship for each 5000 points.

Shields are a mixed blessing. While they provide total protection against bandit fire or bombs, you only have a limited amount of shield energy. Shield energy is totally replenished with each new ship and slowly replenished during sustained play when the shields are not in use.

The variety of attack formations and aliens is staggering. Indeed, they cannot all be stored in memory at one time; thus, the disk must be kept in the drive so that each attacking formation can be loaded as play proceeds.

Bandits.

The game may be played from the keyboard which uses the right and left arrow keys for movement, space bar for firing, and "S" for shields. We found this the least satisfactory method of play. Far better was a paddle or joystick with the knob (or stick) for movement, button 0 for firing, and the space bar for shields. Even better, was a switch-type (Atari) joystick attached to a Sirius Joyport. Joystick movement controls the base, while the button fires your laser and a forward tilt of the joystick activates the shield. We don't see why this movement convention could not have been offered with a standard joystick, but, cynically we observe that doing so would not sell Joyports. We also longed for a continuous fire feature, similar to the *Centipede* arcade game or its Apple look-a-like, *Photar*.

The high score of Bandits is saved each time the disk is booted up, however, it is not permanently recorded. We wish it were along with the player initials.

Nevertheless, despite these criticisms, we found Bandits great fun. If you are looking for nonstop action, look no further; this will give you your fill.

Quadrant 6112

In this easily played and rather nifty game, you navigate a little starship around a small sector of the galaxy defending your turf against nasty aliens. Your quadrant, 6112, is shaped like a rectangle just about the size of a TV screen. What a surprise! Now comes the real surprise. This isn't just another version of an arcade game; it is original!

Located in the middle of your quadrant, are two smaller squares of which the sides, one or two at a time, show only intermittently. These square boxes are actually star gates (or is it the other way around?) from which alien vessels eventually emerge to occupy your quadrant. Your mission, of course, is to blast them to smithereens.

At your disposal, you have the usual

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SOFTWARE PROFILE

Name: Bandits

Type: Arcade

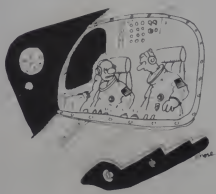
System: 48K Apple, Disk Drive, Joystick recommended

Format: Disk

Language: Machine language

Price: $34.95

Manufacturer:
Sirius Software, Inc.
10364 Rockingham Drive
Sacramento, CA 95827



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laser cannon in the pointed nose of your ship (fired with paddle button 0) and a "heat seeker" that will destroy every enemy that is in normal space. This is activated by pressing the space bar. The temptation is to press the heat seeker when there are many enemy ships on the screen, however, those that are still within the confines of the star gates are not affected by the heat seekers, hence it is wise to wait until a good number have emerged from these protective enclosures.

Control of your ship is the easiest we've seen in any game. Knob 0 controls the ship direction, short jabs on paddle button 0 fire your laser cannon, while holding down paddle button 0 activates your thrusters. It's simple and reliable. The only thing you must remember is that it takes time for your thrusters to change your direction because, like any object, your ship has inertia. In other words, once you have built up speed in a particular direction, you will continue to move in that direction no matter what direction your ship faces.

In addition to getting points for shooting alien ships, you also get points for navigating around the quadrant. Each time you go to a corner, a small red cross lights up and, when you have scouted all four corners, you score a "lap," which is indicated in a counter at the top of the screen. When you have eliminated the current assault, you receive extra points for each lap completed.

If you complete at least one lap in each of four different attack groups, you are awarded a bonus ship. The number of ships you have left is displayed on the screen at all times.

Every so often the alien commander will emerge to see who has been destroying his ships. Beware! He is a very good shot and extremely fast! Fortunately, he does not stay around for long.

creative computing

SOFTWARE PROFILE

Name: Quadrant 6112

Type: Arcade game

System: 48K Apple, Disk drive, Paddles

Format: Disk

Language: Machine language

Summary: Fast moving, easy-to-play

Price: $34.95

Manufacturer:
Sensible Software Inc.
6619 Perham Dr., Dept. G
West Bloomfield, MI 48033

Quadrant 6112.

A thoughtful touch by the author is storing the top ten scores and players names permanently on the disk. We wish more program authors would follow his lead. All in all, *Quardrant 6112* is a fast-moving, easy-to-play game that all of our panelists found good fun.

Lazer Silk

Lazer Silk is an amazingly imaginative game, in which you are a spider defending your web from annoying bugs and deadly insects. To keep your web from being torn apart, you must bundle (capture) bugs as soon as they fly into your web and land. To do this, you must get close enough to touch them. However, certain enemy bugs will not allow themselves to be bundled and, if you touch them, you will be immediately wiped out. Against them, you must use your own deadly weapon, Lazer Silk, to shoot them as they bombard you.

In addition, there are scavenger ants and beetles which scamper around your web and try to steal the bundles for which you have fought so hard. These creatures too may be bundled, but you must reach them quickly.

Another menace is the quick and unexpected electrode which darts around your web, chasing you until either it catches you or you shoot it. In addition, attack spiders occasionally drop fron the top to the bottom of the web; against them there is no defense except to get out of the way.

The web is rectangular with a giant ellipse stretching from corner to corner missing from the center (see illustration). You can travel on any strand of the web which effectively permits you to go up and down, side to side, and diagonally. The game may be played from either the keyboard or a joystick. We found the joystick option far more satisfactory than the keyboard.

We found it took two or three plays of the game to get to know the different bugs on sight. After all, you don't want to go around trying to bundle a bee when it will sting you causing you to lose a life. On the other hand, it is easy to bundle a Xenar mystery bug, but you get 500 points if you shoot it instead. Once you memorize a few of the basics, then it's off to the business of spidering.

On earlier levels, the game seems rather tame and it's generally easy to bundle all of the bugs that land in your web. However, on later levels, you may well find yourself in one corner bundling a medfly when a scavenger ant appears in the diagonally opposite corner and steals two or three of your previously hard-earned

Lazer Silk.

bundles. This is bad not only because you lose your bundles but because it leaves holes in your web over which you cannot travel.

All in all, *Lazer Silk* is a clever, imaginative game; it was especially well liked by the girls on our playing panel. Even so, *Lazer Silk* tended to be less frustrating and last longer than most other arcade-type games, a fact appreciated by younger players. □

creative computing

SOFTWARE PROFILE

Name: Lazer Silk

Type: Graphics game

Author: Eric Knopp

System: 48K Apple, disk drive, joystick

Format: Disk

Language: Machine language

Summary: Novel theme, easy to play

Price: $29.95

Manufacturer:
Gebelli Software Inc.
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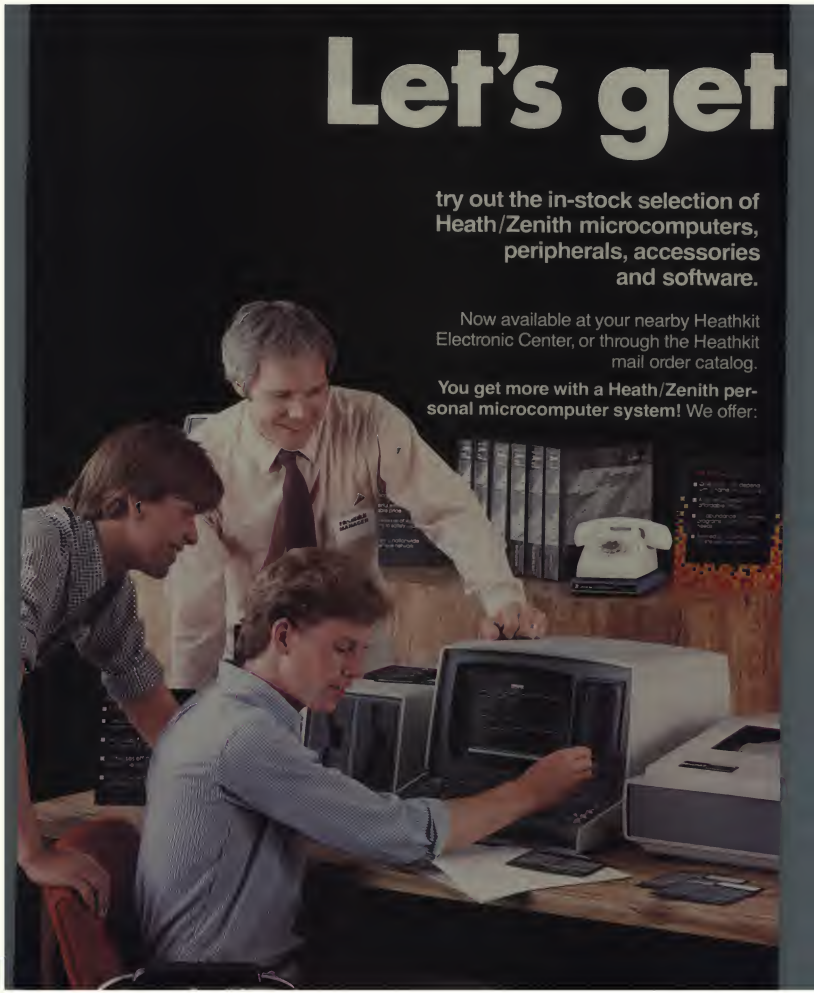

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CIRCLE 293 ON READER SERVICE CARD

Dungeons and Asteroids

David Small

Warlock's Revenge

creative computing
SOFTWARE PROFILE

Name: Warlock's Revenge
Type: Adventure with Hi-Res screens
System: Atari 400/800
Format: Cassette or disk
Language: Basic and machine
Summary: A good adventure game
Price: $34.95
Manufacturer:
Synergistic Software
5221 120th Ave. SE
Bellevue, WA 98006

Warlock's Revenge is an Atari translation of an Apple game, *Oldorf's Revenge*. It is another graphics adventure and seems well done. I didn't encounter any bugs in my playing of it, and I had a good time, although I have to admit I'm beginning to burn out on generic adventure games.

After a certain point, you see, I get tired of trying to figure out which implement I must use to get past a certain point. The game becomes boring, and settles into mere combination testing.

David Small, 11314 Yucca Dr., Austin, TX 78750.

While *Warlock's Revenge* suffers from this malady to some extent, it isn't nearly as bad as some I have seen. It wins points for this; there's nothing worse than an unplayable, un-figure-outable adventure.

In this game, you are leading a party into a dungeon. You can be any of several different types of character (cleric, magician, and so on), each of which has special skills. These skills are needed to get past a certain point in the dungeon and to continue the adventure. Be prepared for a great deal of testing of combinations, or perhaps a short session of dumping the game database to the printer. Hint: the game is all *hardcoded*, with all pictures, etc., coded into the program.

The pictures are all done in graphics 8, the highest resolution mode the Atari has. They seem to have had a good amount of work put into them, and the only detraction is that in graphics 8 the Atari doesn't put out a solid line, it tends to candy-stripe and change colors. This is called artifacting and can be of use to a programmer who understands it; the folks who did *Warlock* didn't, I'm afraid, so you would do well to turn off the color on your TV.

The game itself is a fairly standard adventure, with pictures at each stop and two-word commands. It runs fast enough and is fun to play. I recommend it and had a good time playing it, even if (I must confess) I have yet to completely finish it. This one will take you more than a couple hours to do.

Artifacting can be of use to a programmer who understands it; the folks who did Warlock didn't.

In summary, while it may be "just another adventure," the game is a lot of fun and good to play. Don't let the fact that there is good competition for it worry you; just because there are several good games like it available, doesn't mean this one isn't worth getting. There aren't yet enough adventures on the market to swamp it completely, so if you're into such things, or if you would just like to give one a try, this is a good choice.

Every reviewer has to fight a tendency to be sarcastic when he discovers a game that just doesn't make it. The urge to make cutting comments can be overpowering. In this case I was going to award the Cray-1 Speed In Arcade Games Trophy for this game. But that isn't how I view the purpose of a review. I prefer to try to make constructive comments on games that aren't quite right in the hope that the author(s) will consider my opinions and suggestions and, perhaps, improve the game.

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Kayos

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SOFTWARE PROFILE

Name: Kayos
Type: Arcade
System: Atari 400/800
Format: Cassette or disk
Language: Machine
Summary: Good if you have superhuman reflexes
Price: $34.95
Manufacturer:
Computer Magic Ltd.
P.O. Box 2634
Huntington Station, NY 11746

So we come to *Kayos*. You've guessed it—it doesn't make it. It is very well done technically. It runs faster than most, and obviously a great deal of work went into it. I have no complaint with it technically. However, its human interface isn't very good. It is simply too fast for people. Robots with emitter-coupled-logic reflexes might enjoy it, however.

Kayos.

When you boot it up, you see a field of asteroids crossing space from left to right—a complex animation task for sure; someone worked very hard on it.

At blinding speed a series of blurry objects comes out of the top of the screen and dives upon your emplacement; I could never identify what they were, they went so fast. My average playing time was around a minute or two, and I just couldn't see spending too much time on the game.

Galaxians, and arcade games like it, are a challenge because they are not too fast. Much fiendish design effort went into making them just fast enough to be an agonizing challenge and not simply impossible. *Kayos* lacks this human engineering quality. It is a game sadly in need of a few strategically placed delay loops.

Look for a reissue soon, I hope. This could be a fun game if it were slowed to a playable speed. □

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CIRCLE 181 ON READER SERVICE CARD

TRS-80 Arcade Games

Harry McCracken and Owen Linzmayer

Video game madness is sweeping America. News magazines publish cover stories on video games, bookstores sell books on how to beat them, and chart-topping records are recorded about them. It is not surprising, then, that many software publishers offer versions of the most popular arcade games for home computers.

Not surprising, at least, in the case of such computers as the Apple II, Atari, and TRS-80 Color Computer. Those machines all have high-resolution color graphics, sound routines in ROM, and paddles or joysticks. Not so the TRS-80 Model I and Model III. They have low-resolution black and white displays, no sound routines, and no game controllers. That is why it is remarkable that there are quite a few good arcade-style games for the TRS-80 Model I and III.

Let's look at four games which make especially good use of the limited potential of the TRS-80 as an arcade game machine.

Planetoids

Planetoids, published by Adventure International, is, as the name suggests, inspired by the classic Atari arcade game Asteroids: you control a ship which shoots at floating asteroids and enemy spacecraft.

Adventure International has released versions of *Planetoids* for both the TRS-80 and the Apple II. Amazingly, the TRS-80 version is by far the better of the two.

Planetoids.

Greg Hassett, known primarily for his adventure games, has written one of the best arcade-style games available for any home computer with or without, high-resolution color graphics.

Many home computer games which try to simulate arcade games get the graphics of the original down, but *Planetoids* is one of the very few which do a good job of simulating the *timing* of the original. That means that playing *Planetoids* is much like playing Asteroids.

Planetoids is enhanced by its special features and playing modes. Like many games, it has more than one skill level, but it also has the option of saving high scores to tape, the ability to abort a game in progress, and the ability to "freeze" a game, so that you can answer the phone and come back to an uninterrupted game.

The special modes include "dogfight" mode, in which there are no asteroids and you fight one-on-one with the enemy ships; "cruise" mode, in which the asteroids move very, very slowly, so that you can practice steering your ship; and "practice" mode, in which game play starts out at a higher skill level than normal—*Planetoids*—gets harder as you

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SOFTWARE PROFILE

Name: Planetoids
Type: Arcade game
System: TRS-80 Model I and III, 16K
Format: Cassette
Summary: Excellent version of Asteroids
Price: $19.95
Manufacturer:
Adventure International
Box 3435
Longwood, FL 32750

Harry McCracken, 47 Carleton Street, Newton, MA 02158.

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play—and your score is not recorded on the high score chart.

All of these features ensure that *Planetoids* will hold your interest for a long time.

I do have two small complaints about the game. It does not have sound, and there is no two-player mode. Neither of these is a big problem, but the game would be better if it had sound and two-player capability, as most TRS-80 arcade games do.

Alien Defense

Another game which does a good job of adapting an arcade game to the TRS-80 is *Alien Defense* from Soft Sector Marketing. Inspired by Williams's arcade hit *Defender*, it is probably the most difficult arcade game around for the TRS-80.

As in *Defender*, you control a ship which flies above a horizontally scrolling landscape and shoot down many kinds of aliens, some of which fly down and kidnap people who stand on the landscape.

The graphics in this game aren't as good as those in *Planetoids*; they flicker and the movement is a bit too jerky. That isn't surprising, though; there is a great deal of movement going on in this game.

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SOFTWARE PROFILE

Name: Alien Defense

Type: Arcade game

System: TRS-80 Model I and III 16K cassette, 32K disk

Format: Cassette or disk

Summary: Good version of Defender

Price: $19.95 cassette; $24.95 disk

Manufacturer:

Soft Sector Marketing
6250 Middlebelt
Garden City, MI 48135

Larry Ashmun, the author of *Alien Defense*, has done a good job of putting the ship controls onto the TRS-80 keyboard. While you must manipulate six keys to control your ship, the pattern in which the keys are arranged makes it easy to do.

The Model III version of *Alien Defense* has an added feature: the special character set of that computer is used, so that the little men look like men, and the alien ships look more like alien ships than they do on the Model I. This is the only Model III game I know of which uses the Model III graphics so well.

All in all, *Defender* fans should be very pleased with *Alien Defense*. Like *Defender*, it is a very challenging game, so beginning arcade game players might find it a bit complicated at first.

Defense Command

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SOFTWARE PROFILE

Name: Defense Command

Type: Arcade game

System: TRS-80 Model I and III, 16K cassette, 32K disk

Format: Cassette or disk

Summary: Big Five's best yet

Price: $15.95 cassette; $19.95 disk

Manufacturer:

Big Five Software
Box 9078-185
Van Nuys, CA 91409

Big Five Software has released a steady stream of superb games, over the last couple of years. One of their most recent games, *Defense Command*, is their best yet. It might be described as *Space Invaders* crossed with *Defender*. You control a base at the bottom of the screen, *Space Invaders* style, and protect fuel cells from attacking aliens who try to steal them.

Just about everything which has distinguished Big Five games in the past is in *Defense Command*. Explosions are more realistic; the high score chart lets you type in your full name, rather than just a few characters; and the infamous Big Five Flagship is more evil than ever. Like *Robot Attack*, *Defense Command* talks through the tape port, but the speech is far clearer.

While *Defense Command* is a difficult game to master, it is not complicated; beginners may play terribly, but they will understand and enjoy the game. And because *Defense Command* requires more true strategy to master than the other Big Five games, even advanced arcade game enthusiasts will find it a challenge.

If you have trouble formulating a strategy to play the game well, watch the demonstration mode; the computer plays the game very well, and it is easy to pick up pointers from watching it play itself.

Armored Patrol

In writing a TRS-80 version of an arcade game the biggest problem is usually the creation of an acceptable graphics display. This is a difficult task with almost any hi-res game (what current arcade game isn't hi-res?) but, when a TRS-80 version of a vector graphics game is desired, it borders on the impossible—or so I thought. *Armored Patrol* is an adaption of the popular arcade game Battlezone, which uses vector graphics.

Written by Wayne Westmoreland and Terry Gilman, *Armored Patrol* is an amazing demonstration of how far creative programming can stretch the limited graphics capabilities of the TRS-80. In *Armored Patrol* the player assumes the guise of a tank commander positioned in a desolate battlezone. This death field is littered with indestructible blockhouses which serve as obstacles during a shoot out. Hidden in this barren land is an endless supply of enemy tanks and killer robots bent on destroying the player.

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SOFTWARE PROFILE

Name: Armored Patrol

Type: Arcade simulation

System: 16K Model I or III TRS-80

Format: Cassette

Language: Machine

Summary: Superb arcade game

Price: $19.95

Manufacturer:

Adventure International
Box 3455
Longwood, FL 32750

Armored Patrol allows one or two players, alternating turns, to test their abilities against the enemy forces. The program constantly displays and updates the players' scores and also keeps track of the high-score. The sound effects are an added touch to enhance the captivating 3-D screen display.

Never before had I imagined that my TRS-80 was capable of such a realistic simulation.

The object of this game is survival. By weaving skillfully among the blockhouses, the player tries to gain position from

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which he can safely blast the enemy without risking destruction himself.

An enemy tank can combine forces with a killer robot to attack simultaneously from different vantage points. The player is aided by a radar scope that gives him a rough idea where the enemy is in relation to his position, but visual confirmation is usually required for accurate shooting.

Armored Patrol.

As the enemy tank approaches it grows in size and its surface details become clearer right up to the point where you are looking down the cannon barrel. By then it is usually too late to do anything but pray.

Armored Patrol is a classic in every sense of the word. Its value as a simulation is tremendous but it is also a superb arcade game. Although the controls are a bit difficult to master, it is a wonderful program for game players with even modest coordination. I recommend this package without reservation.—*O.W.L.*

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The Puzzle Of The Tacoma Narrows Bridge Collapse: An Interactive Videodisc Program For Physics Instruction

Dean Zollman and Robert Fuller

On November 7, 1940 the bridge across the Tacoma Narrows went into violent oscillations and collapsed within a few hours (Figures 1-3). Most of the final hours of the bridge and many earlier oscillations were photographed on 16mm color film by Barney Elliott, proprietor of The Camera Shop in Tacoma, WA.

The films of the bridge undergoing oscillations with amplitudes of over two meters can motivate almost any student to learn more about wave motion. Several years ago one of our students paid the ultimate compliment to a short edited version of the original film: "I'd even pay to see that."

Thus, while this event was a disaster in terms of cost and hurt pride to engineers, it has provided physics teachers with the most captivating demonstration of wave phenomena ever devised. Certainly, physics teachers have long applauded the designing engineers for their contributions to physics instruction and Barney Elliot for filming it.

The quality and uniqueness of the Tacoma Narrows Bridge film make it very valuable for audio-visual presentations. When we and Thomas Campbell of Illinois Central College began thinking about subjects for our first interactive videodisc, the Tacoma Narrows Bridge and the reasons for its collapse were natural choices.

Further, several good physics films on wave motion and vibrations are available. By using them and Mr. Elliot's film we believed we could create a low-cost instructional videodisc. Thus, we proposed to the National Science Foundation (NSF) Directorate for Science Education that it support us in this low-cost approach to videodisc education. The NSF agreed to provide funds, so we began planning in early fall, 1979.

Dean Zollman, Department of Physics, Kansas State University, Manhattan, KS 66506.

Robert G. Fuller, Department of Physics, University of Nebraska-Lincoln, Lincoln, NE 68588.

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The Bridge Disc

The Puzzle Of The Tacoma Narrows Bridge Collapse was created as a Level Two videodisc (see box) and is designed for use with a Pioneer PR-7820 videodisc player. Any student who learns physics by using the disc must interact frequently via the remote keypad.

This interaction takes the form of answering questions or making choices which are presented on the television screen. The degree to which the student is active during the lesson can be described in terms of its length. If played from beginning to end as one would a motion picture, the program lasts for slightly less than 27 minutes. When taking part in an interactive lesson, students spend from two to four hours using the system.

By using the programming capabilities of the player, parts of the program can be made available to some students but not others. We used this aspect of the technology to establish three levels of physics instruction.

These levels are labelled red, blue and green and correspond to the three major types of introductory physics courses—physics for the nonscience student, physics presented using algebra and physics using calculus. At various points during the lesson students branch to frames which depend on their level.

As we developed the disc we were guided by some basic principles. First, students should have a strong motivation to study the subject matter on the disc. Second, the physics involved should be presented as a problem or puzzle for the students to solve. They, not we, should be the ones to state "The bridge collapsed because..."

Finally, the interaction between disc and student should be much more than answering questions. By viewing pictures of real experiments they should be able to take data and draw conclusions from them. In summary, the lesson on the disc must be theirs not ours. While we provide the means by which they learn, they discover what they need to know to solve the problem.

With these thoughts in mind we divided The Puzzle Of The Tacoma Narrows Bridge Collapse into five parts: Introduction to the Player, The Bridge Collapse, The Influence of the Wind, The Importance of the Bridge Properties, and Conclusion. Perhaps the best way to see how students work with the disc is to take a guided tour of each part.

Introduction To The Player

We assume that students would not previously have used an interactive videodisc player, so our first step is to teach them how to use the system. They are

guided through a series of operations each of which teaches how to use a key or series of keys needed to interact with the disc.

The presentation requires action on the part of the student; the picture does not change, for example, unless he presses the appropriate key. By the time the student has finished this short section he has demonstrated sufficient knowledge of the system to complete the lesson.

The Hook

When the student reaches the end of the introduction to the player he is told to enter the number 49, then press RECALL SEARCH. These entries on the keypad recall from memory the frame number stored in memory location 49, then cause the machine to search to that frame.

The next picture states PRESS AUTO-STOP. When this key is pressed, the machine plays to the frame stored in the memory location which is one greater than the last one used. (In this case the disc plays to the frame stored in memory location 50.) This series of entries begins the physics lesson.

We have informally named this section of the disc "the hook" because it is used to pique the student's curiosity about the Tacoma Narrows Bridge and its collapse. It "hooks" or intrinsically motivates him to complete the study of standing waves which is recorded on the disc.

Here the student views the construction, initial oscillations, violent oscillations and collapse of the first Tacoma Narrows Bridge. Accompanying the video is an audio narration created from written accounts of Professor F. B. Fahquarson, a consulting engineer, Kenneth Arkin, chairman of the Tacoma Narrows Bridge Authority; and Leonard Coatsworth, a reporter for the Tacoma News-Tribune and the last person to drive onto the bridge.

We feel that this seven-minute sequence will hook even the least interested student into wanting to learn more about the reasons for the bridge collapse.

After the bridge has collapsed and Mr. Coatsworth has lamented the loss of his daughter's dog Tubby (the only casualty), the videodisc stops on a frame containing the question "Why did the Tacoma Narrows Bridge Collapse?"

We do not answer that question directly. Instead, it is posed so that the student is presented with a puzzle to be solved. During the next two to four hours of study he will discover the pieces that can be put together to help explain this disaster. With some help from a video disc he will solve the puzzle of the Tacoma Narrows Bridge collapse.

The Influence Of The Wind

So far in the lesson the student has been rather passive. He has watched the bridge collapse but has done little else. That situation changes quickly.

To learn about the influence of the wind on the bridge collapse the student must take control of a series of experiments. The experiments involve a model of the bridge, a fan and a piece of cardboard. The fan blows on the bridge with three different speeds. In addition to a constant push, winds can blow in such a

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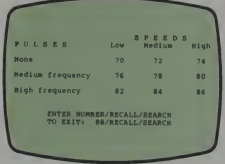
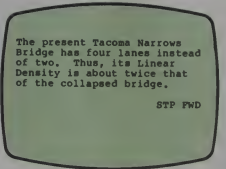
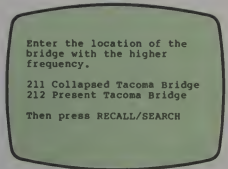
way as to create a pulsating force on bridges.

In this experiment the pulsations are created by periodically placing the cardboard in front of the fan. The fan can be set to three different speeds. The pulsing action results in no pulses, low frequency pulses, and high frequency pulses. With three values for each of two variables, nine different experiments exist. Each of these experiments has been recorded on the videodisc.



The student is introduced to the experiments and told that he must use them to determine what aspect of the wind was important in the collapse. Then a choice matrix (Figure 4) appears on the screen.





By pressing appropriate keys the student may select the experiments he wishes to see.

When he decides he has seen enough, he may end the experiment and move on. But, he cannot go far until he has been tested on his conclusions. A series of multiple choice questions query him about the influence of the wind. Incorrect answers cause the machine to show the experiments again. The student is stuck until he reaches the conclusion that the rate of pulsation, not the speed of wind, is the critical factor.

The Bridge Properties

Pulsating forces arising from wind cause most bridges to vibrate, but the first Tacoma Narrows Bridge fell down. To understand the difference between this bridge and most others, the student moves on to investigate the properties of vibrations in general and of vibrating bridges in particular.

To complete the investigation the student must have some knowledge of the physics of waves and oscillations. He learns this through a series of short presentations which rely heavily on a computer animated film created by Encyclopedia Brittanica Education Corporation with the assistance of Professor Albert Baez.

These sequences, which require some interaction by the student, lead up to a

Capabilities Of The Optical Videodisc

This optical videodisc system offers a new level of capability to the instructional designer. Each side of a disc can contain about 50,000 individual pictures (usually called frames). These frames can be shown one at a time for as long as needed; they can be played at regular speed (30 frames per second) to show normal motion; or they can be played at any slow motion speed forward or backward.

At normal playing speed the videodisc can play one or both of two audio channels. The audio capabilities allow for stereo sound, bilingual education, or different narratives for students with different backgrounds. While all of these features are useful, they would be of limited value without random access.

In a very short time an optical videodisc player can select and play any frame on the disc. For a well-constructed disc the search time is less than a second. For the worst possible situation, a search from frame one to frame 50,000, the access time varies from a few seconds for the educational-industrial models to about twenty seconds for a consumer player.

An interactive videodisc can be created at several different levels of instruction. At Level One the disc is designed for use on a stand-alone consumer model player such as the Pioneer VP-1000. Most discs at this level are motion pictures which play from beginning to end without any interaction. However, consumer players such as the Pioneer VP-1000 and VP-1100 have all the capabilities described above. Interactive discs can be and have been created for it. Perhaps, the best and most interactive to date is The First National Kidisc produced by Bruce Seth Green. (A review of this disc appears in the January, 1982, issue of *Creative Computing*).

A Level Two disc requires a small microprocessor such as the ones built into the Pioneer PR-7820 (formerly called the DiscoVision PR-7820) and the Sony LDP-1000. These players have internal memories which allow the instructor to enter program steps or to load the numbers of significant frames. While the various players have slightly different capabilities, they are all approximately equivalent to a 1K microcomputer.

Generally, a digital program is placed on the second audio track at the beginning of the disc. This program is loaded into the memory of the system and controls the operation of the disc. To date large numbers of videodiscs at this level of interaction have been created by General Motors and Ford. Many auto showrooms have stand-alone players with keypads for interaction. The Puzzle Of The Tacoma Narrows Bridge Collapse is designed for this type of interaction.

The third level involves coupling the videodisc player to an external computer. At present the most frequently used computers are the personal variety. All Pioneer players and the Sony are capable of receiving information from a computer. Thus, highly interactive lessons using all the advantages of both systems are now available.

The economics lesson developed by the Minnesota Educational Computing Consortium and described in the January, 1982 issue of *Creative Computing* is an example of this type of disc. A Level One disc can also be converted to a Level Three disc as was demonstrated by the computer-video adventure game published in the same issue of *Creative Computing*—*D.Z.*

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series of experiments with vibrating ropes. These ropes are placed under different tensions, have different lengths, and have different masses per unit length (linear densities in the language of physics). Experiments for three values of each variable are recorded on the disc.

The student is asked to determine how each variable affects the frequency of vibration for the rope. Exactly what conclusions he is to reach and how he is to do so depend on the instructional level—red, green, or blue. For example, the red level student must use his data to derive an equation which describes how the frequency depends on the three variables, while the green level student must state how the frequency changes as each variable increases or decreases.

The videodisc is an excellent medium with which to present this experiment. In real time the motion of the ropes can be seen only as a blur. Using the slow motion capabilities of the disc, the motion is slowed to the point where the student can count individual vibrations. In addition, each frame on a disc is assigned a frame number. Since frames are shown in real time at a rate of 30 per second, the frame number provides a 1/30th second timer. Using slow motion and the frame number the student can collect data on vibrating ropes in a manner which is not practical in any other way.

Once the student has completed analyzing his data, he must answer questions about his conclusions. First, he is queried about vibrating ropes. Then, to help him see how his conclusions apply to bridges, he is presented with questions such as the green level question in Figure 5. When he has completed this section, the student is ready to put all the pieces of the puzzle together.

The Conclusion

The two major parts of the puzzle—the wind and the properties of the bridge—have been investigated separately. To bring them together, the interaction between the two must be studied. This part of the disc does that at the three levels of instruction.

The red level student looks at the mathematical relations governing the oscillations of the bridge. In doing so he learns that the motions can be divided into two parts—vertical and twisting (torsional). For the Tacoma Narrows Bridge he learns that the frequency of twisting motion and vertical motion were almost identical. Thus, when a part broke and allowed the destructive twisting motion to begin, it did so quickly.

The blue or red level student sees a segment about turbulence which builds up on the downstream side of a flat object in the wind. With animated diagrams such

as Figure 6 they learn how this turbulence can create pulsating forces on a bridge.

All three levels view other examples in which a pulsating force leads to periodic, and sometimes increasing, motion. A flag in the wind, a child on a swing and a bouncing ball are examples of similar physical phenomena.

As television inevitably does, instructional videodisc concludes with a TV commercial. Ella Fitzgerald (or was it Memorex?) displays one more example of a similar event—breaking a wine glass with sound.

Using The Disc

To date, a few hundred students have completed the lesson as described above. Most of them have learned the physics that we hoped they would. More important, they have become involved in the problem solving nature of the presentation. In this way they have learned a little about how science works and sharpened their own ability to look at new situations in a systematic way.

The Future

When we were developing the disc, we included material which would require computer control for full interaction. While the lesson does not require this material to solve the puzzle, it can be designed so that students have more control over what they see. Thus, a program to use the disc under computer control is under development. When that program is completed, we will have finished our work on this disc.

Our experiences with The Puzzle Of The Tacoma Narrows Bridge Collapse have encouraged us to continue developing videodiscs for physics instruction. One videodisc, Physics And Automobile Collisions, is complete but has not yet been used by students. Several others are in various stages of development. In each case we are constructing the discs so that students are presented with problems they must solve, and at least part of the solution involves taking data from videodisc. With this type of instruction we hope to increase students' abilities in physics and problem solving. At the same time we hope they have as much fun learning from videodiscs as we have producing them. □

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What do you do with an interactive videodisc for physics instruction once it is completed. About a year ago we were faced with that problem. After showing it to our friends, relatives and professional colleagues, we looked for a commercial distributor.

At that time the only optical discs being distributed were motion pictures and a few others such as The First National Kidisc. The distributors of these discs were not interested in a disc with as limited an audience as high school and college physics teaching.

Fortunately, a major science textbook publisher, John Wiley & Sons, was interested in this new form of delivering physics instruction. In the spring of 1982 John Wiley began selling The Puzzle Of The Tacoma Narrows Bridge Collapse ($125). Thus, this disc becomes the first Level Two disc to be available from a commercial source.

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LOGO Ideas

Robert Lawler

Passing The Buck

Sometimes difficult problems can be simplified by doing a small part and "passing the buck." This example is to clarify the idea and the Logo techniques for applying it. Suppose you want to print messages in a code where every word is spelled backwards, e.g. sdrawkcab. How can you write a procedure to switch letters around? You know the procedure begins with a title line and a variable input, such as:

```
TO SWITCHEM :INPUT
```

If the input to SWITCHEM has no letters, nothing should be printed — maybe a space. If the input is only one letter long (such as "I" or "a"), it should be printed. If the input is longer, you will always want to print the last letter of the input anyway, so you might as well do that and pass the buck (all those other letters except the last one) to another procedure, call it HARDER:

```
TO SWITCHEM :INPUT
IF EMPTY? :INPUT PRINT SPACE STOP
TYPE LAST :INPUT
HARDER BUTLAST :INPUT
END
```

Now, what should the HARDER procedure be like?

If the input to SWITCHEM was one letter long, the input to HARDER will have no letters — it should stop. If HARDER's input is one letter long, that letter should be printed. If longer, you will want to print the last letter of the input anyway, so you might as well do that and pass the buck (all those other letters of HARDER's input except the last one) to another procedure — call it EVEN-HARDER.

Doesn't that sound familiar? EVEN-HARDER will have to do the job that HARDER was supposed to do. HARDER does the same thing as SWITCHEM. The good trick in passing the buck is *you never have to write the HARDER procedure* if SWITCHEM calls itself:

```
TO SWITCHEM :INPUT
IF EMPTY? :INPUT PRINT SPACE STOP
TYPE LAST :INPUT
SWITCHEM BUTLAST :INPUT
END
```

What Good Is Planning?

One view is that planning breaks a problem up into parts, each of which can be more simply solved than can the whole. For example, if you wanted the turtle to draw a picture of a house, you probably would find it easier first to write a triangle procedure for the roof and a square for the storey then put the two together than you would composing a procedure for drawing the whole thing at once.

A richer view of planning is that the breaking up of a problem is very fruitful because you will create partial solutions which can be used in different ways to make other things. Let's extend the HOUSE example. The simplest extension of a HOUSE would be to separate the parts from each other and reconnect them a different way. Doing so you could make a WISHINGWELL, such as the one drawn by this procedure:

```
TO WISHING.WELL
RIGHT 180 STOREY
RIGHT 180 FORWARD 100
ROOF
END
```

This attempt to use the parts of a HOUSE as parts of a WISHING-WELL runs into an immediate problem: the WISHING-WELL is bigger than the house. If you want both of them in the same picture, it will be necessary to make another triangle and square procedure for a small wishing-well. At this point, it makes sense to generalize the ROOF and STOREY sub-procedures, specifying their size by the use of input variables, as in the procedure below:

```
TO STOREY :SIDE
LEFT 90
FORWARD :SIDE 2
RIGHT 90 FORWARD :SIDE
RIGHT 90 FORWARD :SIDE
RIGHT 90 FORWARD :SIDE
RIGHT 90 FORWARD :SIDE 2
RIGHT 90
END

TO ROOF :SIDE
LEFT 90
FORWARD :SIDE/2
RIGHT 120 FORWARD :SIDE
RIGHT 120 FORWARD :SIDE
RIGHT 120 FORWARD :SIDE/2
RIGHT 90
END
```

Not only are these new procedures more flexible, the way they fit together can now be modified to make a better house than the original.

```
TO HOUSE.WITH.EAVES
RIGHT 180 STOREY 100
RIGHT 180 ROOF 120
END
```

□

Robert Lawler, Centre Mondial Informatique Et Resources Humaines, 22 Avenue Matignon, 7508 Paris, France.

What is Logo?

Molly Watt

Logo is a computer language which was developed to provide an environment which allows learning to take place as naturally as possible. Seymour Papert and his colleagues at Bolt Beranek and Newman and later at MIT set out to create a computer language which would combine the capabilities of artificial intelligence with the theories of Jean Piaget in order to allow a learner to build his own intellectual structures through estimation, interaction, experience and revision.

The Logo language is designed to provide an environment in which the child learner is in charge of

- Setting a problem to solve.
- Making choices.
- Playing with the problem, experimenting and trying out solutions.
- Building on what he has already done to do something more.

The language is interactive. You learn it *at* the computer. After working with a problem for a while, you edit it, revise it, and then play your next steps.

With Logo, a young learner can enter directly into the world of turtle geometry. Without memorizing formulas, he can create procedures for drawing squares, triangles, and circles.

This is unlike my own experience in geometry. I learned geometry in high school only because I was required to take the course as preparation for college.

Geometric thinking is possible now for any learner without a series of prerequisites. At the Lamplighter School in Texas, three year olds have used Logo to explore turtle geometry. And MIT students use the concepts of turle geometry used in Logo as a way to explore mathematics.

Seymour Papert is often quoted as saying that "Logo has no threshold, no ceiling." I have heard it said that Logo is a six year old's dream and a computer scientist's nightmare. Logo makes complex explorations possible for learners of all ages, without imposing artificial hurdles.

With Logo, a young learner can enter directly into the world of turtle geometry.

How does a child explore turtle geometry? It is really quite simple. Every child knows how to move from one place to another. Using his own experience in walking, a child "teaches" the turtle to move across a computer monitor leaving a trail or line to create a drawing.

Let's call our learner Wendy. Her first experience might be something like this:

1. She decides to experiment by drawing a square.

2. She paces a square on the floor to notice how she draws it.

3. She remembers how she did it and types a set of commands to the turtle which might look like this:

FORWARD 25 (no, not far enough)
FORWARD 25 (okay, that's enough)
RIGHT 40 (oh, that wasn't what I meant at all, let's try more) RIGHT 40, (well that's not it, try again) RIGHT 10 (that's it)
(let's see, what was it,) FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90

And so on until she has a square. With that accomplished, she can simplify the steps and teach the computer to do it by shifting to the edit mode. What shall the name of this procedure be?

Very often a student will name it with her own name, typing:

```
TO WENDY
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
END
```

The turtle will then "know" how to WENDY, and will execute a square every time the command WENDY is typed.

Now Wendy can enjoy playing with the procedure WENDY, and will probably type it over and over for the pleasure of watching the turtle "know" how to WENDY. The second WENDY will be drawn in a screen position which will surprise her, and our new Logo user will immediately type WENDY again just to see what happens. At the end of four

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What is Logo, continued...

WENDYS, there is a new design which can be taught to the computer as a procedure containing the subprocedure WENDY. It looks a bit like a window, so Wendy can type:

```
TO WINDOW
WENDY
WENDY
WENDY
WENDY
END
```

or

```
TO WINDOW
REPEAT 4 (WENDY)
END
```

Wendy has started the process of

Figure 1. Wendy.

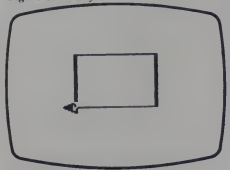


Figure 2. Window.

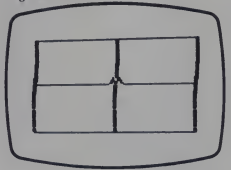
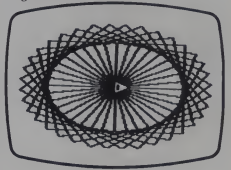


Figure 3. Rosewindow.



- Learning to control the turtle.
- Using the computer as a tool.
- Teaching the computer to execute an original idea and naming it.
- Noting the steps she used in order to save them as a procedure.
- Using the procedure as a subprocedure in her second procedure.

She has started to create her own computer language.

Taking the same example one step further, our new Logo user, in playing with WINDOW, may quickly discover that by using the procedure WINDOW and then rotating the turtle's position slightly a new design is made that holds a shape which begins to approximate a circle. This experiment can be formalized by typing, for example,

```
TO ROSEWINDOW
REPEAT 9 (WINDOW RIGHT 10)
END
```

As in all learning, the first job is to learn to control your tool. If you are using a pencil, you must practice holding it.

Your first written word may be your own name, which is a profound word to the writer. It permits you to show ownership, authorship, borrow library books, sign a check and send a greeting card through the mail. It is still a long jump to writing a dissertation or even applying for a job. However that one word puts you into the powerful world of words which make up magazines, recipes and phone books.

So it is with this first turtle drawing. Suddenly the Logo user is part of the world which assigns airplane reservations, cashes checks, and launches space shots. This is a world of power, which has in this first lesson become part of Wendy's own learning continuum. The process is intrinsically motivating and fascinating.

As every person can learn to use a pencil, everyone can — and will — learn to program a computer.

Projects by New Users

I think that it is important to look at some examples of tasks that some real students have set for themselves as problems to solve when beginning to learn Logo and to use a computer.

My purpose is to demonstrate the many working styles and interests which Logo can support. These students were in my classes in Amherst and Cambridge, MA and were between the ages of 8 and 17.

After several class sessions in a hands-on laboratory, I often suggest to my students, "See if you can make the turtle draw your initials." Many try the project, seem to enjoy the challenge, and then go on to some other experiment.

Two students, Ted and Stella, were working side by side, and became completely absorbed in drawing letters. Each determined to create a complete alphabet.

Ted immediately wrote a procedure to produce the whole alphabet, before creat-

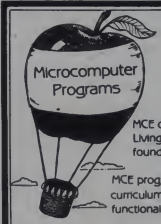


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Figure 4. T.

ing the individual letters. It looked like this:

```
TO ALPHABET
A
DRAW
B
DRAW
C
DRAW

END
```

Ted then began the long process of creating procedures to draw each letter in turn. After his alphabet was completed he was dissatisfied with the amount of time each letter was displayed on the screen. He began to work on the more complex programming problem of creating something for the computer to do invisibly so that the letter on the screen could continue to be displayed for a longer period. This was a natural extension of his alphabet procedure.

Stella started out to solve what appeared to be the same challenge as Ted's. During the process, she became fascinated by the proportions of height and width and how a variable input could change the relationships represented graphically.

The qualities of the computer which allowed her to experiment with inputs and then provided her with an almost instant reformulation of her letters heightened her excitement as well as her understanding about one way a computer could extend her thinking.

She began to collect patterns for monograms and initials which might make interesting designs on stationery. Her classmates used her program to think about embroidering on denim. For her final project, Stella created an art show using Logo procedures.

In one of the first Logo classes, Mark and Suzy became a working team. Mark seemed to need to be admired for his programming prowess and Suzy was reluctant to touch the computer.

This combination worried me because it seemed to reproduce the stereotyped, and I believe harmful, pattern of the way men and women relate to technology.

Listing 1. Time.

```
TO WAIT :T
 IF :T = 0 STOP
 WAIT :T - 1
END

TO TIME :HH :MM :SS
 TEST :SS = 60
 IFT MAKE "SS :SS - 60 TIME :HH ( :MM + 1 ) :SS
 IFF MAKE "SS :SS + 5
 TEST :MM = 60
 IFT MAKE "MM :MM - 60 TIME ( :HH + 1 ) :MM :SS
 TEST :HH = 12
 IFT MAKE "HH :HH - 11
 WAIT 200
 PRINT []
 ( PRINT :HH :MM :SS )
 TIME :HH :MM :SS
END

"FALSE is 1
"TRUE is 1
```

This twosome often seemed to have private jokes and to direct gestures toward classmates. Although I felt uncomfortable and wondered whether I should intervene, their classmates paid them no attention.

In the meantime, I watched and thought about them whenever I had a second to spare from this demanding programming class. I was aware that none of my suggestions had been accepted by either of them. While Mark was actively executing his ideas, Suzy admired, and I waited.

Then one day the duo split, each needing a computer to work on.

Mark was inventing a clock. It was a digital clock. The person using his program could type in the hour, minute and second and could then watch time move in five-second increments. His ability to capture some essence of time was satisfying to him, and truly mystifying to his classmates. Mark told them that his program was simply an approximation of time as is the time that all clocks keep.

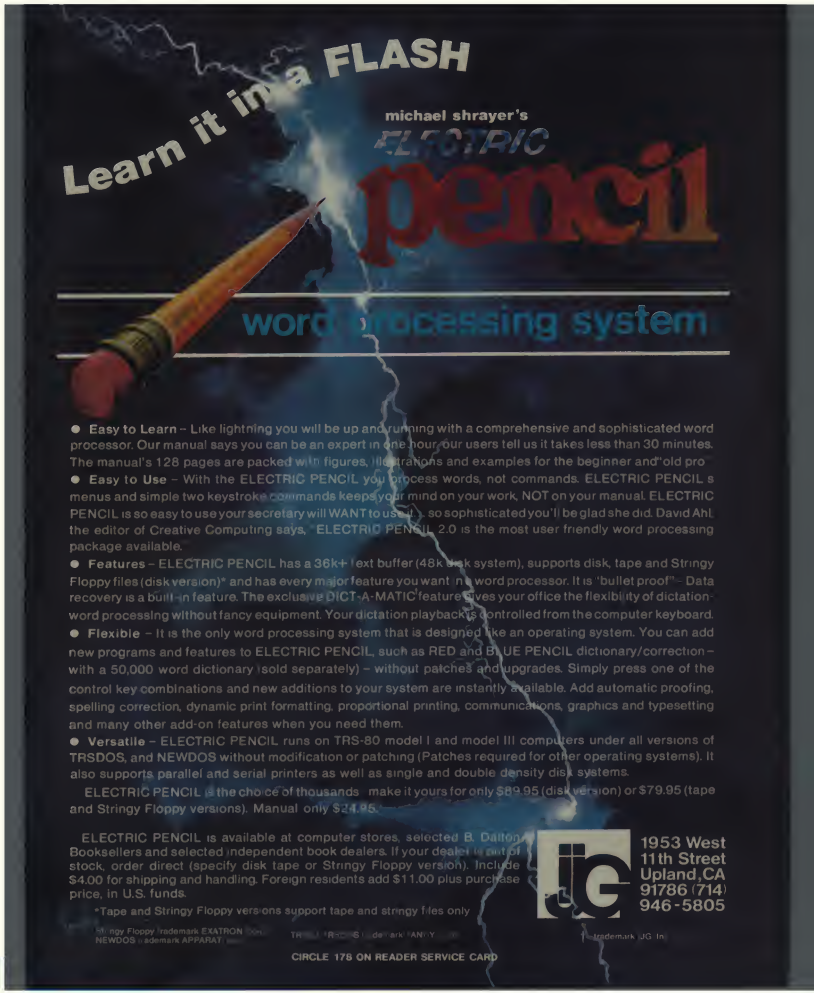
Listing 1 shows how his program looked after a solid week of programming.

Figure 5.

S 10 50

S 25 35

S 70 7



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His program does have some "bugs" which he has probably solved by now. One is the matter of conversion; the seconds do not convert to minutes after the number 60 is reached. This was not discouraging to Mark. This was the next part of his program which needed attention in order to make it work better.

On the other side of the classroom, Suzy sat at a computer alone. At first she seemed to me to be immersed in a science fiction book. As I moved nearer, I saw that she was using the science fiction book as a reference for her work. She was working with an intensity I had not seen previously.

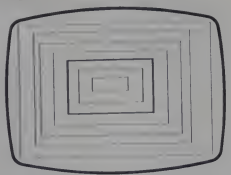
Between footstamps and fistshakes at the computer she was creating a science fiction book. She had discovered that the computer could print words. Linking her interest in reading science fiction with her limited knowledge of microcomputers, she had started on her first self-initiated project. She organized the procedures shown in Listing 2.

As the course ended, Suzy was beginning to experiment with turtle geometry to illustrate each chapter. My next steps for Suzy were to teach her how to save pictures drawn on the video screen, and to introduce her to the Logo text editor.

Suzy shared her project with her classmates during the last day of class. The science fiction aspect captured their imaginations, and they demonstrated genuine interest in her work.

With our visions of what is possible for a Logo user to accomplish, Suzy's example may not seem dramatic. I include it because I believe we often push students to go too fast and forget the value of allowing a person to set his own goals. I do not believe that Suzy would have started sooner if I had structured the lessons differently; she needed a period of watching to get herself ready.

Figure 6. Door Through Time.



One visually oriented student spent many class periods creating drawings, saving his pictures directly on his disk without writing procedures. Jamie planned color and line relationships carefully and gave names which suggested to me the dimension of fantasy the computer offered him.

While classmates often gave pictures and procedures single letter names to avoid laborious typing, Jamie was content to take the time to type "Door Through Time," "Sparkle in the Night," "Experience in the Fifth Dimension," delighting classmates with his naming as much as with the pictures.

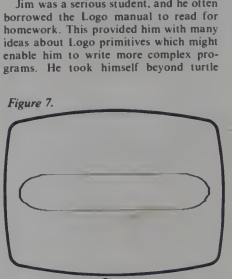
Another example of the way an individual entered the Logo environment or "mathland" is Jim. He simply started experimenting with the turtle.

He drew a shape which he later named "slot" because it looked like one. This slot with its circular ends and straight line connections intrigued him. During a series of lab periods, interrupted by several other projects, he progressed to "tslot" which added color and assumed a new position on the screen.

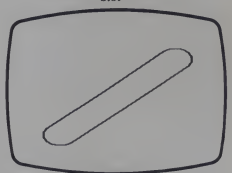
Next he played with variable inputs in order to experiment with size relationships. His moment of astonishment came when he discovered that the formula for a circle which he had memorized was approximate.

Jim was a serious student, and he often borrowed the Logo manual to read for homework. This provided him with many ideas about Logo primitives which might enable him to write more complex programs. He took himself beyond turtle

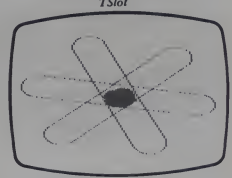
Figure 7.



Slot



TSlot



TSLOTT 2 20

Listing 2. Science Fiction.

```
TO MARS
 PRINT [A PRINCESS OF MARS]
 PRINT [THE GODS OF MARS]
 PRINT [THE WARLORD OF MARS]
 PRINT [THUVIA,MAID OF MARS]
 PRINT [THE CHESSMEN OF MARS]
 PRINT [THE MASTERMIND OF MARS]
 PRINT [A FIGHTING MAN OF MARS]
 PRINT [SWORDS OF MARS]
 PRINT [SYNTHETIC MEN OF MARS]
 PRINT [LLANA OF GATHOL]
 PRINT [JOHN CARTER OF MARS]
 PRINT [THIS IS THE MARS SERIES NO.1-11 IN ORDER
 BY EDGAR RICE BURROUGHS AUTHOR OF THE FAMEOUS
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 END

 TO DRAGONS
  PRINT [DRAGONFLIGHT]
  PRINT [DRAGONQUEST]
  PRINT [THE WHITE DRAGON]
  PRINT [THIS IS THE DRAGONRIDERS OF PERN TRILOGY
        BY ANN MCAFFERY]
 END
```

geometry to write an interactive program which enabled the user to choose a polygon with any number of sides of user-specified length for the turtle to draw.

This project of Jim's pushed my programming ability, for I, too, was a new Logo user. I would often take my back-up copy of his disk home to work out various ways to solve his programming problems and bugs. After inventing or getting myself help with possible solutions or simpler examples, I created a new file called HELP to provide him with examples of possible solutions to his problem.

Jim, being an independent thinker, would study the examples in my HELP file, then say thoughtfully, "No, I don't believe that I want to do it that way," and continue with his own exploration and problem solving. I did notice that some of the HELP ideas found their way into his programming, and most of the inventions remained Jim's own.

At the end of the session, Jim was still working on centering his polygons above the text, and I had begun to use a HELP file with other students.

My first task was to invent a computer culture.

My last example is Manual. I have no file for his work. He was the class conceptualizer. He had started using computers because he enjoyed the fast action and energy of video games. He knew what would make an exciting program. Manual would strike up a conversation with a likely programmer describing an idea for a program. The talk continued as the other student moved toward a computer and started working out Manual's ideas. When Manual was satisfied that the person was "hooked" on the idea, he retreated and started another person on another idea.

I have Manual to thank for the work I do in the middle of the night, figuring out how to make a ball-shaped turtle appear to "bounce" off the edges of the screen.

These stories offer examples of the many ways in which students can explore a computer environment using the Logo Language.

Perhaps I've made it sound as if it "just happens." Because Logo permits a student to discover in a manner which is natural to the learning process it may appear that I have undervalued the teacher's role. Now we will look at some of the ways I have come to think about my role as teacher in a Logo classroom.

The Teacher's Role

Every computing class I have led has been made up of students with a wide variety of experience and knowledge about computers. Some students have never seen a real computer. Some may even be certain that the computer is *the* enemy of humanity and spend energy directing prejudicial comments toward it. Other students may own their own computers, belong to "user's clubs" and have been programming for years.

This situation in itself was somewhat unnerving to me. I had made a commitment to myself to become knowledgeable about Logo and instructional uses of computers in order to integrate this tool into a school curriculum. I was determined to create a relationship between the current computer revolution and life in school.

I had no models. I had never used a computer nor seen any person other than my husband use one. My first task was to invent a computer culture. This culture needed to be able to support all the students *and* me as a learner alongside them.

Any teacher's first job is to assess the situation and equip himself with:

- Knowledge
- Experience
- Hardware
- Time

We must examine our own attitudes about computers in our society, acknowledge the areas creating distress and identify the areas bringing optimism.

As Logo teachers our roles will cover a diverse, and perhaps uncomfortable range including demonstrator, teacher/lecturer, teller, time structurer, problem setter, management solver, arbitrator, decision maker, challenger, helper, collaborator, process sharer, question asker, idea extender, observer, documenter, admirer, enjoyer, time provider, technician, and model learner.

I require each student to keep a journal of process notes, questions and descriptions of problems encountered. I read these regularly and respond.

In response I might write a comment which is similar to an oral response, "That sounds frustrating."; "Wow! You figured it out!"; "I'd like to see how your procedure works"; "Jim figured out how to do a similar problem, why not ask him for help next time?"; "I don't know the answer to this question, let's get together after school and visit the computer store."

The journals provide a valuable vehicle in which to keep track of progress and to allow patterns to become visible. Often simply describing a problem will allow a student to understand it more fully, and thus be able to solve it. Journals provide direct access to help. They enable students to formalize their own thinking.

The journals provide me with a sense of being in charge, of knowing what is going on, and, a means of keeping records of student work. They provide an opportunity for a personal relationship with each student on a daily basis. Since I am also learning Logo, the journals provide me with a sense of comfort; I can see what I need to learn, and decide what my own homework will be.

Beyond this, the journals provide both the students and me with an assurance that this is a collaborative learning experience, and that I am working *with* them. Confidence about this alleviates, I believe, for both the students and me the sense of anxiety which might otherwise be present in teaching and learning this subject. Most educators agree that anxiety interferes with learning.

As a Logo programming teacher, it is my job to make back-up copies of all my students' disks in order to protect the students from work loss due to damage or filing mistakes and to enable me to see the patterns in the work of individuals so I can plan my next formal lesson for the class.

Journals provide direct access to help. They enable students to formalize their own thinking.

I can collect small groups of students around a common interest or programming problem. Sometimes I will ask a student to share some work with the whole group as a teaching example or as a model. By examining the work on the back-up disks I can also determine whether a programming problem should be solved with a "gift" of a tool which the programmer is probably not yet ready to invent on his own. (Some tools I have given include procedures for creating circles, explosions, and countdowns.)

The disks give me time to work on programming problems by *trying* the program, and trying several solutions, away from the stress of a class period. Inevitably the disks force me to think about my own next learning steps.

During the actual lab time I wander, watch, listen, and answer.

I feel that the words I use are important.

Instead of solving a problem for a youngster by telling or showing the solution immediately, I usually say: "describe the problem," "Tell me what happens", "What did you want to have happen?"; or "Try it now and show me." Some teachers ask the student to "Teach me what you did."

This type of response is important for several reasons.

- It gives me, as teacher, time.
- It gives the student time.

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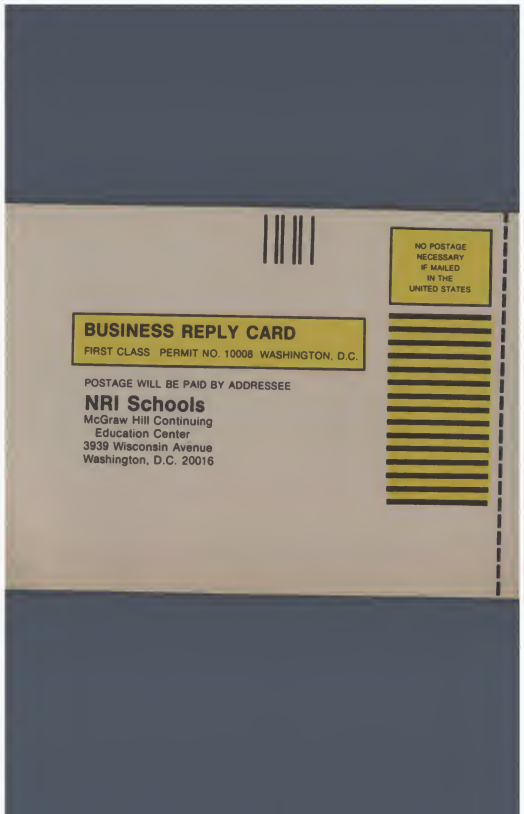
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What is Logo, continued...

- Description is a matter-of-fact task which can diminish emotion and allow the describer to see what actually happened clearly. (Frequently in the middle of describing, a student will say "Oh, never mind, I see what I did.")

If *after* a student has described the problem and neither of us knows how to solve it, we write a plan together in plain English words. It includes a statement describing what the student *wanted* to have happen. Usually when a solution is not clear to either of us, we are working with an example which is too difficult for us. We substitute a simpler problem "for practice."

Then, together we write a superprocedure in the same way that Ted wrote one for his alphabet, before he had invented the subprocedures. I make very sure that the first step in the procedure is one that the student and I can solve successfully right then.

Other jobs for the teacher include collecting, displaying and identifying resources.

I have rarely seen a computer which is not surrounded by a group interacting with it and kibbitzing with each other in a most congenial way.

I use bulletin boards to stimulate the learning process. I might post a weekly "Mystery Procedure," a new command with its definition and examples of its use, a challenging programming idea, a procedure to copy, a picture of a student's procedure, or a chart of students' names indicating their specific areas of expertise in order to make peer tutoring possible for every student. Sometimes I post an interactive program for students to copy, use, then modify and make their own.

Creating a Supportive Community

The computer community which we establish in our classrooms is for many students (and teachers) a first computer culture. As educators, we must be concerned about the values which are formed and used by this community of learners.

Many question my use of the word "community" in connection with computers. However, I have rarely seen a computer which is not surrounded by a group interacting with it and kibbitzing with each other in a most congenial way.

Most computers are a social *and* an intellectual center in a classroom unless usage is specifically regulated otherwise. Watchers see new ways to solve problems, participate in brainstorming new ideas and derive a great deal of pleasure from the process.

Teena Crowley, a third grade teacher, said, "I wish Logo were everyone's introduction to community work. Everyone is involved and offers input from the start."

Usually during a first class with a group I find it important to declare myself a Logo *learner* as well as a Logo teacher. I do it because it is honest and because it establishes a basis for collaboration. The responsibility for helping and teaching and creating this class belongs to all. It is an ideal opportunity for me to model the motto "Life Long Learning," certainly an important part of any curriculum.

Many issues emerge in the establishment of a Logo community. One of the first is the issue of ownership of procedures. Is it copying or stealing to save work which did not necessarily originate from the saver's own inspiration?

The nature of Logo filing and saving makes it almost impossible for beginning users to keep separate files, and so from the first time SAVE is typed, a file of mixed-up origin exists.

I prefer to be excited by the possibilities of this "sharing" rather than regret it as a necessary "evil." I legitimize the sharing, giving, changing, and using of one another's procedures as part of the context of the community we are creating together.

I share my work with my students and I encourage them to exchange procedures among themselves.

Classes soon begin to create a vocabulary specific to their community. In one class a procedure named WING — basically an outwardly spirally triangle which appeared to fly across the screen — became a favorite expression for a way of moving quickly across a space with arms rotating rhythmically. This reference point created a sense of cohesion and inclusion among classmates and added a dimension of good-natured humor.

I credit some of my success in creating a supportive community to my insistence that part of the experience in computer class is participating in discussions about ethical and responsible computer use.

I am genuinely worried about how our society makes decisions about compuer use. I make clear to my students that computers are surrounded by a human culture with developed values and a sense of conscious choice about their use.

I believe that one way people develop into responsible, rational human beings is by participating in discussions about dilemmas with peers.

I often start a discussion with a simple story. Ideally, it describes an issue which is real or potential issue for this class, without embarrassing any group member. Once I told about a filing mistake I made when making a back-up copy of Ted's alphabet. Half the procedures for creating letters disappeared through my mistake. I had to tell him what I had done to his work, and how sorry I was to have made such a silly and harmful mistake.

Part of the experience in computer class is participating in discussions about ethical and responsible computer use.

A 20-minute period of sharing of mistake stories followed. No one was required to talk, but all class members were expected to participate by being part of our circle. The rules also prevented comments or judgments being directed towards any person or point of view. Discussion was encouraged.

Other issues which have worked for discussions in my classes are:

- Scheduling of computer use.
- What about someone who doesn't take a turn?
- Is it okay to borrow disks, copy disks, change disks?
- What about using "bad" or "dirty" words to name procedures?
- Should all schools have computers?
- Should all kids have to learn to program a computer?
- Why would a girl want to use a computer?
- What kinds of information should a school computer keep?
- Is it possible to have a really "private" computer file?
- What are some ways computers work in our lives?
- How can I get my family to value my programming instead of dismissing me as a "brain"?

The discussion which touched me the most deeply was requested by my students at the end of a summer school session. The subject was: now that we know so much about computer programming, how can we help our teachers feel comfortable knowing less than we do, so we can have computers in schools?

Beyond these ways of thinking about structuring a class and a curriculum, there are many opportunities for collaborative programming. One teacher has helped her students create a class adventure game using Logo.

The class planned the rooms, and then pairs or individuals created the procedures

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to make each room. Her role was to set up the structure and aid in the process of linking.

Harold Abelson's manual for Logo gives many examples of interactive programs which can be enjoyed by a class. Many teachers are using it to create their own programs for guessing numbers and creating crazy sentences.

Dan Watt's work creating curriculum for a dynamic turtle which moves according to laws of physics is interesting to use and then modify.

A great need exists for all Logo teachers to share their emerging curricula. This will enhance our collective understanding and provide more models about the ways students can work within a Logo environment.

What Logo Teachers Say They Teach

- Computer literacy.
- The history and learning theory in Logo.
- How to program a computer-like character, a turtle robot or Bit Trak.
- Controlling a turtle on a screen.
- How to pace out shapes and then teach the turtle to draw shapes.
- How to change pencolors and background colors.
- How to edit.
- How to initialize a disk.
- How to draw initials.
- How to use repeat.
- How to use subprocedures in procedures.
- How to use recursion.
- How to read a print-out of programs.
- How to draw procedure trees.
- How to use variables.
- How to use the Logo Manual.
- How to manage files and clear the workplace.
- How to use existing interactive programs and modify them.

This simple and straightforward list may be more or less what you expected. However when I ask my Logo students, whether school children or professional educators, what they learned in Logo class the list is quite different — fuller and more profound.

What Logo Students Say They Learn

- About problem solving and estimation.
- About thinking and learning styles.

This person used to develop applications for the 8086/8088 market with the best of them.

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What is Logo, continued...

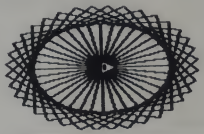
- About how to use their own learning style.
- To think logically.
- To work without emotional manipulations; the computer doesn't care whether you feel angry.
- To use procedural thinking.
- To use strategies for problem solving.
- To become comfortable thinking mathematically.
- To be able to think geometrically.
- To be able to consider laws of motion.
- About language by creating my own system for naming procedures.
- About graphics and design.
- How important revision of procedures and text is, and how simple it is to do.
- That decimals are useful.
- How to type.
- How to be patient.
- How to take risks in working.

The most significant things they claim to have learned include:

- Looking at their own mistakes with an interest in understanding what happened instead of shame.
- Feeling competent in setting their own problems and supported in solving them.
- Understanding that learning and doing involve frustration and ease; they go quickly or slowly, parts are intriguing or boring, and this is what makes up all work and life.

There is no question in my mind that working with computers is one way of forming a direct link with a sense of the future. Computers can provide a sense of optimism, new frontiers to be explored, and a kingdom to be conquered.

Logo was developed to create an interactive environment, a mathland, in which students could set their own pace, problems and goals. It is a comfortable way for me to enter the future. It is a challenging way and it is a way that I can understand, choose and control. □



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In case you wondered who else believes in our Universal Operating System, there's the fact that the p-System is licensed by most of the major hardware manufacturers around. Manufacturers like IBM, DEC, TI, HP, Commodore, Osborne, Philips, and Zenith. You know, all those "little guys."

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VIDEODISC UPDATE

Anyone trying to track down the Aurora interface (Apple II to Pioneer VP-1000 videodisc player) mentioned in our January 1982 issue may have had a problem. Reason: Aurora is still around but they sold the rights to the interface to another firm, Anthro-Digital Software, P.O. Box 1385, Pittsfield, MA 01202. It's now called the Omniscan Laser Video Disc Interface and is available with software for $250.

Anthro-Digital also offers a Flipper for $50 which switches Apple output signals (two in to one out or one in to either of two outs), an excellent word processing system (The Executive Secretary), a mini word processor for the Hebrew language ($60) and several other interestsing products.

AMDEK PRICING

Two new Amdek products were mentioned on this page in the August issue. The final prices announced at NCC were different than our advance information. The 3" microfloppy disk drive is $899 (not $699) and the digital plotter is bargain priced at $949 (not $1200-1300).

JAPAN, INC. GETS SMARTER ABOUT SOFTWARE

For three years we have been admiring the computers and peripherals from various Japanese makers. But none has really proved a threat to American makers. Why not? In one word, software, or lack thereof. As I observed back in the October 1979 Creative Computing, a computer without good software might as well be a boat anchor.

Not many Japanese computers have wound up as boat anchors, but not many have been sold in the U.S. either. However, that is about to change dramatically with the strokes of several pens on contracts between Microsoft and three Japanese manufacturers.

MS-DOS, a 16-bit operating system developed by Microsoft for the IBM PC, will be implemented on computers from Hitachi, NEC, and Panasonic. Also, Wang, a major force in the WP market, has tapped Microsoft to implement MS-DOS on their low-end "professional computers."

Along a similar vein, the Structured Systems Group has also signed on the dotted line to convert their accounting software to several Japanese makes.

As if this weren't enough, take a look at the phenomenal amount of software released by NEC for the PC8000 series (see CES/NCC report in this issue). Not only that, but NEC has announced a similar committment for the just-announced Advanced Personal Computer.

We also can't help but be mightily impressed with the new 16-bit Mitsubishi computer. It supports CP/M-86 and has dual 300K disk drives and 128K RAM standard. As if that weren't enough, it also includes IBM 3270 emulation, Tektronix 4010 emulation, MBasic Plus, Fortran, Cobol and two versions of Pascal.

Someone must have told the Japanese about software. They listened and learned fast!

ATARI/LUCASFILMS JOINT VENTURE

In an uncharacteristicly low-key press conference at CES, Atari announced the formation of a new company owned 50-50 by Atari and Lucasfilms (creators of Star Wars, Empire Strikes Back and Raiders of the Lost Ark). The union was apparently sparked by Smalltalk-creator Alan Kay formerly of Xerox PARC (Palo Alto Research Center), now of Atari. What did Alan Kay have to say? Well, seems he ducked out of the press reception early--if he was ever there at all.

Anyway, after ducking all questions, an unnamed spokesman for Atari told us that the first product of the joint venture will be a video game based on Raiders of the Lost Ark. What else? No answer.

Are we optimistic? Guardedly, yes. But as Charlie Brown once said, "there is no greater burden than having a great potential."

TRS-80 COLOR COMPUTER TO BE SOLD IN INDEPENDENT OUTLETS

Tandy with some 6000 Radio shack outlets for TRS-80 computers is looking for even greater retail penetration. A first move toward this goal is the signing on of 60 RCA consumer electronics distributors to handle a repackaged version of the TRS-80 Color Computer. These 60 distributors service about 2000 retail outlets.

The color computer will be repackaged in a white case and will carry the designation TDP System 100, with TDP standing for Tandy Distributor Products. Pricing will be comparable to the existing unit in Radio Shack stores ($399 for 16K version, $499 with extended Basic).

MATTEL: HERE WE GO AGAIN

The on-again, off-again release of the keyboard unit for the Mattel Intellivision video game accompanied by lower and lower prices is on again. The original price of $700 in October 1979 was far over competitive units. However, pricing was the least of Mattel's problems since the keyboard unit was plagued with hardware problems and lacked applications software.

A re-release of a re-engineered unit at a lower price is now scheduled for 1983. 1983!? Well, we'll see.

K-MART COMMITTING TO COMPUTERS

K-Mart announced that 1100 stores will handle the Commodore VIC-20, up from 550 stores two months ago. In addition, a spokesman confirmed that the chain has committed to an equal dollar amount (around $10 million) of TI 99/4A home computers. The chain also expects to handle the lower-priced ($100) Timex/Sinclair unit.

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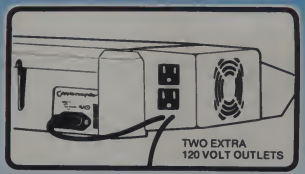

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DEALER INQUIRIES INVITED

The Role of Motivation in Computer-Assisted Instruction

Richard P. Swenson and Chrys Anderson

In one of his early (1961) articles, noted Harvard psychologist B.F. Skinner decried the common use of aversive techniques in the classroom. In Skinner's opinion, "The birch rod and cane are gone, but their place has been taken by equally effective punishments (criticism, possible ridicule, failure)...the student must learn, or else!"

Studies in the area of human learning have repeatedly demonstrated that the best teaching methods are those that rely most heavily on positive techniques to motivate people. Since motivation has been identified as a critical component in learning, it makes a great deal of intuitive sense to apply the knowledge we have about motivation to one of the newest and most promising forms of education, instruction via computer, or computer-assisted instruction (CAI).

An essential prelude to a discussion about motivation is an explanation of the role of reinforcement in learning. Reinforcement is a technical term used by psychologists. It refers to any event which follows a behavior and subsequently increases the likelihood that the behavior will occur again. A reinforcer increases the frequency of the behavior it follows.

Good teachers are skilled at identifying and delivering reinforcers in the classroom. For many young children, verbal praise ("Good work!") is a very effective reinforcer. Stars or points to be accumulated and exchanged for some privilege are also useful.

An important aspect of reinforcement is the fact that, by definition, it must be individualized. What is reinforcing to Johnny will not necessarily be reinforcing to Jane. To determine if a suspected reinforcer is effective, it must be tested empirically; it must be validated.

Children prefer to watch a video alligator eat a stick man than see the man escape unscathed.

In the design of educational software, the role of reinforcement is too important to overlook. We are aware of two instances in which intrepid programmers created such clever reinforcement routines that they felt no need to validate them. In one case, the feedback routine was designed to send a Snoopy dog parading across the screen with a sign that read "Good job!" Snoopy was programmed to make that entrance whenever a student made a correct response to a question posed by the computer.

If, on the other hand, the student made an incorrect response, Snoopy made his appearance by walking upside down across the top of the video screen, dropping his sign about halfway across. Not too surprisingly, many students deliberately chose wrong answers so they could see Snoopy upside down on the screen, which was much more interesting than the intended reinforcer. The programmer had guessed what the students would "work for"—and guessed wrong.

Similarly, another programmer learned the hard way that children prefer to watch a video alligator eat a stick man than see the man escape unscathed. The lesson to be learned in both cases is the same: a routine is only reinforcing if it works, and the only way to determine if it works is to put it to an empirical test. Since a reinforcement routine which "isn't" can negate an otherwise excellent program, it is clearly worth the time it takes to test it.

Richard P. Swenson and Chrys Anderson, Educational Research, Inc., 44 N. Last Chance Gulch, Helena, MT 59601.

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Motivation

From the preceding discussion, perhaps it is obvious that the most important function of reinforcement in a CAI program is a motivational one. It provides the student with a reason to keep learning. But reinforcers differ in kind. Reinforcement is frequently characterized as primary, secondary or generalized.

Primary reinforcers are those which are essentially unlearned and which are almost universally reinforcing. Their motivational properties seem to be inherent so no learning is necessary. Food when hungry, and water when thirsty, are good examples of primary reinforcers. Stimulation, visual or tactile, can also be considered a primary reinforcer.

In terms of the computer, visually stimulating things like "crazy art" (randomly generated flashing lines) perhaps come the closest to fitting the definition of a primary reinforcer. A person apparently need not learn to be entertained by the appearance of visually stimulating material on the screen.

Secondary reinforcers are no less potent motivationally, but they are learned motivators. Praise is the classic example of a secondary reinforcer. It means nothing to a newborn, but most of us, at some point in the course of our socialization, learn to value the praise of others, initially our parents and later other "important persons." An example of a routine using secondary reinforcement on the computer would be one which allowed the user to earn the opportunity to play a video game.

Generalized reinforcers are actually a special class of secondary reinforcers. They require learning as do all secondary reinforcers, but they are general rather than specific. Money is the best example. Money is an extremely powerful reinforcer in our society not because of its intrinsic worth, but because it can be exchanged for things which are valuable (shelter, clothing, food).

On the computer, a generalized reinforcer might be given in the form of a point, star or other marking on the screen. The accumulated points would become valuable if they could subsequently be exchanged for privileges or valued objects.

There are advantages and disadvantages associated with each class of reinforcer. Generalized reinforcers have one big advantage insofar as it is very difficult to satiate or become tired of them. To the extent that they are general (e.g., they can be exchanged for any number of different things), the user does not tire of accumulating them. It is, on the other hand, relatively easy to satiate a person with primary and secondary reinforcers if they are programmed to be delivered at a high rate.

However, the use of generalized reinforcers in CAI has a major disadvantage —the reinforcers are external to the computer. Both secondary and primary reinforcement routines can be totally self-contained. The motivational system is built-in to the computer program. Generalized reinforcers, on the other hand, depend on occurrences totally independent of the machine. True, the computer can reliably deliver the points (or whatever) dependent on a student's response, but it can't see to it that the points are subsequently exchanged for something of value (a grade, praise or money). If the accumulated reinforcers are never exchanged, they will probably lose their reinforcing qualities in a short time.

There are no rules to tell us when to use a particular kind of reinforcement. Experience and knowledge of the results of various studies allow us to make educated guesses about what is likely to be most effective for a given audience.

Reinforcement designed for computer software can also be described along a continuum of "obtrusiveness." As such, it can be passive, active or interactive.

The timing of reinforcement is as important as its occurrence.

Reinforcement which is passive only delivers information about the adequacy of a user response. For example, a program which presents a new arithmetic problem when the previous one has been correctly answered is passively reinforcing. The user is informed that the response was correct; but nothing else happens on the screen.

Active reinforcement also provides information about response adequacy, but the reinforcement event contains additional information as well. The additional information might be in the form of added visual stimulation (e.g., flashing happy faces) or it might contain elements of positive praise ("Good job, Charlie!").

The critical difference between the two types of reinforcement is the addition of information above and beyond the simple acknowledgement of a correct response. This additional information tells the student that "someone" is pleased and happy about his success.

Interactive reinforcement has all the properties of both passive and active reinforcement, but it adds a new dimension—it allows user participation. A video game which can be played only after the user has made a correct response falls into this category.

To design educational software with highly effective motivational routines, one must first recognize the critical nature of the role of reinforcement and the dimensions along which reinforcers can vary. The next step involves understanding some of the variables which influence the *effectiveness* of the reinforcer. We will limit our examination to four of the most important variables: timing, appropriateness, relevancy, and configuration.

Timing

The timing of reinforcement is as important as its occurrence. In other words, if the timing is off, there is little value in delivering the reinforcer. Chances are very great that an improperly timed reinforcer will actually reinforce something other than the desired response.

To be most effective, reinforcement should occur immediately after the desired response. (In fact, the literature shows that the ideal interval between the response and the reinforcer is .5 seconds.) Initially, the reinforcer should be delivered every time the desired response occurs. This is true whenever an individual is learning a new skill. As the individual gains some experience and knowledge, the reinforcement schedule should be "thinned out"; it should be given less than every time the desired response occurs (e.g., every other time or every fifth time).

Timing is an especially critical variable of reinforcement with important implications for educational software programs. Not only are immediacy and scheduling important factors, but there is an additional temporal element to consider—length or duration of reinforcer. Assuming that the reinforcement event has a discrete beginning and end, how long should it appear on the screen?

There is obviously no simple answer to that question. It depends to a great extent on the type of reinforcement used in a particular program. An interactive reinforcement in the form of a challenging Star Wars-type game can be effective if it is programmed to last several minutes. An active reinforcer such as a happy face or a "good job" message will quickly lose its effectiveness if it appears on the screen for longer than a few seconds.

Appropriateness

Appropriateness of reinforcement is another important consideration. At an abstract level, there is no such thing as an "appropriate" reinforcer; there are simply effective and ineffective ones. At a different level, appropriateness does become an issue.

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CIRCLE 110 ON READER SERVICE CARD

Role of Motivation, continued...

Before planning any aspect of the motivational routine, a programmer must know the audience for which it is intended. Age of the audience is an extremely important factor. Clearly, what turns a 5-year-old on is unlikely to have much appeal to someone who is 50.

The best information a program designer can have is that stemming from an empirical test. If you really want to determine if a happy face reinforces a 10-year-old, the way to find out is to test as many of them as are willing, able and available. There is no substitute for an empirical test.

Another audience variable which must be considered is nature of disability, if any. For instance, let's look at an educational program geared toward teaching about common anti-epileptic medications and their side effects. The audience in this case would probably be epileptics and parents and professionals who deal with epileptics. It would, then, be clearly inappropriate to design a motivational routine which employed flashing lights or pictures of any sort, since flashing is an environmental condition known to precipitate seizures.

Similarly, materials directed toward students with learning disabilities or autism must be designed specifically for those groups. Autistic children, for example, have been found to "over-react" to certain kinds of visual stimulation and to select irrelevant aspects of a stimulus display when learning.

With the learning disabled student, planning is even more complicated since there are so many different disabilities which require unique interventions. The child with dyslexia will have substantially different needs than the child who occasionally reverses digits.

Relevancy

Relevancy of reinforcement is a relatively new consideration stimulated by attempts to design better and better computer courseware. The goal of educational software is to teach concepts and skills in the most expedient way. Research in the areas of psychology and human learning shows that reinforcement is critically important. An individual must be motivated to learn.

The goal of educational software is to teach concepts and skills in the most expedient way.

To be maximally efficient, reinforcement should be not only motivational but informational as well. In other words, the event designed to be reinforced should, if at all possible, also add to the user's information about the subject matter. For example, a word game might be the reinforcer following a lesson in English, or an exciting game routine might require the application of newly-learned math skills.

"Can I borrow the calculator tonight?"

Configuration

When we speak of configuration, we refer to the feedback routine as a whole and not just its reinforcement component. Although it is possible to structure a program to minimize student errors, in most programs students will continue to make several or, perhaps, many errors before they learn the material well enough to make only correct responses.

As long as students continue to make errors, the computer must be programmed to deal with those errors in some way. The psychological literature, and our own years of experience in teaching, point out the need not only to accentuate the positive but also to minimize the negative aspects of feedback. We have drawn the conclusion that as far as incorrect responses are concerned, the less said the better. Of course, the student requires the basic feedback that a given response was incorrect, but any additional, judgmental information is not only unnecessary but undesirable.

By this time, it should be increasingly clear that developing sound motivational routines for educational software is a complicated and challenging proposition. There are no simple rules of thumb, no universal truths. There have been many studies done in the unending attempt to discover how and why people learn, and some of those findings have been summarized above. Two final points are in order, however, before we conclude this discussion.

Psychologists have long talked about an "inverted U-shaped curve" of motivation. In so doing, they refer to the relationship between the speed of learning and the strength of a given motivator at a given time. As the incentive or motivation becomes more compelling, an individual's rate of learning will improve...up to a point. Beyond that point, performance will actually be hindered.

This makes a great deal of intuitive sense if you think of the increasing pressure on an individual to respond correctly. At a certain level, the pressure becomes too great—too much hinges on his response. Elements of anxiety begin to enter the picture and performance begins to deteriorate correspondingly. In the design of educational software, then, you can have too much of a good thing.

This brings us up to the second and final point. There is a danger that reinforcement routines can be distracting. Two minutes of shooting down planes on the screen as a reward for an instructional segment completed may put the student into a different mood that is detrimental to efficient learning. Once again, the best way to determine the optimal circumstances for learning using the computer is the empirical test. There is no substitute. □

International Computer Problem Solving Contest II Results

Donald T. Piele

Devising a computer problem solving contest for the growing crop of young, talented computer problem solvers becomes more difficult each year. The problem is this: How do you create a set of five programming problems that will keep a team of three computer whiz kids busy for two hours and at the same time not be a frustrating experience for a beginning team?

Last spring Tim Fossum, a colleague at the University of Wisconsin-Parkside, and I faced this problem for the sixth consecutive year. In each of the three divisions; elementary grades (4-6), junior (grades 7-9), and senior (grades 10-12), we created a set of five computer problem questions. All three sets appeared last month in this column and interested readers were invited to solve them. This month, as promised, we present a complete set of solutions to all 15 problems (five for each division) along with an announcement of the top teams in each division.

Elementary Division

At the request of several local contest directors, we agreed to experiment with an elementary division this year for stu-

Donald T. Piele, University of Wisconsin-Parkside Box 2000, Kenosha, WI 53141.

Figure 1. *Elementary Division Winners*

Place	Team/Member Names	Advisor/School
1	Apple Maniacs Nick Wilt Jason Hagen	M. Kinney Park Road Elementary School Pittsford, NY 14534
2	The System Crashers Paula Rickert Ethan Magdovitz Urjeet Patel	R. Grierson The Latin School of Chicago 59 W. North Blvd. Chicago, IL 60610
2	Nether-Providence M.S. Erik Grisson Mike Vartanian	N. Rader Wallingford-Swathmore School D. 200 S. Providence Rd. Wallingford, PA 10986
2	Jackson Kenny Hempstead Mike Parr Paul Franklin	B. Davis Morgan Hill Unified S.D. P.O. Box 927 Morgan Hill, CA 95037
2	Rotton Apples Bill Childs Tim Kokesh	G. Stallings Bartlesville Association of Computer Hobbyists 1406 Macklyn Lane Bartlesville, OK 74003

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CIRCLE 297 ON READER SERVICE CARD

Place	Team/Member Names	Advisor/School
2	Apple Peelers	G. Stallings (same as above)
2	Apple Eaters Roland Dreier	E.J. Romer Princeton Day School Box 75 Princeton, NJ 08540
3	Richard Schossberg Kevin Blackman	G. Ropes Rippowam-Cisqua School Box 488 Bedford, NY 10506
3	Peter Thomas Ian Tholl	B. Thomas Washington Apple PI P.O. Box 34511 Bethesda, MD 20817
3	The Random Mathew Zimmer Scott Leban Lang Ambrose	D. Reilly Norfolk Academy 1585 Wesleyan Dr. Norfolk, VA 23502
3	The Computer Artists Steven Dollins Richard Langston	A. Dollins The Micro Computer Center 1409 Terrace Dr. Pittsburgh, PA 15228
3	Lone TRS Shack-Man Barry Brown	J. Brown Harding Academy Box 775 Searcy, AR 72143
3	Denmark Dennis Hall Marc Majcher	Fairport Central 38 West Church St. Fairport, NY 14450
3	JAS Jeff Chrisope Andy Lorenz Steve Gray	D. Stranger CAPS Project Rochester Public School Rochester, MN 55901
Honorable Mention:		
	The Mirman School	Los Angeles, CA
	Blessed Sacrament	Morton, IL
	American School in London	London, England
	MSD Washington Township	Indianapolis, IN
	Orchard Lake Middle School	West Bloomfield, MI

dents in grades 4 through 6. We were surprised to discover that over 118 teams at 46 contest sites participated officially.

First place in the elementary division went to the Apple Maniacs, Nick Wilt and Jason Hagen, from Park Road Elementary School in Pittsford, NY. They were the only team to solve all five problems successfully. The contest director was Margaret Kinney, a parent volunteer who teaches programming at two of the Pittsford Schools.

Second place was shared by six teams who solved four problems very well, and third place was shared by eight teams who also solved four but not without some difficulty. Several schools were also cited for honorable mention. The complete rankings appear in Figure 1.

Junior Division

We received the results from 307 teams in 83 local contest sites in the junior division. Top honors went to The Two Charlies, a team consisting of Charles Tsai and Chuck Williamson from Salem. Their advisor, Harold Snyder, reports that both

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boys are outstanding students and very active in the Continental Mathematics League and the Atlantic-Pacific Mathematics League contests.

Charles Tsai, a freshman at South Salem High School last year, had the top individual total score during the year for his school. He has his own TRS-80 at home and programs in Basic and machine language.

Chuck Williamson was an eighth grader at Leslie Middle School, next door to South High, which made it convenient for him to take honors geometry at South High while still in junior high. Chuck uses an Apple II at home but during the contest The Two Charlies used a SOL computer and wrote their programs in Microsoft Basic.

Second and third place honors were awarded to eight other teams. All of these teams solved all five problems. The complete list of winners appears in Figure 2.

Figure 2.

Junior Division Winners

Place	Team/Members	Advisor/School
1	The Two Charlies Charles Tsai Chuck Williamson	Harold Snyder South Salem H.S. 2405 Saginaw St. Salem, OR 97302
2	Pet People Mark Knutsen Glen Whitney	M. Monaco / K. Warner Abraham Clark H.S. 122 E. 6th Ave. Roselle, NJ 07703
3	Apple Core Dwight A. Lee Eric Brand Andrew Williams	Rich Rozychi Rolling Meadows H.S. 2901 Central Rd. Rolling Meadows, IL 60008
3	File Types Stephen Schmidt Dan Shafer Jonathan Johnson	Bruce Campbell The Prairie School 4050 Lighthouse Dr. Racine, WI 53402
3	The Bucketheads Larrson Ullman	Joseph Hofmeister Cincinnati Country Day School 6905 Gwen Rd. Cincinnati, OH 45243
3	Compu-Tigers Anton Rang Don Greene	Don Schultz New Richmond M.S. New Richmond, WI 54017
3	Nodules Josh Millard Jason Finn Mike Selinker	L. Kashner / D. Fredrickson South Shore M.S. 8875 Rainier Ave. Seattle, WA 98118
3	David Franklin Dan Schwartz	Susan Fleig Georgetown Day School 4530 MacArthur Blvd. Washington, D.C.
3	Ferrandopulle Koh	Doug Lewis Gilman School 5407 Roland Ave. Baltimore, MD

Senior Division

As usual the senior division was the most popular. Results from 586 teams were reported from 147 contest sites. First place in the senior division went to the team of Spencer Greene and Truman Joe of Klein High School in Spring, TX. Their school adviser, Josie Mallery, said both are talented academically and shine particularly in mathematics.

Spence, a sophomore, and Truman, a junior, both have Apple II computers at home and write programs in Basic and assembly language. Both boys compete regularly in mathematics competitions and Spence is preparing for the Mathematics Olympian sponsored by the National Council of Teachers of Mathematics.

They correctly solved all five problems on an Apple II computer. Second place went to the Return of The Electronic Imbroglio, a team from Cambridge Rindge and Latin School in Cambridge, MA.

Eight teams finished in third place. Each team solved all five problems with varying degrees of ease and style. The complete list of winners appears in Figure 3.

Overall Results

On the surface it might appear that this year's contest problems were too easy since so many junior and senior division teams solved all five problems. But in fact it turned out to be just about right since only 1.7% of the senior teams and 3% of the junior teams solved all five problems. The average number of problems solved (out of five possible) was 1.6 in the senior division and 1.3 in the junior division.

It appears that the gap between the experienced teams and the beginning teams is getting wider as microcomputers become commonplace in elementary and secondary schools across the country. The few schools that have been involved with microcomputers for several years are beginning to see the results of providing talented kids access to computers.

The level of difficulty for each contest problem can be judged by observing the frequency with which the problem was solved during the contest. This number appears as a percentage in Table 1. Thus a low value means the problem was more difficult.

Focus

One of the reasons that we continue to create the problems for this programming contest is because it is fun and a challenge. From the feedback we get from local contest directors, this is the same reason their students enjoy entering the contest.

The problems we select require a combination of skills: 1) Good control of a programming language—every problem can be solved using standard Basic (All of the teams which were ranked this year used Basic. Advisors of the few teams that used Pascal reported a severe handicap because of the time needed to compile the program and the string handling limitations); 2) The ability to solve problems in general; 3) Experience in implementing a problem solving strategy within the context of a computer language.

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CIRCLE 238 ON READER SERVICE CARD

How to Solve It, continued...

The problems we use are generally classified as:

1) Words: Searching/sorting, replacing, rearranging, modifying.

2) Numbers: Multiple precision arithmetic, special properties.

3) Simulations: Simple games or experiments.

4) Print Graphics: Designs that can be printed out.

5) Puzzles

We were pleased to hear reports from several contest directors that our problem solving emphasis is causing some advisors to change the focus of their curriculum. In some areas teachers came to the contest specifically to see how their curriculum could be modified to help students prepare for the next contest.

Conclusion

It has never been the intention of this contest to glorify the winning team or the concept of winning in general. There is no trip to Disneyland or free microcomputer for the winning team. The top team in each division simply has their names and the name of their school engraved on a traveling silver trophy which they can keep for one year.

Most of the recognition involved with this contest comes at the local level. Several directors sent us newspaper stories describing the outcome of the local contest which often involved an awards presentation and sometimes even a dinner. Providing this kind of recognition can only be done at the local level where getting your name printed in the local newspaper is always a thrill.

Finally, our congratulations go to each student who participated this year. Only one team, of course, can "win" in the sense of being ranked first in its division. But from what we saw in the returns, there are many young students who are winners all over the world. These students have demonstrated their ability to take on a difficult challenge and give it their best shot.

Post Script

Next year's contest will be held on Saturday, April 30, 1983. Schools that cannot hold the contest on this date will be allowed to hold the contest on Friday, April 29. In order to continue organizing and printing the contest, a small fee of $2 will be charged to each local contest site within the United States.

Foreign countries will be charged $5, the extra amount needed to cover postage. All funds will be used to support the contest. Complete details will be announced in this column in January. Interested parties who write for information should include a stamped self-addressed envelope. Send to: Dr. D.T. Piele, Box 2000, University of Wisconsin-Parkside, Kenosha, WI 53141. Everyone who participated in last year's contest will automatically receive an entry form in January.

Figure 3. *Senior Division Winners*

Place	Team/Members	Advisor/School
1	Spencer Greene Truman Doe	Josie Mallery Klein High School 16715 Steubner Airline Rd Spring, TX 77373
2	Return of The Electronic Imbroglio	Elizabeth Griffiths Cambridge Rindge & Latin S 459 Broadway St. Cambridge, MA 02138
3	Team #1 Ryan McClure Tom Kasyl Tom White	David Dussault Livonia H.S. Big Tree St. Livonia, NY 14487
3	Mash 1 Rick Bouchard Mike Grier Norm McClarkin	Milford Area Senior H.S. West St Milford, NH 03055
3	Elmira Lancers Glenn Basman Jim Kuhn Dave McClarkin	J. Galbraith/ R. Clausi Elmira Secondary School Elmira, Ontario Canada
3	SR. #1 Russell Gehr Mark Lindell Robert Schepire	Philip Gibbons Bethlehem Central H.S. Delmar, NY 12054
3	Team A	G. Peddle North York Board of Education Downsview, Ontario, Canada
3	Team A	Joseph Reger Ben Gurion University Beer Sheva, Israel
3	Romulus Peter Chrisos Edward Lam Aaron Washawsky	Ian Hodgson Wagar H.S. Cote St. Luc Quebec, Canada
3	Team A Brian Kelley Dave Poole	Ava Crum Winfield High School Winfield, WV 25213

Table 1. *Frequency Distribution*

Problems Solved	Elementary	Junior	Senior
4	5%	15%	39%
3	5%	23%	14%
2	22%	25%	19%
1	15%	25%	25%
0	10%	11%	3%
Average number of problems solved by all teams.	1.7	1.3	1.6

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1982 Contest Solutions

The solutions listed below represent some of the best efforts of the top ten teams in each division of the 1982 contest.

All of the solutions were written in Applesoft Basic to run on the Apple II computer—the computer most commonly found in schools. □

```
1     Elementary Problem #1
2     FOOD THOUGHT
3     ********************
10 INPUT "INPUT THE NICKNAME YOU GIVE YOUR GUARDIAN(S): "A$
20   INPUT "INPUT A NUMBER: "B$
30   INPUT "INPUT A KIND OF FOOD: "C$
40     INPUT "INPUT ANOTHER NUMBER SMALLER THAN THE FIRST: "D$
50   IF VAL(D$) > VAL(B$) THEN 40
60   INPUT "INPUT YOUR NAME: "E$
70   ********************
75
80 PRINT: PRINT "DEAR "A$
90 PRINT
100 PRINT "THE $"B$" YOU GAVE ME FOR SPENDING MONEY AT CAMP IS"
110 PRINT "GONE. I SPENT MOST OF IT ON "C$". DO YOU THINK YOU "
120 PRINT "COULD SEND AN EXTRA $"D$"? THINKING OF YOU OFTEN."
130 PRINT
140 PRINT "                    LOVE, "E$

INPUT THE NICKNAMES YOU GIVE YOUR GUARDIAN(S): MOM AND DAD
INPUT A NUMBER: 15
INPUT A KIND OF FOOD: NACHOS
INPUT ANOTHER NUMBER SMALLER THAN THE FIRST: 12
INPUT YOUR NAME: NICK

DEAR MOM AND DAD

THE $15 YOU GAVE ME FOR SPENDING MONEY AT CAMP IS
GONE. I SPENT MOST OF IT ON NACHOS. DO YOU THINK YOU
COULD SEND AN EXTRA $12? THINKING OF YOU OFTEN.

                    LOVE, NICK
```

```
1     Elementary Problem #2
2     FOUND THOUGHT
3     ********************
10 PRINT "WHEN YOU ENTER TIME , SEPARATE THEM IN HOURS,MINUTES,SECONDS"
20 PRINT "SEPARATED BY THE NUMBERS WITH COMMAS(,)."
30 PRINT
40 INPUT "WHAT TIME DID YOU GO TO BED? ";A,B,C
50 INPUT "WHAT TIME DID YOU GET UP? ";D,E,F
60 PRINT
70 G=A*3600+B*60+C              'G=seconds from Noon to bedtime.
80 H=D*3600+E*60+F              'H=seconds from midnite to wakeup.
90   IF H<G THEN H=H+86400      'If H<G then H=H+seconds in a day
100   IF G=0 THEN H=H+86400
105
110   I=H-G                     'I= total time in seconds.
120   PRINT "YOU SLEPT FOR ";I;" SECONDS."
130 END

WHEN YOU ENTER TIME, INPUT THEM IN HOURS,MINUTES,SECONDS
SEPARATING THE NUMBERS WITH COMMAS(,).

WHAT TIME DID YOU GO TO BED? : 10 , 45 , 32
WHAT TIME DID YOU GET UP?    : 7 , 34 , 47

YOU SLEPT FOR  81555  SECONDS.

WHAT TIME DID YOU GO TO BED? : 2 , 0 , 0
WHAT TIME DID YOU GET UP?    : 12 , 1 , 1

YOU SLEPT FOR  goo61  SECONDS.
```

```
1     Elementary Problem #3
2     STAR TRACKS
3     ************************
10 FOR I=1 TO 5
20   FOR J= 1 TO I
30     PRINT TAB(10-I)"*";
40   NEXT J
50   PRINT
60 NEXT I
70 END
```

```
    *
   * *
  * * *
 * * * *
* * * * *
```

```
1     Elementary Problem #4
2     EGG TOSS
3     ************************
10 FOR I = 1 TO 2
20   X=RND(1)
     'X = random number
     between 0 and 1.
30   IF X > .5 THEN 100
40     PRINT "HEAD";
50 NEXT I
60   PRINT "YOU WIN"
70 END
90
100 PRINT "SPLAT!"
110 END
SPLAT!
GOOD SPLAT
GOOD GOOD GOOD SPLAT
SPLAT!
GOOD GOOD GOOD GOOD GOOD
GOOD YOU WIN!
```

```
1     Elementary Problem #5
2     WORDS WORTH
3     ************************
10 INPUT "ENTER A WORD "W$
20 PRINT
30 FOR I=1 TO LEN(W$)
40   L$=MID$(W$,I,1)
50   L =ASC(L$)-64
60   PRINT L$;
70   IF L<15 THEN PRINT " ";
80     PRINT L
90   S=S+L
100 NEXT I
110 PRINT
120 PRINT "THE WORTH OF THE WORD
    "W$" IS"S"."

ENTER A WORD PRICELESS

P              16
R              18
I               9
C               3
E               5
L              12
E               5
S              19
S              19

THE WORTH OF THE WORD PRICELESS
IS 106 .

ENTER A WORD WORTHLESS

W              23
O              15
R              18
T              20
H               8
L              12
E               5
S              19
S              19

THE WORTH OF THE WORD WORTHLESS
IS 139 .
```

```
1     Advice Problem #1
2     DETERMINE DESIGN
3     ********************
10 INPUT "NUMBER OF ROWS - ";N
20   FOR R=1 TO N:   R = ROW
30 X=R-10*INT(R/10): X = 10 MOD 10
40     PRINT TAB(N+1-R);
50   FOR I=1 TO 2*R-1: C = COLUMN
60     PRINT X;
70     IF C<R THEN X=X+1
80     IF C=R THEN X=X-1
90     IF X>9 THEN X=0
100    IF X<0 THEN X=9
110   NEXT C
120   PRINT
130   NEXT R
140 END
```

How to Solve It, continued...

```
NUMBER OF ROWS = 7
      1
     232
    34543
   4567654
  567898765
 78901098765
 7890123210987


NUMBER OF ROWS =  14
       1
      232
     34543
    4567654
   567898765
  78901098765
  7890123210987
 789012345654321098
 901234567654321098
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CIRCLE 308 ON READER SERVICE CARD

How to Solve It, continued...

```
[illegible]
[illegible]
[illegible] : 1=1+1 : GOTO [illegible]
[illegible]
[illegible]
[
```

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How to Solve It, continued...

```
      Sent a Problem #5
      FRACTIONS TO DECIMALS
      *********************


10 INPUT "ENTER YOUR FRACTION : ";A$:PRINT
15 DIM Q(99),RM(99)
20    R=REMAINDER, D=DENOMINATOR, Q= DIGITS OF ANSWER
30    R=VAL (A$): Z=LEN(STR$(R))+2 : D=VAL(MID$(A$,Z))
40 PRINT A$: " = ";
50       IF R<D THEN 70
60       A=INT(R/D):PRINT A$:R=R-A*D
70        R=R*10
80  FOR L=0 TO 99
90    IF R=0 THEN L=L-1 : GOTO 130
100     RM(L)=R: Q(L)=INT(R/D): R=10*(R-Q(L)*D)
110      FOR L2=0 TO L: IF R=RM(L2) THEN FL =1 :GOTO 130
120      NEXT L2 : NEXT L : PRINT "NO REPETITIONS IN FIRST 100 DIGITS."
130    ****************************



140 IF L=-1 THEN 180
150 PRINT ".";
160   FOR Z=0 TO L: IF FL AND L2=Z THEN PRINT "(";
170      PRINT Q(Z);: NEXT : IF FL THEN PRINT ")";
180 PRINT :PRINT :END



ENTER YOUR FRACTION : 1/3

1/3 = .(3)

ENTER YOUR FRACTION : 22/5

22/5 = 4.4

ENTER YOUR FRACTION : 1/7

1/7 = .(142857)

ENTER YOUR FRACTION : 3/8

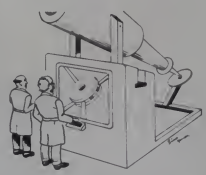
3/8 = .375

ENTER YOUR FRACTION : 45/56

45/56 = .803(571428)

ENTER YOUR FRACTION : 11/59

11/59 = .(186440677966101694915254237288135593220338983050847457627 1)
```



"There it is, Perkins, the most elementary particle of matter."

INTERNATIONAL SUMMER CONSUMER ELECTRONICS SHOW

June 6-9, 1982

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Conrad Hilton Hotel, Chicago

1982 NATIONAL COMPUTER CONFERENCE

JUNE 7-10 • ASTRODOMAIN • HOUSTON, TEXAS

David H. Ahl

I was on the first flight in the morning of Tuesday, June 8 from Chicago to Houston. My seatmate, an engineer connected with the oil pipeline busiess, commented to me that after years of flying between Chicago and Houston, he had rarely seen a plane absolutely full.

I allowed that the full load was understandable since probably three quarters of the people on the flight were going from CES to NCC.

"CES, NCC. What are those?" he asked.

"Good question," said I and went on to explain about the two largest extravaganzas in the consumer electronics and computer industries.

CES is short for Consumer Electronics Show. It is held twice a year, the Winter CES the first week in January in Las Vegas, and the Summer CES the first week in June in Chicago. It is strictly an industry show; the general public is not allowed in. It's the place where manufacturers of hi-fi systems, video equipment, personal communications, security systems, telephones, video games, electronic games, wristwatches, calculators, and every other conceivable consumer electronic device come to display their wares.

The audience (show attendees) are principally buyers for department stores, chains, and independent dealers. Also other manufacturers attend to see what the competition is up to and, of course, the press is there en masse to see what's new and report on it for their respective audiences.

CES sprawls over three floors of the McCormick Place Exhibition Center as well as acres of pavement outside (for the satellite antenna systems and dishes) and spills over into two hotels. The booths are lavish and spectacular with many covering as much as 2000 square feet. Those on the main floor are often two-story affairs with private lounges on the second floor, well stocked with refreshments, for closing the big deals.

Every effort is made to woo the dealer, particularly in hotly competitive areas such as video game cartridges, component hi-fi systems, and auto sound systems. Activision, for example, sponsored an elaborate party with a jungle theme to introduce their new Atari video cartridges. Jensen sponsored a paddle wheel cruise on Lake Michigan to show off their new auto sound speakers. On any given evening of the show, at least twenty-five receptions are being held simultaneously.

Manufacturers show off their wares at two extravaganzas

Unlike a consumer show where the products displayed are all available, CES is a place for trial balloons. Frequently, manufacturers will show prototype products. If they get enough orders, the item goes into production. On the other hand, if demand is soft, the product may never see the light of day. For example, three years ago five video game systems were shown at CES but only one of them, the Atari VCS, ever made it to marketing a major way. At each succeeding CES, various Hong Kong and Japanese companies have shown programmable game units for private labelling. One, the Radofin was picked up by a discount store chain to sell under their brand name, but it never really got off the ground. This year, however, a resurgence of interest in video game units was evident with major manufacturers such as Coleco jumping into the fray. By Christmas, there will be six competing units on the market: the Atari VCS, the Atari 5200 (a 400 computer system without a keyboard), Mattel Intellivision, NAP, Odyssey 2, Colecovision, and systems from Emerson and Tyrom (the makers of the Omar backgammon and chess computers).

There were only three new computers at CES, the Panasonic JR-200, NEC PC

CES/NCC continued...

6000 and Sinclair Spectrum. Several Japanese manufacturers were showing computers that had been shown at previous CES shows but for which there was not sufficient demand to bring them to market. We are assured now, though, that Casio, Quasar, and Toshiba will all have new units on the market by year end.

Speaking of computers, why should the NCC (National Computer Conference) be scheduled the same week as CES? Simply because five years ago when these shows were scheduled no one forecast that computers would be a consumer item and that there would be any overlap in exhibitors or audience for the two shows. Today, we know better, but unfortunately, many manufacturers had to make a hard decision as to which show to exhibit in. Some, such as Commodore, Texas Instruments, Toshiba and Panasonic elected to exhibit in both shows. Others such as Atari, Casio and Sinclair put all their marbles in CES. But the vast majority of computer manufacturers opted for NCC.

Like CES, NCC is also an industry show; the general public is not allowed in. Although a huge show with high attendance (over 90,000), NCC is far more sedate than CES. Although manufacturers spend big bucks displaying their hardware to best advantage, they tend to do it without the aid of Penthouse Pets, Playboy Bunnies, and other scantily clad females gracing their booths. NCC is also somewhat quieter than CES since there aren't scores of hi-fi manufacturers vying with each other to show off zillion watt amplifiers or earth shaking woofers.

Inevitably at every press reception or meeting in the press room the first question asked is, "what did you see that's new?" That's what we are going to try to answer for you, albeit somewhat briefly, in the space below. We can't begin to describe all of the new products of the over 600 manufacturers represented at the two shows. However, we have tried to select some of the most significant new introductions, the most interesting, and some novel and unexpected entries.

Among my colleagues, there was general consensus that this was the year of the video game at CES. I counted 16 separate manufacturers making cartridges for the Atari VCS and six making other systems or cartridges. This growth is staggering from the three manufacturers that existed a year ago.

NCC was unquestionably dominated by microcomputers and more specifically, small business systems. There were at least four Osborne clones, two Apple clones and scores of TRS-80 Model III look-a-likes.

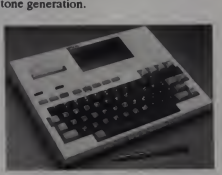
And now, join us for a tour of these shows and some of the new products displayed.

COMPUTERS

Epson Compact Computer

A notebook-sized computer that runs on internal batteries for up to 50 hours with power and features comparable to many desktop computers was introduced by Epson America.

Called the HX-20, the computer features 16K RAM expandable to 32K, and 32K ROM expandable to 64K with an optional expansion unit. Other features include RS-232C and serial interfaces, a full-size ASCII keyboard, a built-in 24-column dot matrix printer with bit addressable graphics capabilities, an LCD virtual screen with a 20 x 4 character display and virtual width to 255 characters available by Basic "width" command, and tone generation.



The HX-20 uses an extended version of Microsoft Basic and has internal time, date and alarm string functions. Optional interfaces include a barcode reader, audio cassette, and systems bus for expanded capabilities. A microcassette and ROM cartridge are also available.

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

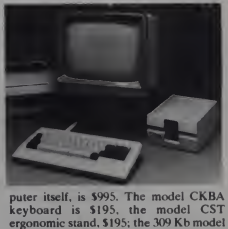
CIRCLE 340 ON READER SERVICE CARD

Cromemco CP/M System

Cromemco, Inc., announced the C-10 personal computer system. It uses a Z-80A microprocessor operating at 4MHz with 64K of RAM, and has a 25 line by 80 character graphics display on a 12" green phosphor CRT.

The C-10 Super Pak system also includes a double sided, double density disk drive, a detachable keyboard, RS-232 serial and parallel ports, and an RS-232 modem port with full handshake capability and an array of software packages. The software packages include a CP/M compatible operating system, Structured Basic, as a word processing package and a spread-sheet calculator program. $785.

Cromemco also offers the pieces as separate items. The C-10 personal computer itself, is $995. The model CKBA keyboard is $195, the model CST ergonomic stand, $195; the 309 Kb model CFD floppy disk drive, $595; and the model CLQ letter-quality printer, $895.



The use of double sided, double density 5 1/4" floppy disk drives gives the C-10 drives 390 kilobytes of storage per drive The C-10 is also upwardly software compatible with other Cromemco computers, including the System One, System Two and System Three series. All programs that can run under the CP/M or CDOS operating systems can also be run under Cromix, Cromemco's proprietary version of Unix. If a piece of software is written in Cromemco's Structured Basic language, the program created on the C-10 can run on Cromemco's 16/32-bit Motorola 68000 microprocessor-based CPU board, the DPU. In addition to the Structured Basic included with the Super Pak and word processing packages, high-level languages such as Fortan, rational Fortran, and Cobol are available.

Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043. (415) 964-7400.

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Wang Professional Computer

Wang Laboratories, Inc. introduced the Wang Professional Computer. It includes a 16-bit professional computing system, the ability to function as a workstation on any Wang 2200, Virtual Storage (VS), Office Information System (OIS), or Alliance system, and more communications options. The Wang Professional Computer can run in stand-alone mode, through coaxial cable to other Wang products, over phone lines to Wang and non-Wang products, and through Wang-Net, Wang's local area network.

Other features include Microsoft's Disk Operating System (MS-DOS), which is enhanced by Wang, and optional CP/M 80 operating system emulation, and Wang's PC-Word Processing.

The Wang Professional Computer is a highly modular system. It can be configured as the basic "off-the-shelf" system with the electronics enclosure and detachable keyboard, or it can be expanded into

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CIRCLE 342 ON READER SERVICE CARD

Innovative Unit from Grid

Grid Systems Corporation announced the portable Compass Computer which provides managers of corporations with the means of gathering information from colleagues and internal and external databases, the tools to analyze this information, and a way to report their results. It includes program development tools and applications programs that include text editing, graphics, a project management package, database management and an electronic spread sheet program, terminal emulators, and a network of sup-computers that extend the Compass Computer's range and power.

The compact 9 1/4 lb. Compass Computer is a portable workstation for a corporate management information system, and both Grid Central and Compass Central are support computers backing up Compass Computer users.

A bit-mapped, flat-panel display measuring 4 3/4" x 3 1/2" can produce characters along with charts or graphs. A matrix density of 320 by 240 dots produces high-quality graphic images in amber which, according to recent studies, produces the least eye strain. For text-editing application, the screen can display as many as 24 lines and up to 70 proportionally spaced characters.

Wider data formats can be viewed by scrolling, which extends the width of the text to as many as 256 characters. When handling columnar data, as many as 256 columns of varying widths can be created. In this way, the left-to-right width for columnar documents such as spread sheets is virtually limitless on the Compass Computer. Base price $8150.

Among the developmental tools included in the Compass Computer are five compatible languages (Microsoft-compatible Basic, Pascal, C, PL/M, and Fortran 77), an editor, and a macro assembler. The five applications packages are Gridfile, Gridplan, Gridplot, Gridwriter, and Gridpath.

Grid Systems Corporation, 2535 Garcia Ave., Mountain View, CA 94043. (415) 961-4800.

CIRCLE 343 ON READER SERVICE CARD

Micro Source Portable Unit

Micro Source Inc. introduced the M6000P portable microcomputer system. The standard system features the Z-80 CPU, 64K RAM, a standard keyboard with 83 keys, a 9" CRT with 80 character by 24 line video interface, and a CP/M 2.2 operating system. The system includes two double sided, double density, 5 1/4" disk drives. An 8-slot card cage can hold a wide variety of STD Bus circuit boards.

Micro Source Inc., 595 N. Clayton Rd., New Lebanon, OH 45345. (513) 687-1395.

Apple III CP/M Card

Apple Computer announced Softcard III, an Apple III Z80 board for CP/M capability. With the Apple Softcard III System, CP/M-based application programs join the Apple III library of software, which is based on the Apple III Sophisticated Operating System (SOS). The system supports the Apple 5-megabyte mass storage system, Profile, on which both SOS and CP/M files can be stored.

The Apple Softcard III System includes a plug-in Z80 microprocessor card, CP/M software, four manuals, and Microsoft Basic. The system requires a 128K Apple III personal computer with a suitable video display device. Optional peripheral devices include a compatible printer, external Apple Disk III drives or Profile hard-disk drive. $450.

Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95014. (408) 996-1010.

CIRCLE 344 ON READER SERVICE CARD

Dynabyte Monarch

The Dynabyte Monarch is a multiuser computer system for concurrent processing of both 8 and 16-bit programs.

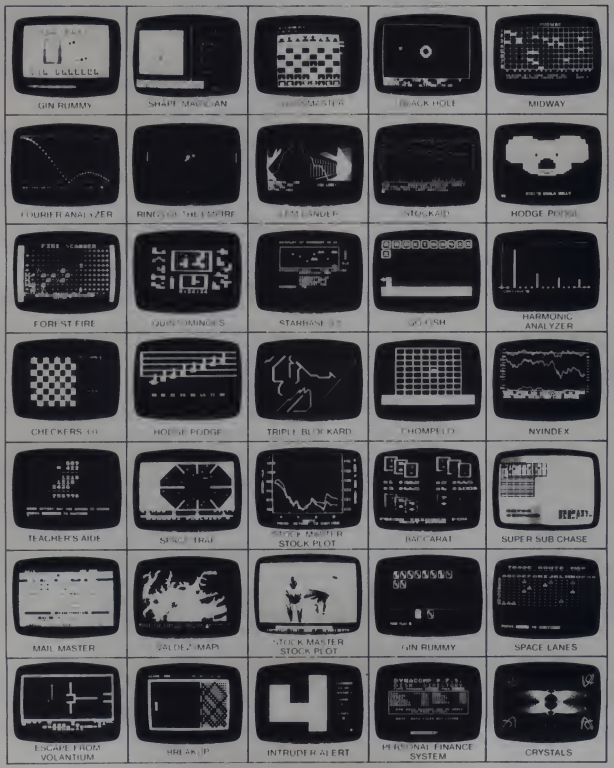
Monarch supports CP/M, MP/M II, CP/M-86, MP/M-86, Unix, Oasis-16 and Business Basic (Basic Four compatible). Monarch incorporates a single-board design without giving up expansion capabilities. Both the Multibus and S-100 bus are offered as optional internal card cages.

Monarch's Model 6600 standard configuration includes 256K RAM, 19Mb Winchester disk storage, nine RS-232 serial ports, one RS-422 high speed port, one parallel port, and an 8" IBM-compatible disk drive. $10,995. Eight additional serial ports can be added, as well as up to 1 megabyte of memory in 256K increments. Monarch can expand to 76Mb and a 17Mb cartridge tape drive expansion unit. Error correction circuitry is also available.

Dynabyte, 521 Cottonwood Dr., Milpitas, CA 95035. (408) 263-1221.

CIRCLE 345 ON READER SERVICE CARD

It's hard to picture all of DYNACOMP's *software*



TURN TO NEXT PAGE....

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DYNACOMP

*Quality software for**:

APPLE II Plus
OSBORNE-1
NORTH STAR***
ATARI
PET/CBM
ALTAIR****
NEC PC-8000
TRS-80 (Level II)**
SUPERBRAIN*****
CP/M Disks/Diskettes
(MBASIC/CBASIC)

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*$1.00 U.S. funds for foreign mailing

CARD GAMES

NEW

BRIDGE MASTER II (Available for all computers) Price: $21.95 Diskette
If you liked DYNACOMP's BRIDGE II you will absolutely love BRIDGE MASTER! BRIDGE MASTER II is a complete bridge playing system that plays a strong game of bridge and provides a challenging opponent for the serious bridge player. Features include bidding conventions, bidding explanations, point count, and scoring with duplicate and rubber sessions. After playing a specific hand, you may replay the same hand, with the option of auto-bidding cards with your computer opponents. This feature allows you to compare your bidding and playing skills to BRIDGE MASTER. Bonuses for game contracts and slams are awarded as in duplicate bridge. Doubled contracts are scored based upon a vulnerability table. Vulnerability is determined by the number of tricks bid and made. Each player's score is displayed at the conclusion of each hand played. Total scores, number of contracts made and set, and % hands made. BRIDGE MASTER II checks the best computer bridge program available.
DYNACOMP's previous BRIDGE II routines were used in many bridge tournaments. BRIDGE MASTER II has a command change of $8.00 plus postage and handling (see ordering information box). Original cassette/diskette must be returned.

BACCARAT (Atari only) Price: $15.95 Cassette/$22.95 Diskette
This is the European card game which is the favorite of the Monte Carlo jet set. Imagine yourself at the gaming table with a stack of chips in front of you and a cool sign. Lucky number 7 in CRAPS or nine bonus on the Atari Casinos full high resolution color graphics and sound/moving wood. Runs in 16K. Requires one joystick.

GIN RUMMY (Apple diskette only) Price: $22.95 Diskette
This is the best computerized version of GIN RUMMY existing. The computer plays exceptionally well, and the HIRES graphics are unsurpassed. Who else can he said?

POKER PARTY (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
Play draw poker with up to 5 of your friends against the computer on the bank. POKER PARTY is a fun game. Comprehensive scores available for two-man competition. Five party cassettes of play are available. Each of these players lists will get to know them has a different personality to the bets at a session program to build on hold under pressure. Practice with PUNCH IT! before going to the casino. Requires one standard Apple monitor and diskette versions require a 32K (or larger) Apple II.

GO FISH (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GO FISH is a children's/adult card game. The opponent is a friendly computer with user inputs that are simple enough for children to play. Excellent graphics and sound. Available in versions running in 8K, 16K, 24K, 32K and 40K of RAM. A must for children! Runs in 16K.

BLACKJACK COACH (12K TRS-80 only) Price: $29.95 Cassette/$33.95 Diskette
BLACKJACK COACH teaches and evaluates professional playing methods. This program will coach you using the Basic and the Complete Point Count Systems. The BLACKJACK COACH will deal you hands, evaluate your performance, score the playing and betting strategies used, and keep track of your wins/losses. It reports player and dealer hands and information of various methods of play. All the standard player choices are included: insurance, splitting pairs, double down and surrender options. A 52 card game may be used to collect data. If you like money at the tables, investors your skills with the REAL KING'S COACH!

THOUGHT PROVOKERS

MANAGEMENT SIMULATOR (Available for all computers) Price: $25.95 Cassette/$29.95 Diskette
MANAGEMENT SIMULATOR is a business management game which allows you to test your management skills when placed in a realistic business situation. Your company competes with up to four companies in a specific industry. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful company is determined by the highest stock price when the game ends.

FLIGHT SIMULATOR (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
A realistic and extensive mathematical simulation of take-off, flight and landing characteristics of a typical jet aircraft. Features and the characteristics of a real aircraft. You can practice instrument approaches and navigation using VHF/omni and compass headings. The more advanced pilot can also perform basic maneuvers such as constant airspeed descents. Although this program does not employ graphics, it is exciting and very addictive has the software rewrite in CBASIC/MBASIC. Runs in 16K RAM.

VALDEZ (Available for all computers) Price: $17.95 Cassette/$21.95 Diskette
VALDEZ is a game of navigation and instrument navigation in the Valdez Narrows of Alaska. Your task is to navigate a Alaska Seafood line tanker/ore carrier from the Gulf of Alaska to Valdez Harbor! See the software reviews in 80 Software Critique Personal Computing and Creative Computing.

BACRAGMMON 2.0 (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
BACRAGMMON 2.0 is a backgammon game which allows you to play against the computer or against a friend on separate systems connected by a modem. The computer will make its moves at a speed you determine. The program will double as genuine dice rolls. Board positions can be created as saved for replay. BACRAGMMON 2.0 plays in accordance with the official rules of backgammon and is easy to position using the cursor control and RETURN key combination plus

FROG MASTER (Atari only) Price: $17.95 Cassette/$21.95 Diskette
The Atari APX's first prize winner! FROG MASTER combines exciting arcade features in addition to being a highly challenging game of skill. Use your joystick to guide your frog across the busy highway and the treacherous river to the safety of the lily pads. If the going gets too rough, you can always call for help from the Bonus Frog. Your score is determined by giving them a reward to join the right number of frogs in the lily pads. Full color graphics and sound bring this game to life. Once you learn about the various special rules of FROG MASTER, you will fall by the wayside, but some will get through. As they leave you can look inside their heads to see how they think. As you progress in FROG MASTER, you will encounter more and more challenging situations. Fast action and strategic learning combine to make FROG MASTER a challenging and exciting experience. As you teach them they teach you how learning takes place! Game graphics! Runs in 16K. Requires joystick.

FORESTRY (Atari only) Price: $14.95 Cassette/$19.95 Diskette
Using excellent graphics and sound effects, this simulation puts you in charge of a forest. Your goal is to maximize your revenues from cut the fir while maintaining the forest for future generations. Your decisions in planting, cutting valuable harvesting are result in startling predations. Life-like variables are provided to make FORESTRY truly computerized and challenging. The new game starts the same setting and there are 3 levels of difficulty.

CRANSTON MANOR ADVENTURE (Atari Star Soper/Bros and CP/M only) Price: $19.95 Diskette
An Apl A comprehensive Adventure game for Star Soper/Bros and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather priceless treasures. Lurking in the manor are many unfriendly characters who will do anything to prevent you from succeeding. Your quest will be long, hard and challenging. You can search more than 100 rooms. Save the current position and continue the game at a later time. Only the game the log in to clear. Play can be stopped at any time and the status stored on diskette.

SPACE EVACUATION! (Available for all computers) Price: $18.95 Diskette
Can you retrieve the galena and evacuate the Earth before the star explodes? Your computer becomes the ship's computer as you explore the unknown reaches of outer space. Encounters in outer space interesting as it combines many of the exciting elements of classic space games with the mystery challenge of ADVENTURE!

MONARCH (Atari only) Price: $14.95 Cassette/$18.95 Diskette
MONARCH is a fun-loving economic simulation requiring your interest as your term as your nation's leader. You must control your country's economy and military and keep your people happy. Your task is to distribute to the resources and how much to allocate to the military. You will find that all decisions involve a compromise and that it is not easy to make everyone happy. Runs in 16K. Requires joystick.

BUSICOM 909 (Available for all computers) Price: $14.95 Cassette/$21.95 Diskette
Subtract the Rabbit's color puzzle is an interactive algorithmic logic, and a "Concept" for computer calculation. The BUSICOM 909 WORDS presents you with each step shown as a colored view of the color. It then asks the color problem. The problem you step to a time with each step shown as a colored view of the color. Can you solve the color in fewer steps. In any case, it now beats disassembling the color as putting all and replacing the colors! Requires 16K.

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run on/on 16K program memory space (ATARI requires 24K). Except where noted, programs are available in ATARI BASIC, TRS-80 Level II, NEC and Apple (Applesoft) source and diskette as well as North Star BASIC (single density computers) diskette. Additionally, most programs are available in standard 8080 Z/80 code diskette format for use with computers running CP/M, TRS-80 Model II, and SUPERBRAIN operating systems. CBASIC (for example) Altos, Xerox 820 North Zenith and many others). DYNACOMP diskettes are available for the North Star SuperBrain and Osborne computer systems

ATARI, PET, CBM, NORTH STAR, CP/M, MBASIC, CBASIC, APPLE II, APPLE II Plus, SUPERBRAIN, NEC PC-8000 and ALTAIR are registered trademarks of and diskettes are all 5200.00 Model I software is available on cassette (only) for the TRS-80 Model III. Exceptions: VALDEZ (CBASIC), GRAPE GROWER (CP/M), TRS-80 diskettes are not supported with either DOS or BASIC.

****For most North Star disk based systems.*
*****For Altos systems having Microsoft BASIC.*
******For SUPERBRAIN systems running under MBASIC or CBASIC (state which).*

AND MORE...

NEW

STARBASE 3.2 (Available for all computers) Price: $11.95 Cassette/$17.95 Diskette
This is the classic space simulation for multi-several nine hours. For example: the Cruelties zero alone in the Interstellar without starting which also area long starbases in other quadrants. The Cruelties also with a both light and heavy cruisers and more when shot at! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a Faction 5-D 5 is mounted! The Cruelties are mad! See the software reviews in 80 U, 80 Software and Creative Computing.

LIL' MEN FROM MARS (Atari only) Price: $19.95 Cassette/$23.95 Diskette
Defend yourself! The little men from Mars are out to get you if you don't get them first. This is a fabulous high-resolution animated graphics (an odds game which measures each of the little men's progress. Requires one joystick.

ALVIN (Atari only) Price: $17.95 Cassette/$21.95 Diskette
ALVIN is an arcade game. You are commanding a highly maneuverable spaceship in a battle against the Alvin. You are attempting to bomb these cities which at the same time trying to avoid their defenses fire (MISSILE COMMAND" in reverse"). Also, your radar has been damaged in that you can only see downwards. This would normally not be much of a problem except that you also have to contend with high flying enemy aircraft! As long as you are above these aircraft you have the advantage and are safe. However, high level bombing takes considerable skill and practice. Additionally, you must watch out for the Alvin's deadly bombs. Full color graphics and sound make this one of the most exciting arcade games in the states. A fun game. Requires 16K.

ESCAPE FROM VOLANTIUM (Atari only) Price: $15.95 Cassette/$19.95 Diskette
Bring the action and excitement of an arcade game to your computer home with ESCAPE FROM VOLANTIUM! Your mission is to escape from the planet Volantium with the secret treasure before the guardians outbreed being eaten. If he is killed with a direct shot just put a big squad off; a shot opens in the direction of the Treasure. Or these doors are opened immediately. If you fail to escape in time, the door closes and a new guardian appears. Sometimes you can smash through the door by shooting it repeatedly. The door's status is important. At the beginning of each game you may select the appropriate degree, adding to the excitement! Uses high resolution graphics and sound. Runs in 16K.

ALPHA FIGHTER (Atari only) Price: $17.95 Cassette/$17.95 Diskette
You are either fighter, and attack ship in this program in one! ALPHA FIGHTER is a game where you shoot enemy spaceships and avoid their shots. The goal is simple. ALPHA BASE is in the path of an alien UFO mission, let the UFO's get by and the game ends. Both games require 16K memory and get progressively more difficult the higher you move! ALPHA FIGHTER will use to 16K options.

THE RINGS OF THE EMPIRE (Atari only) Price: $14.95 Cassette/$18.95 Diskette
The empire has developed a new battle station protected by rotating rings of energy. If each new gun blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game has an 16K systems employs intensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) Price: $15.95 Cassette/$19.95 Diskette
This is a last pea of graphics game which places you in the middle of the "Dreadnaught" having just stolen an plans. The Dreadnaught is a huge spaceship with seven levels and hundreds of rooms. Your mission is to escape with the plans in one piece. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will use on 16K systems.

MIDWAY (Atari 32K only) Price: $14.95 Cassette/$18.95 Diskette
MIDWAY is an exciting extension of the game of Battleship. It mixes the challenges of strategy and chance. Your opponent can be another human or the computer. Color graphics and sound enhance the play. Runs in 32K.

GOLF PRO (Atari only) Price: $17.95 Cassette/$21.95 Diskette
GOLF PRO uses high resolution graphics are joined together in GOLF PRO to make the most realistic golf game for the Atari. Really appreciate this game should have a color TV so that you can see the difference between the blue of the water hazards, and the white sand of the traps. You tee off with a wood are your wedge to the sand trap, and putt on the green just as would be done on the course. Based on Super Star Computer's popular GOLF PRO! Requires 16K and one joystick.

GAMES PACK 1 (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GAMES PACK 1 contains the classic computer games of BEAU KNOCK, LUNAR LANDER, HUMURAZ 7, SMITE 10 and HOSS. These games have been combined into one large program for ease of loading. They are individually accessed by a convenient menu. This collection is worth the price all by itself! Requires 16K and one joystick.

GAMES PACK II (Available for all computers) Price: $14.95 Cassette/$18.95 Diskette
GAMES PACK II contains the games of EIGHTS, JOTTO ACEY DEUCEY and HOSS. Like GAMES PACK I, GAMES PACK II is a fun package loaded a new program and are called from a menu. You will particularly enjoy DYNACOMP's versions of CRAZY EIGHTS.
Why pay $9.95 or more per program when you can buy a DYNACOMP collection for just $14.95?

MOON PROBE (Available for all computers) Price: $12.95 Cassette/$16.95 Diskette
This is an extremely challenging "moon lander" program! The more moon probe you send, the more on land in a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle. Runs in 16K Atari.

SPACE TRAP (Atari only, 16K) Price: $14.95 Cassette/$15.95 Diskette
This game is "shoot 'em up" arcade game plays you near a blue hole. It's a world of space monsters coming the planet and attempt to blast as many of the alien ships as possible before the black hole closes about you.

SUPER SUBMARINE (Atari only) Price: $19.95 Cassette/$23.95 Diskette
SUPER SUBMARINE simulates a search and destroy mission. Set your course and keep an eye on the ocean readings as you hunt for the hidden submarine. Set the depth charge for the proper depth and watch them explode! Runs in 16K. This is an addictive game which takes advantage of the Atari's graphics and sound capabilities. One or two players. Joysticks required.

TWO PLAYER GAMES

NEW

TWO PLAYER GAMES (Available for all computers; 32K disk/diskette only)
DYNACOMP has re-opened the discontinuation rights to the last eight of Robert Lansing games. These two-player games were originally written for the North Star computer but have since been converted to play on all the computers currently supported by DYNACOMP. Each game is written in a manner which makes conversion to other systems easy. Each game or program runs as a dedicated by each of 5.95 diskette. $23.95 disk. Purchase one games then then a bargain you can not pass up.

Set #1 PANZER and BLITZKRIEG
PANZER
Size 32 Nov. 1942 Place: Several miles east of Kurs Russia. The Russians have just liberated Kurs and are moving quickly to stock the German forces which are preparing for a big desperate attempt to halt the Russian advance BLITZKRIEG
Date: Spring 1940 Place: Northern France. The German forces have just launched their massive offensive and are paying attention to the west. France The German forces has penetrated the Ardennes and Meuse. The heroines of Dunkirk, the defense of the Aisne Marne Canal, and the final collapse of the French Army. Will the south has all passed. And, now, the drive on Paris.

Set #2 STARSHIP TROOPERS and INVASION OF THE MUD PEOPLE
STARSHIP TROOPERS
Size: 1 Man Platoon Place: Aerobatt planet of Steel The first all-out battle on the planet Shoal which will match equal forces of Terran and alien units. The outcome will set the course of the conflict, for the planet of Shoal is a key position in the solar sec
INVASION OF THE MUD PEOPLE
A Peruvian army battalion has been dispatched to a remote village area to investigate the destruction of many local villages. Your task is to search out the cause of the destruction. Your reconnaissance and escape routines appearing from waves of alien mud balls which feed upon human flesh and destroy the terrain

Set #3 FALL OF THE THIRD REICH and ARMORCAR
FALL OF THE THIRD REICH
Date March 1945 Place: Remagen, Germany. The allies under General Eisenhower had reached the Rhine. The Germans had failed in destroying the Ludendorf railroad bridge, allowing several allied forces to cross the river and finally collapsed on March 17 and on. the allies began their drive on Berlin.
ARMORCAR
Date: 2 Feb. 1980 Place: Rhein Ruhr, Russia. A German frontline unit is hard pressed for tube equipment and mode of supplies. A relief convoy of armored cars must reach them through partisan-infested territory

Set #4 MOUNT SURIBACHI and MIDDLE EARTH
MOUNT SURIBACHI
Size: 10 Feb 1945 Place: Iwo Jima. The Japanese opened fire here Mount Suribachi in the marines landed on the pearly-hue-shaped island. Gunfire from the hill could cover the entire island. thus it was a crucial objective if the marines were to succeed in their attempt to capture an Air Base. Mount Suribachi is the first of the Japanese defended positions in the marines' drive to the north.
MIDDLE EARTH
Date 1997 Place: MIDDLE EARTH. Through a maze of tunnels, caverns, and swirling passageways dim-witted leading from an warrior vole(s) in North America, a team of United Nations' researchers have undertaken a mission to an unknown world. Their goal is to find a way to stop the ever-increasing population explosion. Their mission has been carried to the Earth's core, a land of bizarre, utopian societies. And then the creatures of MIDDLE EARTH appeared ... unmade bed by the most frightening horror stories created by man

MISCELLANEOUS

(RYSTALS (Atari only) Price: $14.95 Cassette/$18.95 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. Runs in 16K.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY
DYNACOMP now distributes the 12 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 us soon for a complete list of the programs in each volume of the NSSE collection.
Price: $9.95 each/$8.95 each in or more.
The complete collection may be purchased for $119.90.

5¼" DISKETTES (soft sectored/box nominal)
As you might imagine, DYNACOMP purchases diskettes in large quantities and at wholesale prices. We want to pass the savings along to you!
Price: $39.95/26 Diskettes

BUSINESS and UTILITIES

PORTFOLIO MANAGEMENT (Apple 48K only) Price: $69.95 two Diskettes
The PORTFOLIO MANAGEMENT system was written by a stock broker to help investors like himself and customers. With this program each file can be easily created and kept up to date. A variety of reports can be generated for: stocks which are active-hot, and profitable; sold out. The user defines the criteria and volume/price parameters
PORTFOLIO MANAGEMENT is a top quality, professional tool which will not only provide you with new convenience but will also save you many $ in brokerage commissions. Order it now and be able to advise your own portfolio!

PERSONAL FINANCE SYSTEM (Available for all computers) Price: $39.95 Diskette
PFS is a single diskette, name-oriented system composed of ten different programs. Besides recording your expenses and income, it can help you plan for the future. Its budget planner lets you compare your actual expenditures in any of 36 user defined codes by month as far as you've been using it, and even provides a graphic of your monetary category! This powerful package requires only one disk drive, minimal memory (DOS Start 32K North Star) and will store up to 400 records per disk (and more if you don't write on the disk by making a few simple changes in the programs). You can record checks plus cash expenses; 1) the) you can finally see where your money goes and eliminate guesstimate and 2) split based calculations. Comment: PFS is the most user friendly and easiest to learn software we've seen. Highly recommended as an added bonus.

FAMILY BUDGET (Apple and Atari only) Price: $34.95 Diskette
FAMILY BUDGET is a very convenient financial record-keeping program. You tell the it the categories you want to create expenditures as well as income on a daily basis. You can record two deductible items and charitable donations.
FAMILY BUDGET also provides a convenient record of all transactions. Each month's data is stored in a file and one enters in any of 21 different expense accounts as well as in 7 payroll and tax accounts. Data can easily retrieved giving the user complete control over all income and expenditure transactions.

TEXT MASTER (Apple 32K, diskette only) Price: $49.95 Diskette
TEXT MASTER is a general purpose word processor for the Apple II computer. It features a powerful, English-like command language that is easy to learn and use. Applications include memos, letters, manuscripts, mailing lists for correspondence, computer programs, data to be used by other programs, and more. TEXT MASTER also interfaces with any printer connected to your Apple II. Its commands control such features as page length, margins, how far to the left or right to start one line, and a lower case adapter. TEXT MASTER can process any length file segment by segment. Thus it is not limited by the size of your computer's memory. Commands are provided to: LIST, COPY, DELETE, SAVE, and RENAME files; SEARCH, SEARCH AND REPLACE, and MERGE text; and PRINT files. The commands available in TEXT MASTER are: COLLECT, LIKE, EXECUTE, NUMBER, INSERT, RE-SEQ, SHOW, SEQUENCE, DELETE, SAVE, COPY, FREE, REPLACE, WAIT, MOVE, MERGE, LIST, PRINT, SEARCH, RENAME, CHANGE, SCRATCH, SHOW, CATALOG, MODIFY, COMPARE, RUN, DISPLAY, HELP

INTELLINE (Atari only) Price: $49.95 Diskette
This software package contains a menu driven collection of programs for facilitating efficient two-way communications between the Atari 800 and other computers via telephone lines. Communications can be in the form of: TERMINAL SESSIONS (CONVERSE is the software) and data files may be transferred between computers. This package includes "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in ATARI BASIC, FORTRAN or any other form using the support can utilize another "uploaded" to another computer making the Atari a very smart terminal. Uses Atari BASIC programs may be uploaded. Further a command file for both of the above can be created to automate frequently performed sessions. That is, you can set up your system for the Northern mainframe and programs, and the Atari will connect them, dial, attempt hand-shaking, answer the data set to receive mode and start your files.

PAYTYPE (Apple 11 plus diskette, one drive required) Price: $39.95 Diskette
PAYTYPE is a payroll system written by a professional with extraordinarily good human engineering features. PAYTYPE prints checks and computes all required payroll data for up to 100 employees per diskette. The pay methods may be hourly, salary commission or any combination. There are multiple options for pay periods, and they also can be used in any combination. Deductions may be computed as a percentage of gross pay or as a dollar amount with a 200 page manual! The manual may be purchased separately for $30, and that payment later applied to the software purchase

SHOPPING LIST (Atari only) Price: $12.95 Cassette/$16.95 Diskette
SHOPPING LIST is a program that maintains an items you purchase at the supermarket. Before you go shopping, you print out all the things you might need, and then display (or optionally print) your shopping list and the cost of each. Adding, deleting, changing and storing data is easy a way from with 16K

TAX OPTIMIZER (Available for all computers) Price: $39.95 Diskette
The TAX OPTIMIZER is an easy-to-use menu-oriented software package which provides a convenient means for analyzing various income tax strategies. Using the information from your tax return, the TAX OPTIMIZER will automatically be computed by all tax methods (regular income averaging, maximum and alternative minimum tax). The user may interactively change any of the values on the tax return and instantly see the effect. Comment: Includes a 200 page IRS office and income complete with the required forms! Available in its data files. Tax OPTIMIZER is an excellent tool.

STOCK MASTER/STOCK PLOT (Apple 48K) Price: $99.95 Diskette
This is a full-featured set of programs for recording and analyzing the performance of records of stocks and commodities purchased. You may record price, revenue, earnings share ROC quarterly earnings and dividends, transactions, long-short term gains, P/E indexes (S&P 500 INDUSTRIALS, DOW JONES) to the price history of any stock against any other, or the indexes. Portfolio value may be evaluated at any time. Comes complete with tutorials, quickly written instructions and sample files.

TURNKEY and MENU (Atari only) Price: $17.95 Diskette
TURNKEY is a utility program which allows you to create autoboot/autorun diskettes which run your programs. With TURNKEY load the program diskette to be modified, and answer the questioned The TURNKEY diskette also comes with a MENU program which creates a menu of up to 10 BASIC programs. The MENU program is automatically run when it appears the memory of any BASIC program on the diskette. Each program is then given a number, and you can run any program with the ability to run any program on your diskette by simply turning on the computer and pressing a single key.

STOCKAID (Atari only) Price: $29.95 Diskette
STOCKAID provides a powerful set of tools for stock market analysis. With STOCKAID you can display paper and figure charts, as well as bar charts which follow the price and volume movements of stocks, commodities or other volume features. STOCKAID allows you to input daily data with a single diskette storage capability of 259 days o 16 stocks. Included are detailed directions and a demonstration data diskette. Comment: A good tool!

NYEINDEX (Atari only) Price: $29.95 Diskette
NYEINDEX is a comprehensive software package for storing, retrieving and plotting the New York Stock Exchange Composite. The daily data and indexes are automatically updated via modem. Any time period may be plotted. Graphs of dialogue include the above plus the index oscillator cumulative advance/decline and moving average. Data entry and editing is easy. The diskette includes more than two years of daily data! COMMENT: It is an excellent companion to STOCKAID.

PLAYER-MISSILE GRAPHICS TABLET (Atari only) Price: $19.95 Diskette
The PLAYER-MISSILE GRAPHICS TABLET was designed to take the drudgery out of developing fun color displays to run on the Atari 400/800. Using the TABLET, the location of the buttons of the joystick and the joystick position are read into the PLOT and DRAWTO. With TABLET you are able to easily design colorful graphic displays and test your ideas and save your creations on diskette for later recall.

LIFE CYCLE ANALYSIS and DEPRECIATION (Apple only) Price: $39.95 Diskette
This program calculates depreciation and business expenses for equipment which can later be used to calculate and display a variety of reports. You may record the purchase price, expected years, usage depreciation schedules and justify tax deductions. The evaluation techniques conform to standards set by federal agencies. This is an invaluable package for any businessman who depreciates equipment. LIFE CYCLE ANALYSIS features menus so no data file creation section and provides formatted hard-copy reports for use by accountants or by tax record keeping purposes. When used for generating tax information, this package is tax deductible! Requires 48K Comes on two diskettes.

MICROMAGIC (Apple diskette only) Price: $39.95 Diskette
MICROMAGIC is a powerful programming tool for MAGIC! MICROMAGIC offers commands which allow you to use MAGIC! as a stand-alone programming package or as a utility program to create stunning animated graphics for use in other programs. The secret lies in MICROMAGIC's special on screen graphics editor. You control a graphics cursor directly from the keyboard, creating high resolution images using all 16 available colors. When you are done with a picture it can be saved on disk with a single key command. Up to 36 images can be saved as "frames" of a movie, and then played back at high speed to create the illusion of animated sequences. Two demo movies are included.
This package makes complex with demonstration programs so that even novice users can get immediate results. No programming experience is required to use MICROMAGIC. The MAGIC! language is featured by the ease required to create graphics images with your computer. INSTRUMAGIC will delight you.

SHAPE MAGICIAN (Apple II, 48K, diskette only) Price: $29.95
A tool for utility for painlessly creating graphics shapes for the Apple Creator, edit and save up to 28 shapes which can then be used to develop arcade games or to simply enhance your programs. Add that professional touch!

EDUCATION

HODGE PODGE (Apple 48K only) Price: $14.95 Cassette/$19.95 Diskette
HODGE PODGE is a game for children and teacher. Pressing any key on your keyboard will cause a random "happening" to appear in the form of numbers of the form "how many" and "what". Each happening is different and children from ages 2½ to 7 HODGE PODGE is a non-threatening teaching tool in which there is no right or wrong answer. Comment: Our children love this program and it's a great way to introduce the computer to children.

TEACHER'S AIDE (Atari and PET only) Price: $12.95 Cassette/$17.95 Diskette
TEACHER'S AIDE consists of three basic modules contained in one program. The first module is designed to help instructors learn facts of varying levels of difficulty. The second module is designed to help instructors learn the names of students. The third module is designed to help instructors learn the names of students. The third module consists of electronic problems, one particularly nice feature of the Division module is that the long hand division steps can be displayed along with the remainder in order to clearly demonstrate to the problem by which the remainder is derived. Using TEACHER'S AIDE is not merely a drill but rather a learning experience!

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) Price: $199.95 Cassette/$45.95 Diskette
DIGITAL FILTER is a general purpose program package which performs digital filtering of data stored in a disk file. Unlikes from a mass filters, in the digital filtering of data the filter characteristics are not determined by directly entering points along the desired filter curve in the mean mode: ideal low pass high pass and bandpass filters may be approximated to varying degrees of accuracy by the selection of the number of points used. The filter program may optionally, also be smoothed with a Hanning function. In addition mode type functions may be selected. DIGITAL FILTER is a very flexible program which can be used to perform digital filtering of data stored in disk files. Also included are several utility programs for reversing, and multiplying two files.

DATA SMOOTHER (Not available for Atari) Price: $19.95 Cassette/$23.95 Diskette
This special data smoothing program may be used by anyone who has a need to smooth data. Typical engineering data which are usually special. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculations. Also included is a demonstration data file and a smoothed results.

FOURIER ANALYZER (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
The Basic program will examine the frequency content of time-domain signals. The program will allow the display and plotting of the input data and results. Practical applications include the analysis of complex wind patterns as such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) Price: $19.95/$23.95 Diskette
This is a special software package which may be used to evaluate the transfer function between any two waveforms and filters by examining their response to pulsed inputs. TFA is a many - models what if FOURIER ANALYZER. The program will automatically compute and display the impulse, step, and frequency response. Whenever FOURIER ANALYZER is changed the selection of a new data set will cause TFA to automatically recompute all comparisons.

HARMONIC ANALYZER (Available for all computers) Price: $24.95 Cassette/$28.95 Diskette
HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Examples include data for power-wise, editing and storage retrieval as well as digitized waveforms. This public version is capable of handling the input data used with equally spaced x or 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 $60.95 when ordered at the same time.

REGRESSION I (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
REGRESSION I performs multiple linear regression analysis on one dependent variable and up to 16 independent variables. Features include step-wise regression, data entry, data storage and retrieval, printing of results, plotting of fitting functions, data editing, automatic data, curve and residual plotting, a statistical analysis (e.g. standard deviation, correlation, coefficient, etc) and much more. Documentation is a complete mathematical treatise. REGRESSION I is entirely the convenient program to use data analysis without a lecture!

REGRESSION II (Available for all computers) Price: $19.95 Cassette/$23.95 Diskette
PARAFIT is designed to handle three cases in which the parameters a embedded (usually nonlinearly) in the fitting function. PARAFIT is a general purpose program for analyzing data consisting of two variables. PARAFIT is numerous than Basic, easily and extensive. PARAFIT is a powerful tool for the serious data analyst. REGRESSION I for polynomial fitting, and PARAFIT for those complex and functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) Price: $24.95 Cassette/$28.95 Diskette
MLR is a professional software package for analyzing data consisting from 2 to 16 variables independent variables. Routine performing the least squares regression calculations. This is a powerful tool for the serious data analyst. The retrieval and editing functions In addition the user may interrogate the software by supplying values for the independent variables. The number of calculated and data sets is limited only by available memory.
REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for $85.95 when cassette or $65.95 when diskettes ordered.

ANOVA (Not available on Atari cassette or for PET/CBM) Price: $39.95 Cassette/$43.95 Diskette
ANOVA is a powerful software package for analyzing data consisting of two variables. Routine performing the DYNACOMP has brought the power of this method to small computer systems. Using ANOVA the DYNACOMP software package handles the 2-way, 3-way and N-way procedures. Also provided are the Tukey and factorial designs. For those unfamiliar with ANOVA, the DYNACOMP manual contains a comprehensive and very natural fashion by a professor in the subject and serves as an excellent introduction to the subject. Accompanying the 3-way and general programs for data base retrieval and editing, a two-way program for data base retrieval and editing, a two-way program for data base retrieval and editing.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)
DYNACOMP is proud to announce the publication of BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 by Dr. Robert Ward and Dr. John Holtzman of the DYNACOMP staff. These info-rulers have been assembled according to chapter. To date and each subroutine is documented with a description, purpose, limitations, and a subroutine.
Volume 1
Collection #1: Chapters 2 and 3 - Data and function plotting, complex variables and functions.
Collection #2: Chapter 4 - Extended matrix and matrix operations.
Collection #3: Chapters 5 and 6 - Random number generators/Monte Carlo, Gaussian etc.'s, series approximations
Price per collection: $16.95 Cassette/$20.95 Diskette
Price for collections 1 or three collection when cassetted and $63.95 three diskettes)
Volume 2
Collection #1: Chapter 1 - Linear polynomial multidimensional parametric least squares
Collection #2: Chapter 2 - Curves approximation by least squares, nonlinear least squares, shifting etc.)
Collection #3: Chapter 3 - Functional approximations by iterative and recursive
Collection #4: Chapter 4 - Special functions approximations: exponential and logarithmic functions
Collection #5: Chapter 5 - Table interpolation: differentiation and integration (Newton Lagrange, spline)
Collection #6: Chapter 6 - Methods for the real roots of functions
Collection #7: Chapter 7 - Methods for finding the complex roots of functions
Collection #8: Chapter 8 - Ordinary differential equations
Price per collection: $14.95 Cassette/$18.95 Diskette
All eight collections not available for $99.95 (eight cassettes) and $129.95 (eight diskettes)
Because the texts are a vital part of the documentation of BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 are available from DYNACOMP separately:
BASIC SCIENTIFIC SUBROUTINES, Vol. 1 (319 pages) $19.95 + 75¢ postage
BASIC SCIENTIFIC SUBROUTINES, Vol. 2 (390 pages) $19.95 + 21.95 postage
See review in BELOSRAD, Dr. Dobbs, and ALCUS

SOFTNET (Apple II and TRS-80 48K cassette only) Price: $129.95
SOFTNET may be used to solve models of open-ended input/output systems to analyze their flow performance. Up to 256 nodes with up to 150 connecting elements may be simulated, and each node may have a maximum of 10 inputs. The model may be set interactively for easier distribution system, chemical feed flow problems building planning, or similar situations, this is an ideal analysis tool!

FILTER ANALYSIS (Apple only) Price: $19.95 Cassette/$23.95 Diskette
FILTER ANALYSIS is the digital prototyper determining the frequency response characteristics of the number of RLC circuits may be included, and any number of pass bands may be specified. FILTER ANALYSIS features 8 types plus frequency response, group delay, and phase response simple. Results may be entered to tabular form or displayed in graphic form versus logarithmic.

ACTIVE CIRCUIT ANALYSIS (Available for all computers) Price: $39.95 Cassette/$39.95 Diskette
SWAP-AP can also analyze the response of the active circuits which contain one or more operational amplifiers. It steps to frequency and the resulting complex voltages at each component you have examined. It requires a response of it then or amplifier may be completely determined from the data. Comment: SWAP-AP is a powerful tool for the AC analysis of analysis of the range of voltage responses also it must contain the operational amplifier model. SWAP-AP is an excellent tool for the AC analysis of active circuits. Cassette or diskette. To be verified at a later date. Execution or editing ACAP should be part of every circuit designer's program library. Required 48K

LOGIC SIMULATOR (Available for all computers) Price: $39.95 Cassette/$39.95 Diskette
Test your complicated digital logic design with computer to gram set of commands. Each of the 16 logic gate operate The elements which may be simulated include inverter AND OR NOR EXAND EXNOR and NAND gates, as well as inverters, JK and D flip-flops, and monostable multivibrators. Also included are clocks and toggles. Displacements and delays may be variable set to probe for glitches and race conditions. Up to 1000 logic gates and 1000 nodes may be placed your breadboard may be simulated by LOGIC SIMULATOR Requires 48K

SEAM DEFLECTION (Available for all computers) (disk, diskette only) Price: $29.95 Diskette/$32.45 Disk
BEAM DEFLECTION is the key to DYNACOMP's new series of structural analysis programs for the analysis of two programs. The first program governs the development of data files which follow the problem. For example the ends of the beam may be supported - fixed or free. The beam may be subjected to concentrated loads, uniform loads, springs, varying physical and having differing spring conditions. The statistical coefficients are used as the basis upon which the program will be developed. The second program reads the data files created by the first program and performs the various process along its length. Read as an 8.5 this information may be easily entered and edited using the data input program.
Following this the analysis program is called. The calculated results on the stress and deflections of the beam both in moments of and graphics of form since the input data is saved - case may be easily review with modification thereby permitting two error check.
The documentation which comes with DEFLECTION CHAIN clearly shows how to use the software. In addition there is a comprehensive discussion of the theory behind the programs. Comment: Although the theory is not for the faint hearted, the theoretical information is supplied in the manual.

STATTEST (Not available on Atari cassette or for PET/CBM) Price: $19.95 Cassette/$23.95 Diskette
This is a volume of reference a per large which helps you get a handle on statistical concepts. In an interview fashion you can build and edit data files and test the difference in means, variances and proportions. STATTEST will also perform data analysis as well as do linear correlation and regression. The user-selected amount of significance is rounded out with a chi-square contingency test and a Spearman and normal random sample generator. The documentation is written by a college professor and is very helpful.

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New York State residents please add 7% 46% sales tax.

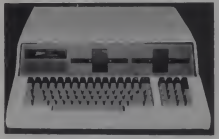
ABOUT DYNACOMP

DYNACOMP is a leading distributor of small system software with sales spanning the world currently features 48 US countries). During the past three years we have greatly enlarged the DYNACOMP product line, has been maintained and improved our high level of quality and customer support. The achievement in quality is apparent from our many repeat customers and the software reviews in such public access as COMPUTER MART, SOFTSIDE Compute A.N.A.L.O.G. SoftaS, Creative Computing and Kilobaud. DYNACOMP sales has also been closer to demonstrate an network. Comprehensive documentation is written by a college professor and is very helpful. The staff is highly trained and always willing to do any problem or user ask us.

CIRCLE 160 ON READER SERVICE CARD

Zenith Dual MPU Systems

Zenith Data Systems introduced the Z100 series of desktop computers which have as standard features both 8- and 16-bit microprocessors, a five-slot S-100 expansion chassis, two built-in 320K 5 1/4" diskette drives, 128K RAM, color graphics with control of eight colors and 144,000 dots, and keyboard in a single housing. Memory is expandable on all models to 768K.



The computers use the IEEE 696 expansion chassis (commonly called the S100 bus), which enables the use of a wide variety of S100 options.

Digital color or RGB output is standard on both versions of the Z100. The low-profile version also has monochrome composite video output.

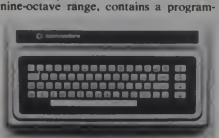
It also uses CP/M on the 8-bit side of the computer, which makes transfer of 8-bit software to the Z100 possible, while Z-DOS and the diskette format of the Z100 make most software for the IBM personal computer available to the new Zenith computers. The retail price of a Z100 system including software is less than $5000.

Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025. (312) 391-8181.

CIRCLE 346 ON READER SERVICE CARD

Five from Commodore

The Commodore Max Machine is a three-in-one home computer/game machine/music synthesizer which includes an array of arcade games, educational and musical programs and peripherals. It has a 40-column x 25-line screen and 16 colors. The sound system produces three independent voices, each with a nine-octave range, contains a programmable ADSR generator and a programmable filter, and has variable resonance. $179.95.



The Commodore 64 gives home and business users 64K computing capability along with "three-dimensional-style" color game graphics and music synthesis. The Commodore 64 can use VIC-20 peripherals and can also use many programs and files created for Commodore's line of PET

and CBM education- and business-oriented computers. It has a 40-column x 25-line screen and 16 colors, as well as 64K RAM. $595.

The Commodore Information Network, is a user-oriented telecommunications service that allows home computerists to get technical assistance, exchange programming tips, access Commodore product information and play games. Users of Commodore's VIC-20 home computer can access the service with the VICmodem cartridge and a modular telephone. With the purchase of a VICmodem, Commodore provides a free one-year subscription to CompuServe, and one free hour of time on the CompuServe network.

Thirteen cartridge games—including three Bally/Midway arcade games—for the VIC-20 are now available. Commodore also has a complete range of peripheral products for the VIC, including a single disk drive, graphic printer, VICmodem, and 16K memory expansion cartridge. The Bally/Midway games are *Gorf*, *Omega Race*, and *Wizard of Wor*. Commodore's own *Space Vulture*, *Raid on Fort Knox* and *Pinball Spectacular* are also available, as are *Mole Attack* and *The Sky is Falling*. Commodore's children's cartridge games. The five Scott Adams adventures are also available.

Commodore also introduced the BX256 16-bit multiprocessor professional microcomputer, featuring 256K user memory (RAM), the BX256 is an enhanced version of Commodore's B series microcomputer and has two processors, including a 16-bit 8088 for CP/M-86. It also has an 80-column screen and built-in dual disk drives. It is expandable to a maximum of 256K RAM internally with 640K externally, and can accommodate an optional Z80 processor board. $2995.

Commodore also has the B128 microcomputer which features 128K user memory (RAM), an attached 80-column screen and built-in dual drive. B series computers are expandable to a maximum of 256K RAM internally with potential for 640K

externally, and accommodate an optional Z80 processor board to provide CP/M compatibility. $1695.

The P128 microcomputer is the third generation of the PET series. The P128, which connects directly to a television set monitor via built-in RF modulator, features 128K RAM, 40 columns by 25 lines display, and 16 colors for either text or graphics. The P128 also features a high resolution graphic display of 320 by 200 pixels. Storage in the P128 is expandable

to a maximum of 256K RAM internally and 640K externally. This third-generation machine also becomes a multi-processor system via a Commodore-designed Z80 processor board that offers CP/M compatibility. $995.

A "Family" of "Easy" spreadsheet programs has also been introduced by Commodore. The four new programs, EasyCalc, EasyPlot, Easy Tools, and EasyScan, run on SuperPet and Commodore 64 micros. EasyCalc is $149.95 for the SuperPet and $99.95 for the Commodore 64. EasyPlot for the SuperPet is $149.95 and $99.95 for the Commodore 64. Commodore dealers have EasyTools for the SuperPet for $124.95 and for the Commodore 64 for $79.955. EasyScan is $124.95 for the SuperPet and $79.95 for the Commodore 64.

Commodore Business Machines, Inc., Computer Systems Division, The Meadows, 487 Devon Park Dr., Wayne, PA 19087. (215) 687-9750.

CIRCLE 347 ON READER SERVICE CARD

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CIRCLE 239 ON READER SERVICE CARD

Lobo Personal Computer

Lobo Drives International introduced the MAX-80 personal computer.

The streamlined keyboard unit houses the 5 MHz Z80, 64K RAM, two RS-232C serial ports, a built-in Centronics-type parallel port, a buffered bus expansion connector, and built-in controllers for all standard floppy disk drives as well as a hard disk interface.

The MAX-80 supports two business-oriented operating systems—the TRSDOS-compatible LDOS and CP/M.

Standard 80 x 24, 64 x 16 and 16 x 32 video display modes are all software selectable, and both text and graphics characters are generated in user-accessible RAM. The 76-key keyboard with a numeric pad and four function keys also houses a real-time clock with self-charging backup battery. The complete MAX-80 keyboard unit is priced at $800 and the high-resolution, green screen monitor is priced at $150.

Lobo Drives International, 358 S. Fairview Ave., Goleta, CA 93117. (805) 683-1576.

CIRCLE348 ON READER SERVICE CARD

Altos Network Systems

Altos Computer Systems announced a family of 16-bit microcomputers that are compatible with a variety of operating systems and business application software programs.

Based on the Intel 8086 microprocessor, the ACS8600 systems allow up to eight users to share up to a million bytes of main (RAM) memory, plus on line floppy Winchester hard disk storage of from 1 to 80 megabytes. They feature error detection and correction and a memory management system.

The basic system, with 512K RAM, 20Mb hard disk, and floppy disk backup, lists for $12,500. The 40Mb system is also available with up to 80Mb possible using an upgrade kit. Mag tape cartridge (17Mb) backup is available too.

The family supports the Xenix operating system—Bell Lab's Unix, version 7 adapted by Microsoft—as well as CP/M-86, MP/M-86 and Oasis-6.

Languages supporting end user applications are Microsoft versions of Basic, Cobol, Pascal, and Fortran, as well as Cis-Cobol, RM-Cobol, Pascal/M-86 and C-Basic-86.

In addition to eight terminals and peripherals, the system allows expansion through a Multibus port and accepts both synchronous (bisync) and asynchronous (async) communications protocols. It can handle network data rates of up to 800 kilobaud for high speed networking.

A dual drive floppy disk controller contains one megabyte of storage on two single sided, double density disks. Eight-inch Winchester disks are available in 10Mb, and 40Mb capacities. Floppy disks for backup accept 500K on a single disk, and mag tape systems are available with higher capacities.

Altos also announced Ethernet computer networking capability for its 16-bit microcomputers, and an economical Altos-to-Altos high speed networking scheme called Altos-Net.

The networks implement Altos-Net/Unet networking software, running under the Xenix version of the Unix operating system. Because the two networking schemes—inter-Altos and Ethernet—share the same software, upgrading is possible.

Ethernet will permit the networking of up to 100 Altos 16-bit computers, with up to eight users per CPU. As an alternative, inter-Altos networking can be accomplished with Altos-Net/Unet software utilizing twisted pair cabling with high speed transmission speeds.

Three functional layers make up an Ethernet network: The network medium itself—consisting of shielded coaxial cable, transceivers, interfaces, and terminators; users—who initiate actions and request services; and servers—such as printers and other shared peripherals. Altos computers can be directly (locally) connected to Ethernet through Altos' Ethernet interface as well as indirectly (remotely) connected via telephone lines.

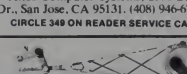
The Altos-Net/Unet software package uses the Internet Protocol (IP) and Transmission Control Protocol (TCP) to provide operating systems support for OEMs and software houses wishing to develop distributed applications.

At the applications level, the software provides file transfer capability, and electronic mail and terminal emulation protocols.

Altos' implementation of Ethernet costs $2,500 per CPU, which includes Altos-Net/Unet networking software and the Ethernet controller. Cabling and transceivers are extra.

Altos Computer Systems, 2360 Bering Dr., San Jose, CA 95131. (408) 946-6700.

CIRCLE 349 ON READER SERVICE CARD



Toshiba Personal Computer

The Toshiba T100 personal computer has a 64K RAM. It also uses a 32K ROM for Basic and a 16K RAM for video. The T100 can accept four double sided, double density, 5 1/4" floppy disks each holding 280 kilobytes. It features a 90-key detached keyboard and a choice of five I/O video screen options, including a flat-panel liquid crystal display showing eight lines of 40 characters each.

Three other products announced by Toshiba America, Inc. are the P1350 LetterPerfect printer, OCR-V100 page reader, and DF-2100 document filing system.

TAI's P1350 LetterPerfect printer operates at 100 characters per second in word processing applications and at 160 cps for data processing jobs. The printer provides graphics production capability and handles interchangeable character fonts. It also provides friction or tractor paper feed of up to five-part copy.

The OCR-V100 page reader is a data entry unit which reads at 250 cps and recognizes a variety of typewriter fonts separately or in combination.

Toshiba's DF-2100 document filing system features charge-coupled device (CCD) technology for input, a laser disk system for filing, and a laser print system for hardcopy output. The unit stores up to 10,000 pages of text on laser disks measuring 30 centimeters in diameter.

Toshiba America, Inc., 2441 Michelle Dr., Tustin, CA 92680. (714) 730-5000.

CIRCLE 350 ON READER SERVICE CARD

NEC PC-6000 System

NEC Home Electronics has introduced the PC-6000 computer system. It features a combination of educational and home entertainment capabilities. The basic PC-6000 system (microcomputer keyboard) attaches to a standard B&W or color television.

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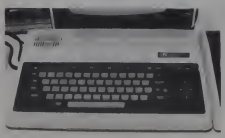
CIRCLE 148 ON READER SERVICE CARD



Utilizing NEC's Z80 microprocessor, the system contains 16K RAM and 16K ROM that are both expandable to 32K. Also featured is a version of the Microsoft Basic, with enhanced graphics and sound capabilities utilizing joysticks.

Additional peripheral equipment includes an RS-232 interface, minifloppy disk drive, data recorder for cassette-type programming, 40-character thermal printer, RAM and ROM cartridge to expand memory to 32K, and mask ROM. A 23" monochromatic monitor are also available.

Included among the entertainment software for the PC-6000 system are *Music Editor, Tennis, Othello, 3-D-Maze, High Jump,* and *Graph Generator.*

NEC Home Electronics (U.S.A.) Inc., 1401 Estes Ave., Elk Grove Village, IL 60007. (312) 228-5900.

CIRCLE 351 ON READER SERVICE CARD

SONY Business System

Sony Corporation of America announced a desktop microcomputer for business applications, the SMC-70, which is marketed through Sony's Communications Products Company.

There is a full range of peripheral devices and accessories available with the system, including an optional 16-bit adaptor unit that upgrades the SMC-70 from a Z80A system to an 8086 system. The basic unit offers 64K program/data memory, an additional 38K graphics memory and a separate 32K system memory. Also, 13 resident I/O interfaces are standard. The systems storage options begin with the 3.5" Sony micro floppy disk drives. Also available is a high density floppy disk, a 6 Mb hard disk system and a 256K cache memory device. The basic unit contains four different levels of graphics and costs $1,475.

Sony Corporation of America, 9 West 57th St., New York, NY 10019. (212) 371-5800.

CIRCLE 352 ON READER SERVICE CARD

Unix on CompuThink Hawk

CompuThink has designed the Hawk 32 as a 16/32-bit processor with a multi-user, multitasking system. The Hawk 32 is built around the MC68000 microprocessor which communicates externally with 16-bit capacity, but carries on internal communication at the 32-bit level. The Hawk 32 has a resident memory of 128 kilobytes which can be increased to one megabyte.

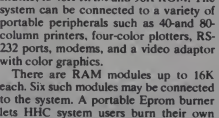
For simultaneous multi-user, multi-tasking applications, the Hawk 32 uses the Unix version 7 operating system developed by Bell Labs. The Hawk 32 Language library consists of 68000 Assembler, C, Pascal, Basic, Fortran 77 and ANSI 74 Cobol.

CompuThink, 965 West Maude Ave., Sunnyvale, CA 94086. (408) 245-4033.

CIRCLE 353 ON READER SERVICE CARD

Friends Amis (Panasonic) Hand-held Computer

Friends Amis, Inc. and the Matsushita Corporation have jointly created a hand-held computer based on the 6502 microprocessor with a 16K operating system in ROM. It is powered by rechargeable batteries.



The computer is expandable, when combined with the Friend Amis Datashuttle, to 40K RAM and 96K ROM. The system can be connected to a variety of portable peripherals such as 40-and 80-column printers, four-color plotters, RS-232 ports, modems, and a video adaptor with color graphics.

There are RAM modules up to 16K each. Six such modules may be connected to the system. A portable Eprom burner lets HHC system users burn their own Eproms using SnapBasic, SnapForth, and other Friends Amis languages. Up to five 16K ROM capsules may be inserted simultaneously in the expanded system.

Friends Amis, Inc., 505 Beach St., San Francisco, CA 94133. (415) 928-2800.

CIRCLE 354 ON READER SERVICE CARD

CP/M Upgrade for DEC VT100

C. Itoh Electronics, Inc. introduced its own version of Digital Equipment Corporation's VT-18X upgrade kit, the CIT-188.

The CIT-188 allows both CIT-101 and DEC VT100 terminals to be upgraded to a 64K CP/M compatible, Z80 based personal computer.

The CIT-188 kit consists of a 64K Z80A based CPU board, a dual DS/DD 5 1/4" floppy disk package, and all necessary hardware, cables and installation instructions.

An optional add-on floppy disk package containing two additional 5 1/4" disk drives is available for $1925. Also offered is an optional dual-processor CPU board, including Z80A and Intel 8088 microprocessors and 128K of RAM.

Distributor: Arco Corporation, 2515 McCabe Way, Irvine, CA 92714. (714) 557-5118.

CIRCLE 355 ON READER SERVICE CARD

8086 MPU for Olivetti M20

Tecmar Inc. has announced an 8086 Alternate Processor for the Olivetti M20 Personal Computer. The APB 1086 board further expands the M20 by adding an 8086 microprocessor with CP/M-86 or MS-DOS to the M20's standard Z8001 processor and Olivetti PCOS operating system.

The M20 basic unit features a Zilog Z8001, 128K memory, one double density, double sided minifloppy, a 16-bit data bus and a 12" monochrome monitor. Also included as standard are five expansion slots, an RS-232C serial interface and a parallel printer interface. $2695.

Tecmar, Inc., 23600 Mercantile Rd., Cleveland, OH 44122. (216) 464-7410.

CIRCLE 356 ON READER SERVICE CARD

Psssstt...

(Jingle Bells, Jingle Bells, Jingle All The...)

We're really not rushing the season. We wouldn't even mention it if we didn't think you'd want to know.

The **Strictly Soft Ware** Holiday Catalogs (Apple & IBM) are going to be ready early this fall. More software than ever. Same great prices. And with a customer service and technical support program that's so good that...well, let's just say someone at the North Pole is on our mailing list.

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CIRCLE 283 ON READER SERVICE CARD

PRINTERS

IDS MicroPrism Printer

The MicroPrism Printer from Integral Data Systems offers dot matrix print quality approaching that of daisy-wheel printers.

The draft mode operates at 110 cps, while correspondence quality throughout is 75 cps. High-density graphics are available in 84 x 84 dot per inch format, and all modes print in a single pass. The MicroPrism makes use of a nine-wire staggered design printhead, capable of printing nearly fully-formed characters.

Integral Data Systems, Milford, NH 03055. (603) 673-9100.

CIRCLE 357 ON READER SERVICE CARD

Daisy Wheel/Dot Matrix Unit

Metaframe announced the Dotsy Printer Center which offers both 150 cps dot matrix and 20 cps daisy wheel printing. The dot matrix mode has a bi-directional 9 x 7 dot matrix with true descenders, and the daisy wheel mode has a bi-directional daisy wheel print element.

The print format for the dot matrix mode is 132 columns and for the daisy wheel mode is 132 columns at 10 pitch.

The dot matrix mode has a print speed of 150 cps and features 96 ASCII characters with upper and lower case. The daisy wheel mode has an interchangeable daisy wheel print element with over 60 type styles. Available interfaces include IBM, Apple II and III, Commodore PET, and TRS-80 I, II, and III. $1450.

Metaframe Computer Corporation, Riverside St., Nashua, NH 06301. (603) 880-3005.

CIRCLE 358 ON READER SERVICE CARD

Versatile Daisy Printer

Daisywriter 2000 is an intelligent letter-quality daisy wheel printer, from Computers International. The printer features a 16K data buffer with an optional 48K buffer available. It also features a universal interface which makes it plug-compatible with all computer systems.

Daisywriter 2000 features: automatic proportional spacing, automatic centering, subscript, superscript, true automatic margin justification, 16 protocol selections, and automatic baud rate selections.

There are 12 different type fonts available in five different languages. The printer uses standard cartridge film ribbon such as used on IBM Selectric II and III. Controls allow for selection of 10, 12, or 15 characters per inch and 1, 1-1/2, or 2 line spacing. Baud rates are DIP-switch-selectable or automatic from 50 to 19,200.

Computers International, 3540 Wilshire Blvd., Los Angeles, CA 90010. (213) 386-3111.

CIRCLE 359 ON READER SERVICE CARD

GE Heavy duty Printer

General Electric introduced the 200 Document Handler Printer, designed for high-speed, heavy duty business use. The printer has a throughput of 200 cps, but still meets ISO NR-60 acoustic noise standards. Four software or switch selectable fonts are available, as well as switch selectable six or eight lines per inch modes.

General Electric, Data Communications Products, Waynesboro, VA 22980. (703) 949-1000.

CIRCLE 360 ON READER SERVICE CARD

Two New Anadex Units

Anadex, Inc., introduced the DP-9620A printer, a member of the "Silent Scribe" line, which features acoustic noise levels below 55 dBa.

The DP-9620A is a stand-alone printer capable of alphanumerics and graphics. Alphanumeric printing speeds range from 200 cps at 10 cpi for a 7 x 9 dot matrix to 100 cps for a 13 x 9 dot matrix. The character repertoire includes the 96-character ASCII set with lower case descenders. $1025.

With multiple operational modes and speed ranges, the WP-6000 "Word Scribe" single pass printer provides letter quality, correspondence quality, draft quality, data processing and graphics printing for the office environment.

For word processing, letter quality printing of 10-pitch, 12-pitch, or proportional spacing can be produced at 150 to 180 cps. Speeds of 250 and 330 cps are obtained in a correspondence quality mode, with 10 and 12-pitch and proportional spacing. In both modes, character fonts include Serifa, Helvetica, and a complete scientific set. The price of the WP-6000 is $1825.

Anadex, Inc., 9825 De Sota Ave., Chatsworth, CA 91311. (213) 998-8010.

CIRCLE 361 ON READER SERVICE CARD

Two from Apple

The Apple Computer Accessory Products Division announced two printers, the Apple dot-matrix printer and the Apple letter quality printer, as part of the company's plan to provide dealers and customers with fully supported systems. Both printers use the features of the Apple II and the Apple III.

The Apple dot-matrix printer has high-resolution graphics output (7 x 9 dot matrix) and a bi-directional speed of 120 characters per second. The Apple letter-quality printer is a 40 cps daisy wheel printer with graphics capability. It prints bi-directionally on individual sheets or continuous forms. Multiple fonts are selected by changing daisy wheels.

Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95014. (408) 996-1010.

CIRCLE 362 ON READER SERVICE CARD

AARDVARK — THE ADVENTURE PLACE

ADVENTURES FOR OSI, TRS-80, TRS-80 COLOR, SINCLAIR, PET, VIC-20

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

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

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

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

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

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

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

CIRCLE WORLD by Bob Anderson — The Alien culture has built a huge world in the shape of e ring circling their sun. They left behind some strange creatures and e lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

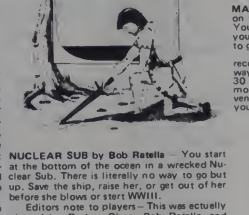
Editors note to players — In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is e very convoluted, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson — This one is for the kids. The house has ghosts, goblins, vampires and treasures — and problems designed for the 8 to 13 year old. This is e real adventure and does require some thinking and problem solving — but only for kids.

Authors note to players — This one was fun to write. The vocebulary and cherecters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logicel thought, mapping skills, and creetivity while keeping their interest.

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

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



NUCLEAR SUB by Bob Retelle — You start at the bottom of the ocean in a wrecked Nuclear Sub. There is literelly no way to go but up. Save the ship, raise her, or get out of her before she blows or stert WWIII.

Editors note to players — This was ectuelly plotted by Rodger Olsen, Bob Retelle, and someone you don't know — Three of the nastiest minds in adventure writing. It is devious, wicked, and kills you often. The TRS-80 Color version has nice sound and special effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen — A second kids adventure. You are trapped in a shopping center during an earthquake. There is a way out, but you need help. To save yourself, you heve to be a hero and save others first.

Authors note to players — This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays nicely. Instead of killing, you heve to save lives to win this one. The player must help others first if he/she is to survive — I like that.

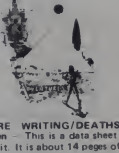
PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

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

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

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

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



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

PRICE AND AVAILABILITY:

All adventures are $14.95 on tape except Earthquake and Haunted House which are $9.95. Disk versions are available on OSI and TRS-80 Color for $2.00 edditionel.

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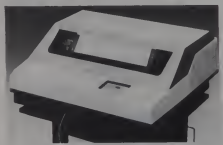
quality mode at 100 cps. Modes are software selectable. The print head is a 24 pin, overlapping design, capable of producing high quality dot matrix text, as well as graphics. The P1350 accepts friction, pin, or tractor feed paper, as well as offering an optional automatic sheet feeder. Paper may be 5" to 15" wide.

Toshiba America, Inc., Information Systems Division, 2441 Michelle Dr., Tustin, CA 92680. (714) 730-5000.

CIRCLE 368 ON READER SERVICE CARD

High-speed Compact Unit

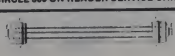
The C. Itoh Citizen 300 Line Printer, a desktop-size, variable speed dot matrix line printer designed for sophisticated printing capabilities in distributed data processing and minicomputer system applications, was introduced by C. Itoh Electronics, Inc.



It features print speeds of 72-300 lines per minute, and allows users to generate near letter quality correspondence, data processing reports and tables, and high resolution graphics for bar codes, OCR, labels, charts, forms generation and multi-part formsets. The 300 Line Printer includes dual microprocessors with RAM and ROM for character selection and generation, three boards and a two-digit alphanumeric fault identification display. The C. Itoh Citizen 300 printer is priced under $5000.

C. Itoh Electronics, Inc., 5301 Beethoven St., Los Angeles, CA 90066. (213) 306-6700.

CIRCLE 369 ON READER SERVICE CARD



DISPLAYS

8 1/2 x 11 Page Display

Micro Display Systems announced The Genius full page display terminal for mini and microcomputers. The Genius displays 57 lines (73 optional) of 80 characters, or a full 8 1/2" x 11" page. Each character is composed of dots in a 7 x 12 format within a 9 x 14 field, giving outstanding resolution.

A raster video generator is located in an enclosure with the CRT and a separate power supply. An interface card plugs into an Apple II slot. The video generator has its own 8K memory so no load is presented to the Apple CPU for refresh.

WordStar software is available for The Genius. In addition, it can emulate other 80-column cards.

Also announced were three compatible interfaces for The Genius full page display CRT: the RS-232, S-100 and Apple III versions.

The Genius is compatible with SoftCard WordStar, and other CP/M based software programs. The 36 lb. display has an 87 MHz bandwidth and 8K high-speed buffer memory. An Apple II interface card is standard with The Genius, which costs $1795. RS-232, S-100 or Apple III interfaces may be selected at no additional charge.

Micro Display Systems, Inc., 1310 Vermillion St., P.O. Box 455, Hastings, MN 55033. (612) 437-2233.

CIRCLE 370 ON READER SERVICE CARD

Neat NEC Monitor

A 12" green phosphor monitor was announced by NEC Home Electronics. The JB-120M has 600-line resolution and display stability during power supply fluctuations. Input is via a standard RCA jack.

NEC Home Electronics (U.S.A.) Inc., 1401 Estes Ave., Elk Grove Village, IL 60007. (312) 228-5900.

CIRCLE 371 ON READER SERVICE CARD

Amdek RGB Monitors

Designed with RGB video input and using a commercial grade CRT, the portable 13" Color III professional monitor from Amdek Corporation provides high-plus resolution graphics display for Apple III and Apple II computers. The Amdek Color III Monitor features 26 x 300 line resolution and 80 x 24 character display capability.

To allow the Apple II and III to be used with an RGB monitor, Amdek has an interface called Digital Video Multiplexor. The Color III retails at $569.

The Digital Video Multiplexor (DVM) is an interface for Apple II personal computers that obtains high resolution color graphics and an 80 x 24 character display. The DVM is basically a four-channel multiplexor—three color channels (under software control) for low and high resolution images and a fourth channel which allows use of an 80-character video board. $199.

A low cost Digital Video Multiplexor for interfacing the Apple II computer to an RGB color monitor for high resolution graphics and 80 x 24 text display was also introduced by Amdek. The Combo-DVM is software color-channel programmable, permitting computer control of the RGB

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CIRCLE 255 ON READER SERVICE CARD

Orange Micro, Inc. 1982

inputs. Four computer-controlled, multiplexed video channels include: Apple II 40 character line text, Apple II low resolution color graphics, Apple II high resolution color graphics, 80 character line text from a vendor board such as the Videx Video term, or the Advance Logic's Smart term.

Amdek Corporation, 2420 E. Oakton St., Suite E, Arlington Heights, IL 60005. (312) 364-1180.

CIRCLE 372 ON READER SERVICE CARD

DISK DRIVES

Amdek 3" Microfloppy

A 3" Micro-Floppydisk dual disk drive, introduced by Amdek Corporation, offers 1 megabyte capacity and is plug compatible with standard 5" floppy disk drives. The drive has a built-in power supply and accomodates two 3" Micro-Floppydisk cartridges. The approximately 3" x 4" cartridge has a hinged cover to protect the disk.

The single-side recording capacity is 125K bytes or 250K bytes for both sides with double density (500K byte) capability. $899.

Amdek Corporation, Marketing Dept., 2420 E. Oakton St., Suite E, Arlington Heights, IL 60005. (312) 364-1180.

CIRCLE 373 ON READER SERVICE CARD

Lobo CP/M, IBM Drives

Lobo Drives International has a full line of disk drives which support CP/M on the NEC PC-8000 computer system. Lobo software enhancements support the standard NEC PC-8031A Mini-Disk Unit; Lobo 8", single or double sided, double density floppy systems; and Lobo 5 1/4" or 8" hard disk systems.

All of these drive types can be on line at once; the simple hardware set up and software start up procedures allow the user to designate the boot drive. When a Lobo dual drive 8" floppy system is in use, the Lobo floppy is able to write in either single or double density format, thus allowing compatibility with standard CP/M systems and package CP/M software.

Lobo also announced high capacity add-on 8" floppy disk systems for the IBM Personal Computer. The Lobo add-on system can be configured with the user's choice of two or four 8" drives, each of which may be single or double sided. With 630 kilobytes per side (double density format), a system of four double sided drives makes available over 5 megabytes of on-line storage. Connection to the computer is made via a Lobo interface board. A minimum system with two single sided drives is $1625. A maximum of four double-sided drives is $3774.

Lobo also offers a 60K compatible version of the CP/M support software for the Apple II. These BIOS modifications are upward compatible with existing Lobo CP/M support and are usable with either the 56K or 60K versions of Microsoft CP/M. Both versions require a Microsoft SoftCard and 16K RAM card. Dual 8" floppy systems are available in single or double sided models and come with the LCA-22 controller interface which can be plugged into either slot 5 or 7. The Lobo software allows these floppy drives to read and write in double density format. Model 950A is $3663, Model 1850A is $4459, Model 5202CA is $2025, and Model 8202CA is $1625.

The Pack allows eight personal computers to share a single Winchester disk. The Pack is a compact hardware multiplexor which attaches to any Lobo Winchester disk unit, and contains interfaces for up to eight computers (any combination of Radio Shack TRS-80 Model I or III, and/or Lobo's new Max-80).

Lobo Drives International, 358 S. Fairview Ave., Goleta, CA 93117. (805) 683-1576.

CIRCLE 374 ON READER SERVICE CARD

Axlon Atari Add-ons

The Axlon RAMdisk 320K Memory System, developed by Axlon Inc., is for the Apple II. Offering 320K bytes of RAM memory, the system functions like two 35-track floppy disk drives. It is compatible with Apple DOS 3.3 and Apple Pascal 1.1, and the CP/M and Flex operating systems.

The Axlon RAMdisk 320K Memory System includes software for diagnostics, fast load and copy routines, and business applications. The system draws no power from the Apple, has memory refresh when the Apple is off, and has a built-in rechargeable battery (good for 3 hours).

Axlon also announced the Atari 800 users' modification called the RAMcram 32K Memory Module. The RAMcram can be used with Axlon's RAMdisk 128K

Memory System. Together, RAMcram and RAMdisk provide a total of 160K RAM memory while leaving the third RAM slot open for future expansion.

When the RAMdisk is used as an additional disk device in conjunction with the Atari 810 disk drive, it is compatible with software using Atari DOS 2.OS. The RAMdisk 128K Memory System includes the 128K RAMdisk module, operating manual, Memory Management Software and utility software.

Axlon Inc., 170 N. Wolfe Rd., Sunnyvale, CA 94086. (408) 730-0216.

CIRCLE 375 ON READER SERVICE CARD

SONY 3.5" Microfloppy

Sony Corporation was showing their 3.5 micro floppy disk system. Sony's micro floppy disk is 3.5" in diameter and can record 437.5K bytes of information (unformatted) on one side, a density much higher than existing systems. The disks are housed in rigid plastic cases which provide good protection from dust and dirt.

Sony Corporation of America, Corporate Communications Department, 9 West 57th St., New York, NY 10019. (212) 371-5800.

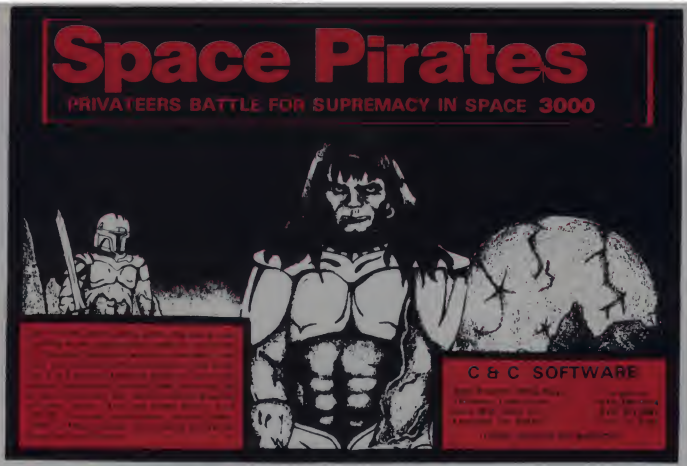
CIRCLE 376 ON READER SERVICE CARD

Trak Expandable Drives

MEC (Modular, Expandable, Compact) is a new approach to packaged disk drive systems for desktop computers developed by Trak Microcomputer Corporation.

MEC floppy master modules include a single trimline Trak drive, built-in diskette storage compartment and a fan-cooled dual drive power supply. Trak's floppy MEC systems are compatible with standard Trak 5 1/2" and 8" drives for Apple, IBM, TRS-80, Heath/Zenith, S-100 and other micros and minis.

Trak also has a line of 5 1/4" Winchester based MEC systems with a total of 14 models offered including master modules with single hard disks, intelligent controllers and host computer adapters, hard disks or floppy disk back-ups, expansion hard disk or floppy disk modules and add-on modules without controllers and



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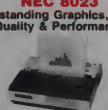

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adapters. Trak MEC hard disk systems are available for the Apple II, IBM, TRS-80, NEC, Heath/Zenith, S-100 bus, LSI-11 and other minis and micros. Representative prices are $429 for a MEC 5 1/4" 40-track single sided drive and $325 for an additional drive. An 8" 77-track double sided drive system sells for $1189; a two-drive system for $2129.

Trak Microcomputer Corporation, 1511 Ogden Ave., Downers Grove, IL 60515. (312) 968-1716.

CIRCLE 377 ON READER SERVICE CARD

IBM Shared Winchester

Tecmar Incorporated announced shared Winchester capability for the IBM Personal Computer. This Shared Disk Facility allows up to four IBM Personal Computers to share a single PC-Mate Winchester disk. It features a 5 or 10 megabyte shared disk, two to four IBM Personal Computers sharing one disk, CP/M-86 and PC-DOS support, and file level lockout. It comes with backup and copy utilities. The suggested retail price for a 5 megabyte shared Winchester $2995, the 10 megabyte version is $3995.

Tecmar, Inc., 23600 Mercantile Rd., Cleveland, OH 44122. (216) 464-7410.

CIRCLE 378 ON READER SERVICE CARD

3.9" Winchester Cartridge

SyQuest Technology has announced the SQ306, a 3.9" removable cartridge Winchester disk drive which provides 6.38 megabytes of mass storage.

The SyQuest SQ306 is compatible with the Seagate Technology ST506/406 5.25" fixed disk Winchester drive. With identical storage capacities (6.38 megabytes unformatted/5 megabytes formatted), performance and data transfer specifications, track and sector formats, and control interfaces, the SyQuest SQ306 can utilize the controller interfaces designed

for ST506/406, such as the DTC 510A, XEBEX 1410 and Western Digital WD 1000, 400. The digital closed-loop embedded servo control design, DigiLok, extends the SQ306 metal band positioner to 100 micro inches.

SyQuest Technology, 44160 Warm Springs Blvd., Fremont, CA 94538. (415) 490-7511.

CIRCLE 379 ON READER SERVICE CARD

UP Winchester Drive

United Peripherals announced the UP-9705 hard disk system. The UP-9705 has 5 megabytes of data storage, which is the equivalent of four double sided, double density 8" floppy disk drives. The UP-9705 contains a single 5 1/4" Winchester drive, a power supply, and a Xebec S1410 single-board controller that features an SASI interface, error detection and correction, multi-sector transfers, and data buffer. It is directly compatible with Apple, IBM and other small computers.

United Peripherals, 432 Lakeside Dr., Sunnyvale, CA 94086. (408) 730-4440.

CIRCLE 380 ON READER SERVICE CARD

MISC. HARDWARE

Datalink Terminal

Axlon Incorporated released Datalink Series 1000, a portable Communication Terminal for multiple markets. It can be used to transmit and retrieve information from databases.

The Datalink has rechargeable batteries and built-in direct connect modem. It measures 1 5/8" x 3 9/16" x 6 3/4". Character speeds of 110 and 300 baud are available through a keyboard selection.

Datalink can use output devices such as RS-232 serial printers and personal computer systems with communications modems. Optional output devices for the Datalink include a 40 character-per-line printer, and a television video display interface. $400.

Axlon Inc., 170 N. Wolfe Rd., Sunnyvale, CA 94086. (408) 730-0216.

CIRCLE 381 ON READER SERVICE CARD

Printer Buffer for Apple

Practical Peripherals introduced Microbuffer, a device designed to allow microcomputers to continue processing while printing takes place. Microbuffer models have been designed to fit virtually all microcomputers and printers.

Text is spooled to the memory of Microbuffer , which in some models can be expanded from a minimum of 16K to 256K. The printer is then driven by Microbuffer, freeing the computer for other use.

Microbuffer is available for inboard installation in the Apple II, in parallel or serial versions. It is also available in models designed specifically for Epson printers, as well as "in-line" design to fit other micro/printer or micro/modem combinations.

Practical Peripherals, Inc., 31245 La Baya Dr., Westlake Village, CA 91362. (213) 991-8200.

CIRCLE 382 ON READER SERVICE CARD

Amdek 4-Color Plotter

The Model DXY four-color Plotter was introduced by Amdek Corporation. It has a 10" x 14" effective plotting range, and allows figures to be drawn using the Control Command or Basic Command. Its functions may be expanded by adding additional ROM.

Maximum plotting speed is 2.73" per second and step size is .003"/step. A Centronics interface is furnished. $949.

Amdek Corp., Marketing Dept., 2420 E. Oakton St., Suite E, Arlington Heights, IL 60005. (312) 364-1180.

CIRCLE 383 ON READER SERVICE CARD

SOFTWARE

Apple Software

Apple Computer, Inc. announced *Quick File III*, a filing system for managing small to medium size collections of information on the Apple III. Quick File III arranges records in alphabetical, numeric, date, or time order. The program requires an Apple III system with at least

HUNTINGTON COMPUTING

NEW ITEMS

#8800	Adam & Eve Paddles (Tech Designs)	$33.99
#3259	Apple Mechanic (Beagle Bros)	$34.99
#8660	Assembler Teacher (Compu. Works)	$30.19
#1017	Bandits (Sirius)	$39.69
#3109	Business Bookkeeping System (Dakin5)	$33.99
#1118	Cannonball Blitz (On Line)	$39.69
#1457	Firebug (Muse)	$33.19
#2963	First Class Mail (Continental)	$62.99
#745	Firmware Rom (Novation)	$34.99
#8077	Firmware Rom (Apple Cntrol)	$34.99
#1456	Frazzle (Muse)	$31.19
#2071	Global Program Line Editor (Synergy)	$33.99
#4403	Gold Rush (Sentient)	$39.69
#8002	Grafax Plus (Epyon)	$66.99
#1409	Graphics Combo Pkg (Subtogic)	$101.79
#1078	Jellyfish (Sirius)	$33.99
#1079	Kabul Spy (Sirius)	$39.69
#1148	Lattice (On Line)	$39.69
#701	The Manager (Omega)	$39.69
#1111	Minuteman 3 (On Line)	$33.99
#330.	P.F.S. Graph (Software)	$106.19
#7508	Personal Finance Master (Spectrum)	$62.99
#1018	Pursuit of Grail Spear (Strategic Sim.)	$39.99
#1164	Pie Writer Multi (Hayden)	$137.39
#1163	Pie Writer Standard (Hayden)	$137.39
#4871	The Programmer Advanced Operating)	$430.69
#214	Pseudo Disk Parvat (Saturn Sys.)	$33.99
#2183	Queen of Phobos (Phoenix)	$39.69
#8	Ark Ramboard (Saturn Systems)	$361.00
#1681	S.A.G.A. #1 Adventureland Adventure Simulation)	$33.39
#9981	Slide Show (E & H Video)	$42.39
#8708	Spell Rom (Intl Comm)	$33.69
#8700	Space Talent 3 Axis (MCS)	$335.69
#8311	Space Talent 4 Axis (MCS)	$466.19
#8640	Speed Read Plus (Optimized)	$90.09
#4651	Spell-Rom (Intl Normal Curve (CE Soft)	$33.39
#4658	Sword Thrust # 7 Hall Of Alchemist (CE)	$33.39
#2765	Vivaterm (Micro Lab)	$62.69

SPECIAL

With any order over $40.00 (COD's excluded) receive FREE a copy of the program Mail Ordering (on disk for Apple). This program will allow you to make up mail orders, with just a few keystrokes. Exclusively available from Huntington Computing. Ask for stock number 998

ADVENTURE INTERNATIONAL

#1664	Adventures # 1,2,3	$34.99
#1665	Adventures # 4,5,6	$34.99
#1666	Adventures # 7,8,9	$34.99
#1677	Adventures # 10,11,12	$32.99
#1668	Apple Spice	$30.09
#1671	Poker Tournament	$17.79
#1681	S.A.G.A. #1 Adventureland	$33.39
#1682	S.A.G.A. #2 Pirate Adventure	$33.39
#1678	Stone of Sevphus	$33.39

AVALON HILL

#2050	B-1 Nuclear Bomber (Cassette)	$12.99
#2057	Computer Acquire (Cassette)	$16.99
#2061	Computer Stocks & Bonds	$13.59
#2056	Conflict 2500 (Cassette)	$13.60
#2060	Empire of the Overmind (Cassette)	$20.49
#2059	Empire of the Overmind	$34.99
#2055	Lords of Karma (Cassette)	$13.59
#2058	Major League Baseball	$33.99
#2051	Midway Campaign (Cassette)	$13.59
#2052	North Atlantic Convoy (Cassette)	$13.60
#2053	Nuke War (Cassette)	$13.59
#2054	Planet Miners (Cassette)	$20.39
#2062	Tanktics (Cassette)	$20.39
#2061	Tanktics	$34.99

AVANT-GARDE

#7003	Chambers of Xenobia	$33.09
#7000	Creative Tool Box	$33.39
#7005	Five Great Games	$33.39
#7004	Five Mini Great Games	$33.39
#7008	Race for Midnight	$33.39
#7006	Sentence Diagramming	$31.19
#7010	Sounds & Scribbling	$33.99
#7011	Super Draw & Write	$18.79
#7009	Super Shape Draw	$16.89
#7015	Word Scrambler	$16.89
#7016	Zero Gravity Pinball	$33.39

Softlights

By Fred Huntington

It's an exciting time around the Huntington household this month. We're very proud to announce the birth of our seven-pound five-ounce baby boy, Dale, born on June 6, 1982 in Visalia, California. Baby and Mama are doing just great and Melody (our three-year-old) loves him and calls him "My baby."

The other big news is that I have resigned my position as school principal so that I may devote full time to Huntington Computing.

We're instituting lots of changes to improve efficiency and speed. Our goal is to get everything out of the door within twenty-four hours with no backorders.

To celebrate the excitement, we're offering the following specials: (Always an excuse to run a sale.)

#9010 **Wurst of Huntington**
List $19.99, **now $9.99**

#4403 **Gold Rush (Sentient)**
List $34.95, **now $25.69**

#1967 **Arcade Machine (Broderbund)**
List $44.95, **now $34.49**

#1970 **Chop Lifter (Broderbund)**
List $34.95, **now $25.49**

#4002 **Verbatim Datalife Disks**
(w/plastic box & hub rings)
List $45.00, **now $33.99**

#9140 **Great Grandma Huntington T-Shirt - $5.00**

GREAT GRANDMA SAYS

Great Grandma Huntington once told me about a computer the Russians invented that was so smart it defected to the West!

Great Grandma also said, "Please buy little Freddy's Wurst of Huntington, because he personally gets two dollars for every one he sells. And, it's good. Just read the review in October 1981 issue of Softalk.

Watch next month's Softlights for the winners of the Great Grandma Huntington contest. There were some fantastic entries.

BRODERBUND

#1960	Alien Typhoon	$31.19
#1963	Apple Panic	$33.39
#1967	Arcade Machine	$39.69
#1968	David's Midnight Magic	$30.69
#1952	Galactic Empire	$33.99
#1954	Galactic Revolution	$33.99
#1953	Galactic Trader	$33.99
#1951	Galaxy Wars	$33.99
#2000	Genetic Drift	$38.39
#1957	Golden Mountain	$16.89
#1950	Hyper Head-on	$31.99
#1962	Labyrinth	$38.39
#1961	Payroll	$338.69
#1968	Star Blazer	$37.09
#1956	Tank Command	$15.99
#1955	Tawala's Last Redoubt	$16.89
#1959	Track Attack	$36.89

MISCELLANEOUS

#8800	Adam & Eve Paddles (Tech Designs)	$33.99
#7890	Apple-cation II (KPS)	$33.89
#3000	Bookkeeper (Delta)	$76.39
#9700	Castles of Darkness (Logical)	$30.69
#3001	Checkwriter (Delta)	$25.99
#9640	Colorbord (Emerge)	$30.69
#9014	Computer Almanac (Huntington Computing)	$36.99
#5380	Crossword Magic	$39.99
#4401	Cyborg (Sentient)	$18.99
#9480	Deadline (Infocom)	$42.39
#9742	Electric Semicolon	$97.49
#9900	Financial Facts (Hanson)	$25.99
#9600	The Game Show	$36.39
#6870	Handwriting Analysis (Micro Lpp)	$16.89
#9840	Jabberlabs (Mind Toys)	$36.39
#9580	The Menu II (E & H Video)	$33.89
#9380	The Menu Generator	$33.89
#4400	OO-Topos (Sentient)	$37.99
#6240	Paddle Adapter (Southern California)	$30.09
#7650	Pornopoly (CCI)	$36.39
#7670	Property Management	$199.99
#3400	Raster Blaster (Budgeco)	$33.29
#9500	Recipe Handler (Soft Touch)	$33.89
#9841	Ricochet (Mind Toys)	$16.89
#6600	Rubi-L Cube (Software Alternatives)	$16.89
#9620	Shadow Hawk One (Horizon)	$43.09
#3380	Space War II (Cidasa)	$33.99
#4252	Star Blaster (Piccadilly)	$38.39
#9180	Starship Commander (Voyager)	$33.89
#4251	Suicide (Piccadilly)	$36.39
#9680	Taiman (Hal Labs)	$36.39
#4850	Time Lord (Ramwara)	$33.39
#9012	Understand Yourself (Huntington)	$34.99
#9740	Volcanoes (Earthware)	$42.89
#9741	Volcanoes Educational Version (Earthware)	$66.49
#9880	Zork I (Infocom)	$33.89
#9881	Zork II (Infocom)	$33.89

ON-LINE

#1120	Cranston Manor	$39.69
#1104	Crossfire	$36.39
#1126	The Dictionary	$87.89
#1125	M.M.S. II	$42.89
#1115	Marauder	$39.69
#1101	Mission Asteroid	$17.99
#1113	Missile Defense	$31.19
#1102	Space Quake	$33.99
#1149	Pegasus II	$38.39
#1117	Safehouse	$31.19
#1105	Screenwriter II	$99.99
#1121	Soft Porn Adventure	$33.99
#1122	Threshold	$33.09
#1114	Ultima II	$66.69
#1112	Ulysses	$39.69
#1100	The Wizard and the Princess	$38.09

SIRIUS

#1058	Autobahn	$33.39
#1077	Bandits	$39.69
#1073	Borg	$36.09
#1065	Cubits & Robbers	$39.69
#1033	Cyclod	$33.39
#1062	Epoch	$33.39
#1070	Joypint	$67.39
#1057	Odyssey	$39.69
#1066	Outpost	$36.39
#1057	Pursuit	$33.39
#1071	Snake Byte	$36.39
#1064	Snooper	$33.39
#1056	Space Eggs	$19.99
#1072	Twerps	$36.09

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Atari® is a registered trademark of Atari, Inc

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CIRCLE 176 ON READER SERVICE CARD

128K RAM, $100.

Apple II *Senior Analyst* and Apple II *Business Graphics* are business software for financial modeling and graphics. Both programs require a 48K Apple II or Apple II Plus with a language or memory card. Apple III *Business Graphics* requires a 128K Apple III. The suggested retail prices are $225 for *Senior Analyst*, and $175 for Apple II or Apple III *Business Graphics*.

Apple III Cobol, is a Cobol language capable of executing mainframe applications. Apple III Cobol features Animator, a screen-oriented, source-level debugger and Forms-2, a Cobol source code generator which creates data entry screens and generates Cobol source for use in a program. Apple III Cobol requires a 128K Apple III system, a video display device, and at least one external floppy or hard disk drive. Full use of the Animator requires 256K. $500.

Record Processing Services, designed for Apple III Pascal software developers, provides file management services for programs handling large quantities of data. The multi-key file access method allows files to be readily interchanged among programs built on *RPS*. *RPS* supports the Apple ProFile hard disk and any other SOS block device, allows a maximum file size of 16 megabytes, permits up to eight keys per file and multi-field keys, and permits multiple simultaneous file scans, optional concurrency control and file locking. It also features six access modes, eleven data types, and duplicate and/or null key values. $150.

SuperPilot is a versatile extension of Apple Pilot. Also announced were two support products in the Apple Pilot family, *Co-Pilot* and *SuperPilot Log*. *Co-Pilot* is a self-contained, self-paced interactive tutorial on two diskettes which teaches how to program in Apple Pilot. *SuperPilot Log* works with *SuperPilot* as an administrative record keeping program. *SuperPilot* requires an Apple II or Apple II Plus with 64K RAM, $200. *Co-Pilot* is $35, and *SuperPilot Log* is $50.

Apple Logo is an implementation of the Logo computer language for the Apple II. It requires an Apple II or Apple II Plus with 64K RAM. The software package, priced at $175, includes a program diskette, a backup diskette, a graphics manual, and a language reference manual.

Eight independently developed software programs for business, education, and the home were also offered by Apple Computer. *Comm-Pac* is a data communications program that enables an Apple II to communicate with other computers, timesharing systems, networks, newswires, and other subscription services. $85.

Paralax is a collection of graphics utilities which lets the user develop and manipulate high-resolution shapes for Applesoft Basic programs. $85.

Designer's Toolkit is a program for the Apple II that computerizes the drafting table to let the user generate graphics for mapping, architecture, and drafting. $225.

Magic Spells is a learning game that transforms the memorization of spelling lists into an adventure complete with castles, treasures, demons, and a sage wizard. $45.

Math Strategy and *Spelling Strategy* are two programs that teach youngsters how to use the mind's eye to sharpen math and spelling skills. It uses Neuro-Linguistic Programming. $45 each.

Moptown is a collection of logic games for children aged four and up. $50.

Speed Reader is a reading development course designed to increase reading speed while increasing comprehension. $70.

Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95014, (408) 996-1010.

CIRCLE 384 ON READER SERVICE CARD

Atari Software

Four new Atari Home Computer programs, a telecommunications kit and several computer programs were announced by Atari, Inc. Atari also announced a reduction in the suggested retail price of the Atari 400 to $349.

Atari *Speed Reading*, which combines computer programs and the Speedway reading course includes five cassettes and a manual, and is recommended for users 15 years old and up. $74.95.

Atari *Music Tutor I* teaches music fundamentals such as note reading, the C Major scale, and key signatures. Both programs are available in both cassette and diskette versions.

Juggles' House and *Juggles' Rainbow* teach pre-reading skills to children aged three to six at home or in a school environment. *Juggles' House* teaches the concepts of upper, lower, inside and outside, while *Juggles' Rainbow* teaches above, below, left and right. It's available in both cassette and diskette versions.

The *Communicator II* is a kit that allows the user to explore the wide range of information, education and entertainment available through computer services, and to communicate with other computers. The Atari 835 Direct Connect Modem (DCM), the TeleLink II cartridge, and a manual are included. $279.95.

The Atari 835 DCM connects the computer directly to a phone line without the need for an acoustic coupler, although it must be used with TeleLink II. The DCM is only available with the *Communicator II* kit. The TeleLink II cartridge is priced at $79.95.

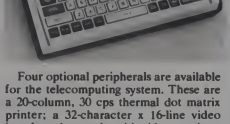
Other programs include *Asteroids*, *Computer Chess*, *Missile Command*, *Space Invaders* and *Super Breakout* for $34.95 each; *Star Raiders* for $44.95; and *Music Composer* for $39.95.

Atari Inc., 1265 Borregas Ave., P.O. Box 427, Sunnyvale, CA 94086, (408) 745-5227.

CIRCLE 385 ON READER SERVICE CARD

IXO Software & Peripherals

IXO, Inc. announced six applications for its telecomputing system—field sales, electronic mail and banking, public data base access, airline reservations and remote personal computing. The telecomputer is a hand-held system with the capability to remotely access and communicate with host computers via plain English prompts and responses. It consists of a full typewriter-style keyboard, LCD display, telephone modem and sophisticated security system, and plugs into any modular telephone jack.



Four optional peripherals are available for the telecomputing system. These are a 20-column, 30 cps thermal dot matrix printer; a 32-character x 16-line video interface that works with video monitors and television receivers; a serial/parallel printer interface to enable the telecomputing system to be used with most 80-column plus printers; and, for those instances where no modular phone jack is available, an acoustic interface. $300.

IXO, Inc. 6041 Bristol Parkway, Culver City, CA 90230. (213) 417-8080.

CIRCLE 386 ON READER SERVICE CARD

VIC-20 Software

Source Marketing, Inc. has announced eight software programs designed to run on the Commodore VIC-20 home computer. Programs are on cassette tape. Offerings include five games, a home and small business management program, one educational program and an entertainment program. Suggested retail price of cassettes is $19.95.

Source Marketing, 50 West Brokaw Rd., Suite 64, San Jose, CA 95110.

CIRCLE 387 ON READER SERVICE CARD

SEARCHING FOR RECORDS CAN BE A REAL HASSLE.

WITH DB MASTER™ IT'S EASY.

It always seems to happen at the wrong time. A file cabinet or two filled with records that are not *quite* in alphabetical order. In there somewhere is the right record, but there's just no way to find it without leafing through the whole mess. Sound familiar?

With DB MASTER finding the right record takes about *three seconds*. You just call up the name, say "Mark Piper," or invoice number "38965," and there it is in front of you. No worries. No misfiling. No anxiety. Think what it means for a business where you constantly need to check product inventories or customer billing status.

But what if you don't know the whole name or the exact number you're after? No problem. DB MASTER's "Search" method makes it simple to find what you're after. For example, you can call up all the "Pipers" and stop when you recognize the right one. And there's more. You don't even have to know the name at all. If all you really know is that it begins with a "P", for instance, you can use DB MASTER's "Wild Card" feature. It'll give you every name in your file that begins with "P". The same goes for a range of numbers. Punch in the range of digits you know, and you'll get a series to choose from. Try *that* with your filing-cabinet system.

We designed DB MASTER to make your life easier. Sure, there are other data base systems available for your Apple II. But, if you're not using DB MASTER you're simply not getting all you could from your data base manager.

Want more capability? DB MASTER provides it with the expanded-capacity Special Edition for Hard Disk to complement the popular floppy diskette version. *And* there are three powerful accessory programs. UTILITY PAK #1, for example, allows you to access other standard Apple files (including VisiCalc), and even change the way you've structured your files. UTILITY PAK #2 allows you to edit or change up to five "fields" in a single pass through your files. And STAT PAK performs statistical analyses on data in your DB MASTER files. Of course, there's considerably more capability in each of our accessory paks than we have room to talk about here. Ask your dealer for the full details.

Stoneware backs up DB MASTER with a support staff second to none. Just give us a call. We can help solve your problems. After all, that's what Stoneware and DB MASTER are all about.

STONEWARE INCORPORATED

50 Belvedere Street, San Rafael, CA 94901 (415) 454-6500

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CIRCLE 278 ON READER SERVICE CARD

VisiCalc Consolidation

Abacus Associates introduced *Viz.A.Con*, a consolidation system for the VisiCalc user. It automatically combines stored data files and prints copies of the results. *Viz.A.Con* runs on the Radio Shack TRS-80 Model III. $89.95.

Abacus Associates, Suite 240, 6565 West Loop South, Houston, TX 77401. (713) 666-8146.

CIRCLE 388 ON READER SERVICE CARD

Apple Plotting Packages

T & W Systems has expanded their product line to include the *Cadapple*, a version of the *T-Square Cad* software which runs on a standard Apple configuration. Hardware required includes a 48K Apple II with Apple Pascal 1.1, two standard 5 1/4" drives, the CCS asynchronous serial interface model 7710, monitor, joystick, or HiPad digitizer and the Houston Instruments DMP-7 plotter.

The program allows the designer to create, erase, change, store and retrieve drawings consisting of graphics and text. The *Cadapple* provides generation of arcs, circles, rectangles, ellipses, regular polygons, arbitrary curves and user defined shapes.

The *Cadapple* is available as a turnkey system, or the software and/or plotter can be purchased separately. The turnkey system including software and hardware with joystick is $9985. The turnkey system including software and hardware with HiPad is $10,775. The *Cadapple* software is $2495.

T & W Systems, Inc., 18437 Mt. Langley #B, Fountain Valley, CA 92708. (714) 963-3913.

CIRCLE 389 ON READER SERVICE CARD

Japan, Inc. goes Microsoft

Four Japanese manufacturers announced support of Microsoft's MS-DOS operating system, a 16-bit operating system developed by Microsoft for the IBM Personal Computer. Hitachi offers the MB-16001, a general purpose personal computer running Microsoft Graphics Basic. NEC offers the NEC 5200 which is designed as a high-end business machine. Panasonic supports MS-DOS on their JB-3000 microcomputer, a low-end machine with a color graphics capability. Panasonic also supports both Multiplan and Microsoft's Graphics Basic. Wang will also support MS-DOS.

Users of MS-DOS systems can run the applications programs available for the IBM Personal Computer as well as all Microsoft languages – MS-Basic interpreter and MS-Fortran, MS-Basic, MS-Pascal and MS-Cobol compilers – on their 16-bit microcomputers.

Microsoft Corporation, 10700 Northup Way, Bellevue, WA 98004. (206) 828-8080.

CIRCLE 390 ON READER SERVICE CARD

Accounting Packages

Three major manufacturers of personal microcomputer systems – Toshiba, Sony, and Xerox – will offer Structured Systems Group (SSG) accounting software (Version 2.0). The complete line of SSG accounting software (Version 2.0) – General Ledger, Accounts Receivable, Accounts Payable, Order Entry, Inventory, and Payroll – run on the Toshiba T-200250, the Xerox 820, and the Sony SMC 70 personal computer.

Structured Systems Group, 5204 Claremont, Oakland, CA 94618. (415) 547-1567.

CIRCLE 391 ON READER SERVICE CARD

Robot Programmer

Savvy is an information handling system for microcomputers. It has a natural programming language, its own operating system automatic database management, and applications programs.

Savvy learns your own language and translates it into a simple language. The Robot Programmmer has been trained to write programs needed to input, output, add, change, and delete database information. *Savvy* comes as a combination of hardware and software – a co-processor with firmware, and additional software on a disk. It will boot and run on all Apple DOS versions and Z80 versions of CP/M.

Excalibur of America, 1176 Franklin Rd., S.E., Marietta, GA 30067. (404) 953-6870.

CIRCLE 392 ON READER SERVICE CARD

NEC Software

NEC Home Electronics USA introduced an orientation to the basics of computer operating and programming. Called *Creative Programming*, the beginning software program and guidebook is designed to help early users learn microcomputer operation in four short lessons. The lessons cover computer language introductions and the significance of the basic functions, how to write a program, and how to load a program. The course is for use on the PC-8000 Series Microcomputer System. The first *Creative Programming* manual retails for $12.95. The remaining five volumes retail for $9.95 each.

The *Basic Language Learning Guide* program concentrates on the features, commands and functions of Microsoft N-Basic. Included are discussions of The Concept of a Variable, Math and the Computer, Format Notation, and Elementary Statements. In addition, there are six appendices devoted to special keys and control characters, reserved words, ASCII Character set, error messages, disk files and N-Basic statements. It is best suited for use with the NEC PC-8000. $19.95.

NEC also has a color word processing system with a self-teaching program and 12,000 word dictionary for the PC-8000.

NEC also has a *Job Costing* system which allows users to keep easier and more accurate track of internal costs by category. The Job Cost System is marketed with the PC-8000, and can interface with the NEC General Accounting System and Payroll System programs. It features a Skeleton General Ledger, Work Codes/Cost Centers, Estimates, Labor/Nonlabor Journals, Income and Expense Statement, and Job Status Report.

The *General Accounting System* for the PC-8000 can be operated by people without prior computer experience. Each Accounts Receivable diskette allows for 500 or more entries. Additional features include an 80-column data entry screen, multiple bank account capability, and capacity for eight separate payroll accounts with payroll summaries by month, quarter and year-to-date. The General Accounting System retails for $395.

Report Manager is a CP/M based program that creates and updates a variety of reports for financial, accounting, engineering and scientific applications. It features editing commands, multiple report pages, the ability to copy portions of rows, columns, or pages; and the ability to reform calculations on calendar and time entries.

Money Decisions provides a collection of business and financial problem-solving tools. Programs on the disk include 34 of the most frequently used business and financial problem-solvers. Among the financial tools included are Future Value of an Investment, Net Present Value, Internal Rate of Return, Term of a Loan, Regular Payment on a Loan, Mortgage Amortization Table, Lease/Purchase Analysis, Depreciation Rate, Tax Depreciation Schedule, Optimal Production Quantity and Breakeven Analysis.

The *Term II* program connects the PC-8000 to the world of telecommunications. Users may talk via their computer screens, transmit files to or receive files from a general purpose time sharing host system such as CompuServe or The Source.

File-Fax is a database and information management system for the PC-8000. It

assures user flexibility and eliminates any requirement for following a certain pattern or structure.

NEC Home Electronics (U.S.A.) Inc., 1401 Estes Ave., Elk Grove Village, IL 60007. (312) 228-5900.

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Fortune Business Software

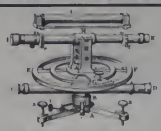
Fortune Systems Corporation introduced for its desktop computer a package of business accounting software that has been transported to the Fortune 32:16, the company's Motorola MC68000-based microcomputer. The menu-driven accounting system consists of seven modules: order processing, accounts receivable, purchase orders, accounts payable, payroll, fixed assets and general ledger. The business system also features file protection, a password security system and user-selected formatting and report generation capabilities. The Fortune 32:16 supports Cobol, Fortran, Pascal and C as well as Basic. The system is based on the Motorola MC68000 32/16-bit chip and uses the Unix operating system. The 32:16 also has Ethernet communications capability. Price is $4,995.

Fortune Systems has signed a license agreement with the IMJ Software Center that provides the Fingraph graphic management information system. This package is used to provide graphic displays of sales management, accounts receivable, income statements and balance sheets. More than 100 standard information charts can be produced directly from the computerized data sheets.

Fortune Systems Corporation has entered into a licensing agreement with Microsoft Corporation to enhancee the Unix operating system. The agreement calls for a technical exchange and makes Fortune Systems the master distributor for the finished product. Microsoft will initially supply Microsoft-developed system enhancements that Fortune Systems can add to its version of Unix. The company will also provide ongoing support and maintenance to Fortune Systems for the operating system.

Fortune Systems Corporation, San Carlos, CA (213) 557-1331.

CIRCLE 394 ON READER SERVICE CARD



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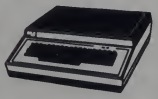

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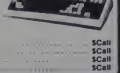

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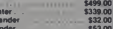

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CIRCLE 140 ON READER SERVICE CARD

The Handicapple

A Low Cost Braille Printer

Barry McConnell

One of the most valuable features of the home computer is its versatility. Home computers have found a place in the laboratory, the classroom, and in the office. Most recently, they have found a place with the handicapped.

The low cost and easy adaptability of the home computer makes it an ideal tool for serving the needs of the handicapped, both on the job and in the home.

At Florida State University, handicapped students are competing with non-handicapped students on an equal basis and are finding new career opportunities through the use of home computers. This article outlines one of several ways in which microcomputers have been adapted to the needs of the handicapped.

One of the first things anyone working with a computer needs is a printed copy of his work. A multitude of printers can be found in the marketplace, but what of the blind individual? How does he read what comes out of the computer? There are very few braille terminals on the market and they tend to be prohibitively expensive for the average person. Additionally, braille terminals, since their design is similar to that of a line printer, are not well suited to word processing or other forms of formatted output. A low cost alternative is available.

Often promoted as the "poor man's printer," the Dynatyper by Rochester Data, Inc. provides the key to low cost braille. The Dynatyper is a solenoid driven array of plastic plungers which sits above the keyboard of a standard typewriter. When coupled with an IBM Braillewriter and a home computer, it gives blind people access to hard-copy braille at an affordable price.

Barry McConnell, P.O. Box 2676, Tallahassee, FL 32304.

Our emphasis at FSU has been on the use of off-the-shelf components to keep costs down and application simple. This configuration fits well in both the home and in the workplace at a minimal price.

Our system consists of an Apple II, a Dynatyper, and a Braillewriter (see Figure 1). Set-up of the system is reasonably

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simple and well described in the Dynatyper manual, which is fairly straightforward though not always easy reading. The only alterations required to the standard configuration consist of a modification of the braille typewriter and a change in the driving software for the Dynatyper.

The Braillewriter is an IBM office typewriter which is converted to type in braille, and has a keyboard consisting of the standard letters, numbers, and punctuation found on an ordinary typewriter.

The shifted keys provide the Grade II contractions used as a form of Braille shorthand. The paper is embossed from the front by raised dots on the typeface and rolls backwards so that the finished paper comes out the rear of the machine.

The modification necessary to operate as a braille printer is a result of the Braillewriter being designed for the blind. The tension springs on the keys are deliberately stiff so as to provide a positive keystroke for a blind individual.

These springs must be stretched as the Dynatyper was designed to operate principally with electric typewriters. Initially, the keys were so stiff that the Dynatyper plungers literally bounced off the keys. The service representative from IBM was very helpful in diagnosing the problem and remedying it.

The modification to the Dynatyper software consisted of designing an alternate character set for braille. Anyone familiar with braille will tell you that it was definitely not designed by a mathematician, as the same dot pattern may mean two entirely different things, depending on the context. For example, the period and dollar sign have the same dot pattern, but a dollar sign is never found at the end of a sentence.

Because we were committed to low cost and easy implementation, we altered the braille character set rather than developing a context analyzing driving routine, which would have required many manhours in development and would have increased drastically the time necessary to print even the simplest document.

One of the first things anyone working with a computer needs is a printed copy of his work.

The availability of the Grade II contractions on the Braillewriter provided a source of extra dot patterns for redefining characters. By converting lower case letters to upper case and assigning a Grade II symbol to each of the special characters, e.g. comma, period, etc., a one-to-one correspondence between the computer keyboard and a braille character was obtained. Special care was taken in redefining characters to make the dot pattern resemble the actual shape of the character whenever possible (see Table 1), in order to facilitate learning of the new character set.

Implementation of the new character set was greatly enhanced by the manner in which the driving routine is loaded; it is loaded from DATA statements by a Basic program. The manual provided for the Dynatyper gives excellent instructions on modifying the existing character set by changing the DATA statements.

Listing 1 shows the line numbers and the data necessary to implement the new character set in Applesoft. Integer applications would modify the array D located in lines 4350 through 4460, using assignment statements rather than DATA statements. The TRS-80 version requires modification of lines 1190 through 1300, starting with the second DATA value (209) on line 1190.

In 18 months of operation, this system has proven to be remarkably durable. It has survived two changes of offices, more than fifty conferences and demonstrations, and a tremendous number of tinkering sessions, with the most serious problem being an occasional key jam. The system is operating at the maximum recommended speed for the Dynatyper with a manual typewriter; slowing the speed would eliminate even those rare key jams.

This system has been coupled with a Control Data Corporation mainframe as a remote terminal providing braille copy to computer science students, and with two different word processing programs for the Apple, *Professional Easywriter* and *Applewriter*, though the carriage width and the size of a braille character allow only 40 characters on a line. It has also proven to be an excellent tool for programming the Apple itself, providing program listings in braille for blind programmers.

Many other applications are possible, and if the spark and enthusiasm of the blind individuals who have worked with this system thus far is any indication, they will soon be demanded. As one blind student said, "Don't give me a handout, give me the tools and I'll build you a world!" □

Table 1.

Uppercase A - Z: Standard Braille

Digits 0 - 9 : Standard Braille lowered one dot position (e.g. 1 = dot 2 2 = dots 2,3 3 = dots 2,5)

Special Characters:			
	! = dots 4,5,6	, = dot 5
	" = dots 4,5	. = dot 6
	# = TH	/ = /
	$ = BLE	< = ING
	% = ED	> = SH
	& = THE	? = ER
	' = '	; = dots 5,6
	(= GH	+ = OU
	) = AR	@ = CH
	: = dots 4,6	[= OF
	* = OW	| = WITH
	- = COM	^ = dot 4
	(=) = AND	

Listing 1.

```
5360  DATA  236,251,240,157,238,
      246,160
5370  DATA  221,250,239,244,28,15
      4,187,159
5380  DATA  208,209,210,211,212,2
      13,214,215
5390  DATA  216,217,30,218,245,24
      9,237,241
5400  DATA  235,161,162,163,164,1
      65,166,167
5410  DATA  168,169,170,171,172,1
      73,174,175
5420  DATA  176,177,178,179,180,1
      81,182,183
5430  DATA  184,185,186,242,214,2
      47,224,218
5440  DATA  214,161,162,163,164,1
      65,166,167
5450  DATA  168,169,170,171,172,1
      73,174,175
5460  DATA  176,177,178,179,180,1
      81,182,183
5470  DATA  184,185,186,217,251,2
      88,187,0
```

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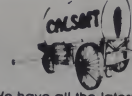

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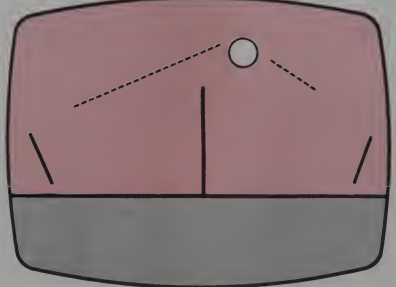

Who Really Invented the Video Game?

John Anderson

The Space Age had just been birthed. Sputnik was a new and somewhat ominous presence in the evening sky—my father tells me he carried me to the roof of our apartment building to see it. I don't remember. The year was 1958, and I was two years old.

Dave Ahl, my boss, was a high school student. He had won a scholarship, one benefit of which was a tour of Brookhaven National Laboratory in Upton, NY. Something he saw on an oscilloscope there remained fixed in his mind for many years, and caused, among other things, a recent pilgrimage of my own.

Nearly 25 years after the fact, I found myself on the Long Island Expressway. I was trying to pass an eighteen-wheeler spewing gravel off its trailer, while I looked for the Brookhaven exit. It occurred to me that the Lab was hardly a stone's throw from Shoreham Nuclear Power Station, that controversial patch of multibillion-dollar poured concrete. I wondered if the proximity was mere coincidence.

Brookhaven is a government installation, and I get nervous at checkpoints. The guard at the gate had a familiar kind of hypertensive bearing. I wished then I had shaved that morning. I proffered my press card with clammy claw. He told me to pull my car off to the side; I knew the jig was up. I was a spy, an agent, a saboteur, and it was all over.

He handed me a piece of paper and said those chilling words: "Have a nice day." Upon inspection, the paper seemed to be a visitor's map. My adrenalin level began to subside.

It's really very simple to get to the Department of Nuclear Energy. You make a right near the linear accelerator, and pull into the lot next to the alternating gradient synchotron. If you see the tandem Van de Graff, you've gone too far.

From there, only one flight of stairs separates you from one of the great, unsung heroes of our time, Willy Higinbotham.

There was Bell, there was Edison, there was Fermi. And then there was Higinbotham.

Willy was responsible for the display Dave saw on that fateful day in 1958. Willy, you see, invented the video game.

There was Bell, there was Edison, there was Fermi. And then there was Higinbotham.

We've received several manuscripts which attempt to set the record straight on the history of the video game. If you claim and can document a video game predating 1958, let us know.

Otherwise, give Willy Higinbotham his profound and historic due. Much to the chagrin of large corporations involved in current litigation, he did it first, and he has proved it.

Though he stands about five feet four inches tall, Mr. Higinbotham commands quite a stature. He very nearly chain-smokes unfiltered cigarettes, which he wolfs down with great voracity for a man of 72 years. His eyeglasses magnify to the point where his corneas seem as large as quarters. He laughs easily and likes to play the accordian, though he admits it's been a while since he's played at a party.

And, as a physicist in the Manhattan Project, he witnessed the detonation of the first atomic bomb.

Before we sat down to speak in earnest, Willy called an old friend, Dave Potter, and asked him to join us. Dave had worked with Willy on the original game designs. We adjourned to a conference room. As Willy got started, other scientists would wander into the room, find a perch, and listen along. "Isn't he something?" one of the scientists whispered as an aside. He sure is.

Back in the 1950's, when tours of the Laboratory were first instituted, they were rather static affairs, usually consisting of a group of photographs to depict some facet of research at the facility. Willy, who discovered his penchant for physics at Cornell and electronics at MIT, explained that he wanted to make his display more dynamic. Give it a little punch. Wouldn't it fill the bill, he thought, if we got some sort of little game going on a CRT, so visitors could have some "hands-on" interaction with the hardware? He and his associates fashioned a tennis game, played on the five-inch screen of an oscilloscope.

Digital computers were coming into their own in 1958; in fact, Willy's own

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A few miles up the road, Shoreham Nuclear Power Station.

This must be the place.

Instrumentation Division was building one at the time. However his game contraption made use of an analog computer, one that used variable voltages rather than on-off pulses to represent information. To this was hardwired a nonprogrammable assemblage of electromechanical relays, potentiometers, resistors, capacitors, and "op-amps," short for operational amplifiers.

Willy himself is the first to admit that the arrangement was rather inelegant. But he also points out that it worked. He did make use of some recently invented transistors as flip-flop switches—a harbinger of things to come. Willy simply did the job in the shortest time with whatever parts were handy. The result was a video game, something no computer, digital or analog, had been harnessed to do before.

The screen display was a side view of a tennis court. It looked like an upside-down "T," with a shortened stem. This was the "net." Each player held a prototypical paddle, a small box with a knob and button on it. The knob controlled the angle of the player's return, and the button chose the moment of the hit. A player could hit the ball at any time, providing it was on his side of the net. Gravity, windspeed, and bounce were all portrayed. For example, if you hit a ball into the net, it would bounce lower than a bounce off the "ground," and would eventually die.

The game was simple, but fun to play, and its charm was infectious. Potter remembers the popularity of the game: "The high schoolers liked it best. You couldn't pull them away from it." He's probably remembering young Dave Ahl, staring at the screen with a little voice inside him saying "this could be important."

The ball and court lines were drawn and redrawn sequentially, at a rate that made for a flicker-free view of ground, net, and ball. This is an approach still used in game playfield display. However the method of ball manipulation was and remains unique.

The game was simple, but fun to play, and its charm was infectious.

Without becoming too bogged down in explanation, consider the following. An oscilloscope is capable of generating cartesian coordinate displays. That is to say, a dynamic "graph" can be drawn, plotting the deflection of x or y proportionally to the voltages input as x or y.

Higinbotham rigged up a circuit wherein the plot of these functions simulated the trajectory of a bouncing ball. Op-amps from a Donner Labs analog computer were used to generate this trajectory and to sense when the ball had struck the ground. When this occurred, a relay would be thrown, reversing the polarity of another op-amp, so that the ball would reflect its path and "take a bounce." Primitive, but effective.

Other op-amps and relays were used to determine whether or not the ball had hit the net. As mentioned earlier, rebound velocity from the net was lower than from the ground, providing an extra bit of realism.

Velocity, slowed continually by windspeed, was simulated straightforwardly with a 10 meg. resistor.

A toggle switch allowed players to choose which side to serve from, and net height, as well as court length, were adjustable. There was no way a player could "miss" the ball, as a push of the paddle button would always result in a hit when the ball was on that player's side of the net. Unless the player chose the correct angle and timing for a return, however, the shot would not make it back to the opponent's side.

The implementation was very much more sophisticated than the first "Pong" games. It was the hit of the Brookhaven "visitors' days" for two years running. Eventually, however, it was dismantled.

I asked Willy why he hadn't patented the thing at the time. He is responsible for over 20 patents, each of which reverted to the U.S. Government.

Dave Potter (left) and Willy worked on the original design.

Willy describes the innards of his electronic tennis game. His rendering of the screen appears at right.

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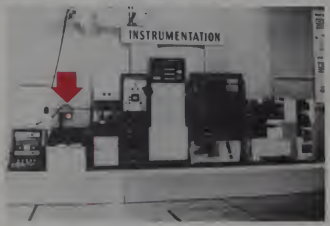


The oscilloscope on which the game appeared.

"We knew it was fun, and saw some potential in it at the time, but it wasn't something the government was interested in. It's a good thing, too. Today all video game designers would have to license their games from the federal government!" The idea somehow pleased Willy, and his laughter signalled it.

To Magnavox, however, the rights to video games are no laughing matter; they could mean millions. The corporation seeks a patent on video games using bouncing balls, and has taken sworn depositions from Higinbotham concerning his own invention. Though Willy stands to make no monetary gain whatsoever, he has a personal stake in the contest.

One must take a broader view of Willy's career to see the tennis game from the perspective that he himself does.

Higinbotham was a graduate student in Physics at Cornell University at the outbreak of World War II. He was invited to join research at the MIT Radiation Laboratory, where he worked on an advanced and important technique known as radio detecting and ranging, later shortened to RADAR.

From there he joined the Manhattan District Project, working as a physicist on another exotic and potentially important technology. He became head of the Electronics Division there in 1945. Higinbotham devised the timing circuits that took the first atomic bomb through the last few milliseconds preceding detonation.

"We knew it was fun, and saw some potential in it at the time, but it wasn't something the government was interested in."

He worked with and knew J. Robert Oppenheimer quite well. "He was a charismatic man," says Willy. "People tended either to worship or detest him. I did neither. He was brilliant, though. There's no doubt of that."

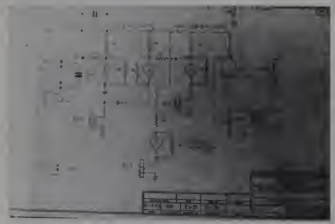
At the time of the blast at Los Alamos, Willy was 24 miles from ground zero, able to watch the entire detonation through welder's glass so thick, he couldn't see an illuminated headlight through it.

I asked him what it had been like. He grew quiet. He said that he and the other observers got into the trucks and made the long trip back to the compound in utter silence. No one had anything to say.

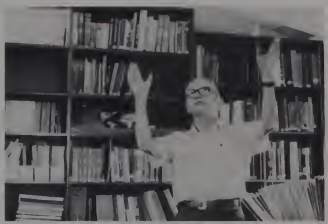
Willy spent the next two years as executive secretary of the Federation of American Scientists, in Washington, D.C. He acted as a liaison between Congress and scientists, lobbying for the nonproliferation of nuclear weapons.

"It's taken over thirty years," Willy observes, "but the message is finally beginning to get through." His face brightens. Today, as a senior scientist at Brookhaven Laboratory, he and his colleagues have amassed the largest and most comprehensive library in the world concerning nuclear safeguards.

I was warming up the car for the long trip home, staring across a field at the building housing the cyclotron. He's not only something, I thought to myself. He's a walking bit of history. He also invented the video game! □



Note the date of the blueprint: Oct. 1958. This date has been verified.



Willy describes the sight at Alamogordo in 1945.

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Add a Joystick to Your TRS-80!

Marc B. Stanis
and
David H. Ahl

Are your fingers as uncoordinated as mine when you try to play *Scarfman* or *Robot Attack*? Somehow, I just don't seem to be able to remember which fingers are controlling up and down movement and which are controlling right and left. And then remembering to fire with my thumb; by this time I'm all thumbs.

This article describes how to add a joystick to a TRS-80 Model I or III in an hour or so for the bargain price of around $15. The joystick is completely compatible with all software (Basic and machine language) that uses the four arrow keys to move and the space bar to shoot.

Since the joystick parallels the keyboard, it doesn't require a power supply. It need not be disconnected after use, nor does it contain any electronic parts. If, for some reason the joystick malfunctions, your computer isn't in danger. At worst, you might have to replace the joystick.

Before you begin construction, read through this entire procedure and be sure you understand it. You will need the parts listed in the table. You should also be aware that this installation will void the warranty on your computer and that it will have to be removed if the computer ever needs servicing by Radio Shack. Even if the modification has been removed the warranty is still void.

Atari joysticks which connect to the ribbon PC connector at the back of the TRS-80 are available from Big Five and Alpha. These do not void the warranty and work with many, but not all games. If you are leery about voiding your warranty we strongly recommend one of these products even though they are slightly less versatile than the one described in this article.

Marc B. Stanis, 14930 S. Springfield Ave., Midlothian, IL 60445.

Examine the Joystick

The first step is to remove the four Phillips head screws from the bottom of the Atari joystick case. Remove the stick mechanism. Be careful not to lose the small spring on the firing button. Examine the printed circuit board. The six connectors on the right side should have wires of the following colors connected to them:

Joystick Position	*Wire Location*	*Color*
Right	Top	Brown
Up	2	White
Common	3	Black
Down	4	Blue
Left	5	Green
Button	Bottom	Orange

If the wire colors do not correspond to this list, change the connectors so they do. Reassemble the joystick taking care that the firing button spring is back in place and that no wires are pinched—either between the edges of the case or between the edge of the case and the PC board.

Cut the DE-9 connector off the end of the Atari joystick cable. Starting from that end of the cable, *carefully* remove 10 to 12 inches of the outer plastic cable sheath with a sharp knife or electrical scissors. Take it slowly and be careful not to damage the six fine wires.

After removing the cable sheath, examine each of the six wires over its entire length to make sure it has not been damaged. If one or more have been damaged, you will have to replace them with fine (24 gauge) flexible wire or remove more of the cable sheath to get 10 to 12 inches of intact wire.

Next, strip off the insulation from the end 1/8" of each wire. Tin the ends of each wire, i.e., with a hot pencil soldering iron, apply a small amount of solder to the tip of each wire. This will make them easier to solder to the PC board in the next step. Apply heat and solder quickly so you do not melt any of the insulation. Inspect your work and set the joystick aside.

Into the Computer

Next you are going to open the computer. Be sure you are working in a static-free location, no rugs, cats, etc. Ground yourself out before starting work by grabbing a water pipe, grounded case of a three-wire power tool, etc.

Remove the screws from the bottom of your computer and remember which screw came from which hole. Label them if necessary. **(Note: Opening your computer voids the warranty.)** If you have a Model I, lift off the bottom of the case and set it aside. *Carefully* flop the PC board in the direction of the wire connector. This exposes the bottom of the printed circuit board of the keyboard.

If you have a Model III, after removing all the screws, turn the computer right side up. Lift the top off and tip it onto the left side leaving all the wires connected. Remove the six screws holding the keyboard cover and set the cover aside. Tip the keyboard forward.

Look at the etching on this PC board. Near each pair of connections (representing each key) is a small silver etching of the name of the key (Model I) or a number (Model III). On the Model I, the second row down on the left, you should find the right and left arrow keys while the rightmost keys in the second and third rows are the up and down arrow keys. Of course, the spacebar is at the bottom. On the Model III everything will be reversed since the keyboard is effectively upside down.

Figures 1 and 2 show the three portions of the etchings on the PC board around the keys of interest. Match this with your keyboard. Solder the colored wires to the connections indicated on Figures 1 or 2.

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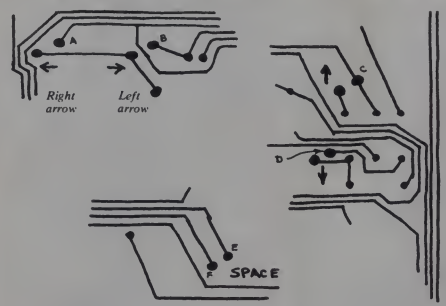

Figure 1. Portions of the TRS-80 Model I keyboard by the arrow keys and spacebar.

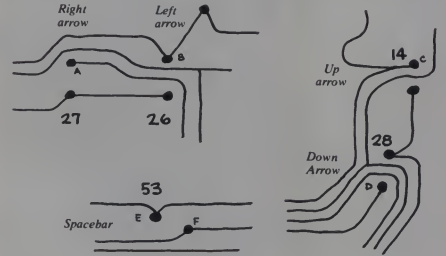

Figure 2. Portions of the TRS-80 Model III keyboard by the arrow keys and spacebar.

Make connections as indicated:

A	*Brown*	*D*	*Blue*
B	*Green*	*E*	*Orange*
C	*White*	*F*	*Black*

Solder these connections by touching the tip of the soldering pencil to the solder blob until it starts to melt (two seconds or so), inserting the tinned end of the wire and quickly removing the soldering pencil. Blow on the connection immediately. Following this procedure should insure that none of the wire insulation melts. If some insulation melts and the exposed wire could possibly touch another connection, unsolder it, cut off the end, tin it, and try again.

Decide where you want the joystick cable to come out of your computer. Model I owners can snake it out through the rectangular ribbon connector hole on the back left of the case although it is difficult to put a strain relief on the cable at this point. A better choice might be the front or either side of the case which choices are also open to Model III owners. With a sharp knife or rat-tail file, cut a small 1/8" notch in the case of the computer.

Back Together Again

Tie a knot in the cable close to the end of the remaining sheathing. Alternatively, you may put a small cable clamp on at this point. Snake the wire to the notch and, with the knot or cable clamp on the inside, reassemble the computer case. When doing this, be sure all the spacers between the PC boards are where they belong, check that nothing is pinched and use the correct screws.

Now comes the moment of truth. Turn on the computer (video display first, if a Model I). If you don't see the normal startup message, immediately turn off the computer; something is wrong. The problem is probably that something is pinched since even gross mistakes in soldering or a shorted connection on the keyboard will not cause a non-startup condition. Re-check everything (keyboard connections, damaged insulation, stray solder blobs, pinched wires, etc.) and reassemble.

After a proper start, try the joystick. Pressing the fire button should print spaces. The up position should print up arrows (Model I) or left brackets (Model III). The left position should print backspaces. The right position should print tabs while the down position should produce a carriage return/line feed. If you get any but these results, open the case and check the connection(s) to the keys which are not responding correctly. Reassemble and try again.

The cable on the Atari joystick is about 40" long; we have used about 12" of it inside the computer which leaves a 28-inch cable. If you feel that this is long enough (it should be for most purposes) and you don't mind having the joystick permanently connected to the computer, then just stop here. You are finished.

On the other hand, if you want a removable joystick or a longer cable, you will have to cut the cable and install male and female connectors and, if you wish, a longer cable. You can choose any one of many in-line connector sets (Cinch-Jones, D.I.N., etc.). Flexible six-conductor cable isn't so readily available and you might have to settle for ribbon cable. Some electronics outlets carry coiled six-conductor microphone cables (for CB and ham replacement use) which is perfect.

Obviously the rule to follow when installing an in-line connector set or longer cable is to maintain the integrity of each wire. When you are done, pushing the joystick left should still act as a left arrow keystroke, the fire button should be a spacebar stroke, and so on.

All done? Load in *Scarfman* or *Robot Attack* or your favorite shoot-'em-up game and you will be amazed. Never thought you could score that high, eh? □

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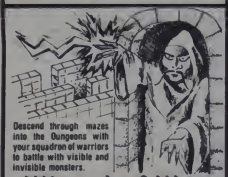

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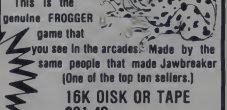

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CIRCLE 259 ON READER SERVICE CARD

Joytricks

John Anderson

Ever stare at the controller jacks in the front of your Atari computer and imagine all sorts of exotic hardware to connect up to it? I have, and while my work on a fully articulated robot arm is progressing quite slowly, there are a few modification projects I've undertaken that require little time, cost very few dollars, and provide nice results.

End Discrimination Against Lefties

As a left-handed gamesman, I've long suspected that my scores have been held down by the fact that joysticks are designed for righties. It's a very simple matter to turn a standard issue Atari joystick (fire button top left) into a lefty stick (fire button top right).

When you disassemble the joystick, be careful not to lose any of the screws or the little spring that sits in the trigger button. Hold the circuit board so it resembles the configuration in Figure 1. Note: newer Atari joysticks have all the connectors on one side of the PC board while older ones have three connectors on each side.

The leads must be removed from the board (grasp the collars; do not pull on the wires themselves) and reattached as shown. That's all there is to it—except to prominently label your new lefty joystick so that it does not drive some poor righty mad. The stick is now "referenced" with the trigger to the upper right.

A Pushbutton Peripheral For Under $8

I've been thinking about a homebrew controller jack peripheral for quite some time now, but the genesis of this idea really belongs to Rick Rowland. Though the controller is at its best when playing a limited number of games, you can do quite a bit with it. If you have a joystick that has seen better days and is ready for retirement, you can reincarnate it as a pushbutton peripheral.

The idea is simple: create a panel of pushbuttons to control all joystick functions.

The idea is simple: create a panel of pushbuttons to control all joystick functions. The Asteroids you'll find in arcades, as well as Space Invaders, Galaxian, and other games, use button rather than joystick input. You can open up this realm at home with a few parts readily available at Radio Shack, and the cord from an old stick (you may try finding a DE-9 plug at an electronics store, and making a cord yourself).

You need only a few short snips of wire, some switches, and a box to mount it all in. I used three packages of push button switches (Radio Shack catalog #275-609). These are momentary contact switches, packed two to a package. I mounted five of them in a deluxe project case (Radio Shack #270-222). The total cost of these items was under $8.00, and created a new and enjoyable input device.

Probably the toughest thing about the whole project is putting the mounting holes into the project case. If you don't have access to a drill with a suitably sized bit or hole cutter, you can do what I did: use your soldering iron to start the hole, and then ream it to size using the blade of a scissors. The two tricks to this technique are to work slowly, constantly checking the diameter of the hole against the switch collar, and not burning and/or cutting yourself. It can be done, and that's an advantage of a plastic project case

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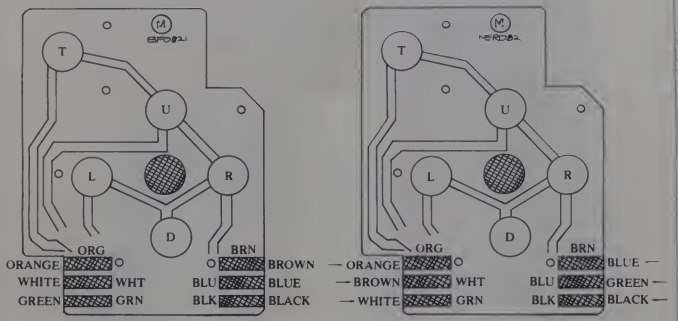
Figure 1.



ORIGINAL WIRING

T = Trigger
L = Left
R = Right
D = Down
U = Up

"LEFTY" MODIFICATION

Figure 1A. New Style Joystick.

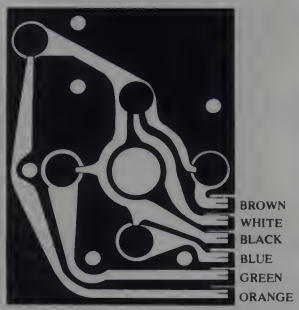


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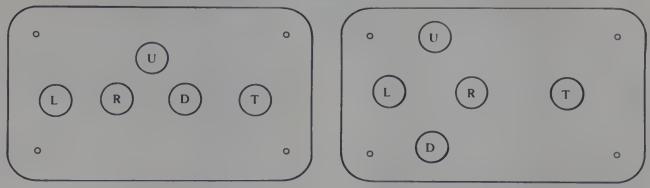
Figure 2.



T = Trigger
L = Left
R = Right
D = Down (Hyperspace)
U = Up (Thrust)

(another is its low price).

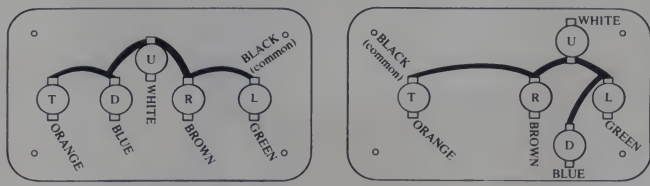
Refer to Figure 2 for possible button configurations. The first is the "classic" Asteroids format. If you're building a peripheral just to play Asteroids, this is the way to go. The second is what we might call a "clock-directional" format, which in the long run proves to be a more versatile set-up. I made up one of each, and prefer the clock-directional arrangement for a variety of games.

You will need a groove in the box portion of the case to allow the cord to pass through. You may again use the soldering iron to do this, making the groove only wide enough to push the retaining collar in. This way it won't be easy to yank the wire out by its roots.

In order to wire up the new peripheral, refer to Figure 3. As far as I know, this color scheme is standard. In order to attach connectors to the pushbuttons, you'll want to press each connector lightly between the jaws of a pliers. If you are careful about this, you will create a good connection without losing the ability to remove the cable later. Those of you who wish to make your own cord will have to find a DE-9 connector, (which may not be easy), and wire it as shown in Figure 4.

Necessarily, diagonal motion is tough with this configuration, as it requires two buttons to be pressed simultaneously. As a result, games in which the player moves in one dimension are especially suited for pushbutton input (Asteroids is a notable exception). If you feel really brave, try it with a maze game, like *Jawbreaker*.

Figure 3. Flip-Side Wiring Diagram.



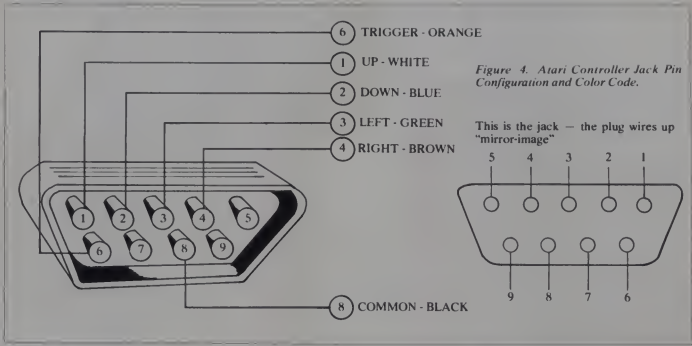


Figure 4. Atari Controller Jack Pin Configuration and Color Code.

Double Your Fire Power

If you construct a pushbutton peripheral with the parts I've listed above, you will have an extra button left over. It is a relatively simple matter to attach this button to the handle of an existing joystick, thereby adding a second trigger in a very handy place. It's nice to be able to fire with the same hand that steers, and because the conventional trigger remains enabled, you can easily squeeze off more shots this way.

Use a blade of your trusty (and by this time, quite dull) scissors to press a hole through the top of the stick. Next, disassemble the stick, following the instructions given above for the "lefty" modification. Remove the white plastic stem from inside the handle. Using a saw or serrated kitchen knife, cut off about a half an inch from the top of the stem. This will provide the needed room for the switch.

Unscrew all collars and retainers from the neck of the button. Solder two 12-inch lengths of wire to the switch contacts, braiding these leads together. Pass them through the hole you made on top of the stick, and through the white plastic stem. Then screw the pushbutton directly into the top of the joystick handle. The other ends of the leads attach as shown in Figure 5. Reassemble the stick, remaining mindful of that little spring that sits on the original trigger button. You will effectively have doubled your firing ability. Remember, however, some games do not allow for excessively rapid fire play.

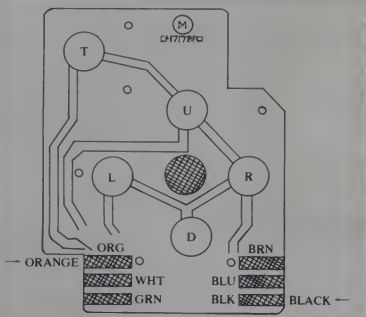


Figure 5. Second Trigger Wiring.

Figure 5A. New Style Stick.

Atari Game Controllers

If you like the idea of a pushbutton controller, but lack the time, talent, or inclination to construct one, you may want to purchase one of the ready-made controllers described below.

Starplex Controller

The Starplex controller from Starplex Electronics, offers an authentic "Asteroids-style" button configuration, as well as the fastest set of pushbuttons I have ever seen. In addition, an optional AA battery powers a "rapid-fire" mode, automatically repeating fire faster than you can do it by hand.

Because the pushbutton array is large and has a light touch, the controller takes a bit of getting used to. Eventually, however, I found that the lightning fast direction changes possible with Starplex resulted in higher scores.

It should be mentioned that because many games do not allow a new shot to be fired until an old one leaves the screen, the "rapid-fire" option will not always work optimally. Still, you can fire continuously merely by holding the button down, rather than having to re-press the trigger for each shot (or battery of shots). Over the long haul this reduces fatigue, and the incidence of "joystick elbow."

The unit lists for $29.95, which is a bargain for the most authentic game of Asteroids this side of the coin-op. It improved my score on several other games as well.

Starplex Electronics, Inc., E23301, Liberty Lake, WA 99019. (509) 924-3654.

KY Enterprises

The controller offered by KY Enterprises uses a directional-style configuration, less suitable for Asteroids but more versatile overall. For those unfamiliar with the arcade configuration, it is much easier to master this logical layout.

The unit exhibits extra sturdy construction—as if its makers knew it would have to withstand a few bounces off the floor. It is very large, and can be cradled or used on a tabletop by even the tiniest kids. The buttons themselves sit in raised collars, and, though not as fast as the buttons or the Starplex unit, appear to be the "regulation" coin-op standard. They are large and easy to control.

The KY Enterprises controller is priced at $26.95, and is available in left- or right-handed models. They also manufacture controllers for the handicapped.

KY Enterprises, 3039 East Second St., Long Beach, CA 90803.

Accu-Play

A third pushbutton controller, the Accu-Play Control Board, we did not have an opportunity to test. It sells for $29.95 from Accu-Tech Products, 10572 Swinden Ct., Cincinnati, OH 45241.

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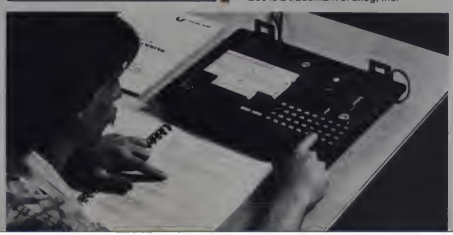


Searching Techniques

Edward Mitchell

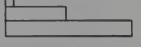
An Introduction to Data Structures

Part 1 of this four-part series introduced the concepts of algorithms and data structures. In this section we will explore several data structures in detail—*lists, stacks, queues, and trees*—and demonstrate their use in table searches, arithmetic expression evaluation, subroutine calls, simulations, process waiting areas in computer operating systems and in a typical application program. By choosing the correct form for the data in a problem, both memory requirements and execution time may be reduced.

This article introduces each of the data structures and illustrates some possible uses. A simple genealogical database is designed showing how tree structures and stacks are used in a real application. The program source listing for the genealogical database appears next month in Part 3. Also in Part 3, methods of programming the data structures in Basic are presented.

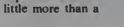
Data Structure Definition

A data structure is an organized collection of data. For our purposes, the smallest piece of data to be used is a simple character or integer, each made from some number of *bits* of storage. The bit, or binary 0 or 1, is the basic unit of computer memory. An integer in this article, and in many real computing systems, occupies 16 bits of storage. Most computers define a byte (usually equivalent to a single character such as A or B) as a sequence of eight bits. For example, a bit, a byte and an integer might be depicted as



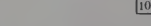
1 bit
8 bits = 1 byte
16 bits = 1 integer

Typically, these are the fundamental storage units that the computer circuitry recognizes. The software manipulates the basic building blocks to develop more complex data structures. For example, a character string is little more than a sequence of characters strung together.

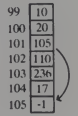


Edward Mitchell, 813 West Stevens Ave., # 1, Santa Ana, CA 92707.

Similarly, an array of integers is just a sequence of integer storage locations.



The building blocks of characters and integers can be combined and referenced in numerous ways to form new data types. By treating the value of an integer as the address of another integer, a new type, called the *pointer* is created. For example, in the small section of memory shown below, the value of memory cell 101 is interpreted as the location or address of another cell.



In this case, we say that cell 101 "points" to cell 105, hence the name "pointer."

By combining groups of characters, integers and pointers, new and complex data types are created.

By combining groups of characters, integers and pointers, new and complex data types are created. When collections of data types are brought together, they are called a *record*. Many languages, including Pascal, PL/1, Cobol, and Ada provide language support for record structures: Basic does not.

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Lists

A *list* is a sequence of memory cells linked together by pointers. The first group has a pointer to the second group, which in turn has a pointer to the third, and so on. The basic list structure is illustrated in Figure 1. The first element of the list is called the *head* and the last element is called the *tail*. New elements are inserted into the list by setting the appropriate pointers.

In Figure 1, much of memory is used for pointers and doesn't hold any data. However, by enlarging the data area, memory usage is improved. For example, a data type made from 16 characters and a pointer appears in Figure 2, where the ratio of useful data memory to pointer memory is much higher.

In Figure 1, the only way to get to element d is to start at the head of the list at a and traverse the pointers until arriving at d. As shown, the list is only traversed in the direction of the pointers. But by adding a new pointer to each list element, called a *backpointer*, the list can be traversed in either direction. Element c can then be reached by starting at the tail and traversing the list in the reverse direction.

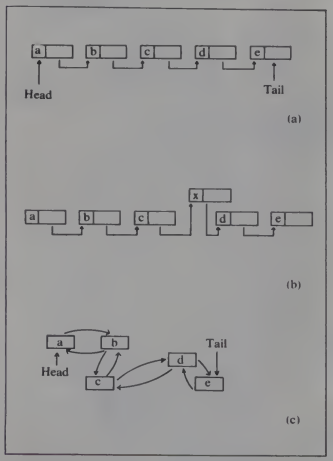

Figure 1. A list is a sequence of memory cells that are linked together. The first element is connected to the second, the second to the third, and so on, through the use of a pointer. (a) identifies the parts of a list structure. The first element is called the head while the last element is called the tail. New elements are easily inserted or deleted simply by changing the pointer connections, as shown at (b). (c) shows the addition of "backpointer" so that the list can be traversed in both directions.

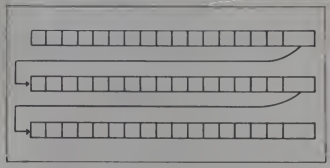

Figure 2. A problem with the list structure shown in Figure 1 is that much of the memory is used to hold pointers, rather than real data. However, if the data area for each element is enlarged, memory utilization can be improved. As shown here, when the data area per element is increased, the ratio of useful data memory to pointer memory is much higher. Of course, if the data area is not completely used, then memory utilization may still be poor.

Self-Organizing Lists

Lists are useful for tables that are subject to frequent changes. In Part 1, a self-organizing list structure was described as a way of sequentially searching a table ordered by the frequency of occurrence of each name. The list structure is well suited to constructing a self-organizing table. As names are added, they are attached at the head of the list. For example, when the name PAUL is added to a list already containing the names GEORGE, LISA, and BERNADETTE, the following list is produced,

To search the list for LISA, the names are examined in the sequence, PAUL, GEORGE, and finally LISA. Once LISA is found, the algorithm puts the name at the head of the list, giving,

Every time a name is found, it is relocated to the head of the list. Names that are accessed frequently stay near the front of the list, while seldom referenced names remain at the rear.

Stacks

Like the list, the *stack* is a structure that may grow and contract dynamically. Stacks are used for subroutine calls, recursive subroutine calls (recursive routines call themselves), arithmetic expression evaluation, sorting and searching algorithms and in many other applications. In some cases, the stack is like an array that grows in size at one end (See Figure 3). Data are always added to and removed from the top of the stack. Consequently, the most recent datum placed on the stack is also the first to be removed.

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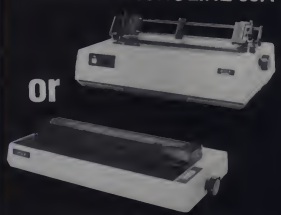

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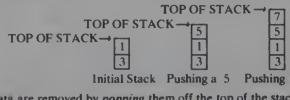
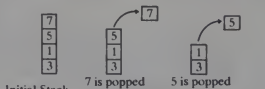
Data are added by *pushing* a new element onto the stack. For example,



Data are removed by *popping* them off the top of the stack.



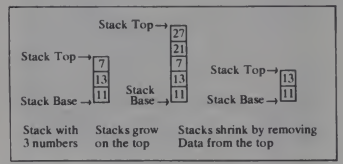


Figure 3. The stack in operation. Data are added by pushing them on to the top of the stack. When data are removed they are popped off the top. Consequently the last number put on the stack is also the first to be removed.

Stacks and Subroutine Calls

Figure 4 shows how stacks are used in subroutine calls. The Basic program shown in 4(a) calls a subroutine, which in turn calls another subroutine and so on. The output from this program is shown in 4(b).

When the program runs, the statement at line 10 calls the subroutine at line 100. When the subroutine at line 100 is completed, the program returns to line 20. Internally, the computer uses a stack to remember the return location. When it executes the GOSUB statement at line 10, it places line 20 on the stack as shown below:

The subroutine at line 100, in turn, calls the subroutine at line 200, placing the return location of 120 onto the stack.

By the time the program reaches line 600, the stack contains,

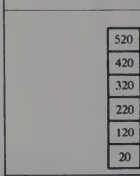
At line 610, the RETURN statement causes the subroutine to return to the line where it was called. So Basic pops the return address from the stack, yielding line 520. At line 520 another RETURN statement is executed, and again, the return address is popped. The program continues popping return addresses until it reaches the STOP at line 30.

```
10 GOSUB 100
20 PRINT "ALL DONE"
30 STOP
100 PRINT "AT SUBROUTINE 100"
110 GOSUB 200
120 PRINT "BACK FROM SUBROUTINE 200"
130 RETURN
200 PRINT "AT SUBROUTINE 200"
210 GOSUB 300
220 PRINT "BACK FROM SUBROUTINE 300"
230 RETURN
300 PRINT "AT SUBROUTINE 300"
310 GOSUB 400
320 PRINT "BACK FROM SUBROUTINE 400"
330 RETURN
400 PRINT "AT SUBROUTINE 400"
410 GOSUB 500
420 PRINT "BACK FROM SUBROUTINE 500"
430 RETURN
500 PRINT "AT SUBROUTINE 500"
510 GOSUB 600
520 PRINT "BACK FROM SUBROUTINE 600"
530 RETURN
600 PRINT "AT SUBROUTINE 600"
610 RETURN
```

4(a)

```
AT SUBROUTINE 100
AT SUBROUTINE 200
AT SUBROUTINE 300
AT SUBROUTINE 400
AT SUBROUTINE 500
AT SUBROUTINE 600
BACK FROM SUBROUTINE 600
BACK FROM SUBROUTINE 500
BACK FROM SUBROUTINE 400
BACK FROM SUBROUTINE 300
BACK FROM SUBROUTINE 200
ALL DONE
```

4(b)



4(c)

Figure 4. Using a stack for subroutines. When the program in (a) runs, it produces the output shown in (b). When the program reaches line 600 the stacks looks as in (c). The line numbers on the stack are the lines that Basic will go to after executing a RETURN statement. The stack allows the Basic program to jump to subroutines within subroutines without losing track of who called whom.

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Stacks and Expression Evaluation

Stacks are used during arithmetic expression evaluation to store temporary results. Users of reverse polish notation (RPN) calculators are familiar with the notion of stacks and their use to evaluate expressions. Pressing the ENTER key is synonymous with a push onto the stack.

Consider the expression (3+5)/(2+2). To solve, we add 3 and 5, giving 8, and then 2 and 2 giving 4. Then we divide 8 by 4 to give 2. During evaluation, two temporary solutions are obtained: (3+5) = 8 and (2+2) = 4. The expression might be expressed as

T1 = (3+5)
T2 = (2+2)
Answer = T1/T2

When the computer evaluates this expression, it uses a stack to store the temporary results.

Evaluating expressions by computer is quite complicated and is not described here (See Aho and Ullman [1977], Grappel, or Maurer). A *parser* must be constructed that distinguishes the precedence of arithmetic operations (e.g. multiply before adding). Because parsers are difficult to construct, we treat the parser as a black box that does the evaluation for us. Given the expression (3+5)/(2+2), the parser begins its work at the leftmost parenthesis. Seeing the number 3, the parser places 3 on the stack to give,

Next, it sees the "+" symbol and temporarily saves it as the arithmetic operator. Then the 5 is placed on the stack,

The operator "+" is applied to the top two elements of the stack to give,

(For those with RPN calculators, this is equivalent to the sequence 3, Enter, 5, +).

Recognizing that expressions within parentheses must be evaluated first, the parser scans to the next subexpression. Both 2s are placed onto the stack, giving

and then added together to give,

Finally, the second number from the top of the stack is divided by the number on the top to produce the answer.

Queues

The line created by bank customers waiting for a teller is a *queue*. New customers (assuming that they are polite and do not cut in) arrive at the rear or tail of the line. When a teller is free, a customer leaves the front or head of the line, and advances to the teller window. In computer terms, a queue is a list in which new elements are always added to the tail and always removed from the head. A queue is shown in Figure 5. Elements are added to the queue as in 5(b) and removed as in 5(c).

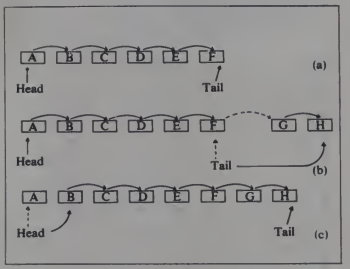

Figure 5. A queue is just like the line that customers form when waiting for service in a store. New customers wait at the end of the line while customers who have waited longest are served at the front. As a data structure, a queue is a list for which new items are always added at the tail and removed from the head. A queue is shown in (a), with A as the first element and F as the last. New elements are added at the tail, as illustrated in (b) showing the addition of two new elements G and H. Elements are always removed from the head of the queue and the head pointer is adjusted to point to the next element in the queue, as shown in (c).

Queues are often used in simulations to keep track of events. For example, in an airport simulation, aircraft are waiting for clearance to taxi to the runway, to take off, and to land. In a simulation, each of the holding points is represented by a queue structure (See Gorney [1979]) for more information about queues and simulations).

A queue is a list in which new elements are always added to the tail and always removed from the head.

In a multi-user computer system, several users may wish to print simultaneously on the single line printer attached to the system. Since the printer can only print one data file at a time, additional print requests are placed into a queue where they wait for processing by the printer.

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Trees

Trees are used to organize data for searching, to represent the syntactic structure of program inside compilers, and in database management systems. A family tree, illustrated in Figure 6(a) is a tree structure showing relationships among family members.

Each of the parts of the tree has a name, as shown in 6(b). Since the tree is upside down, the top point is called the *root*, and the lines issuing downward from the root are *branches*.

Each of the branching points is called a *node* while *leaves* are found at the extreme ends of the branches. A tree with two or fewer branches at each node is called a *binary tree*. Trees containing more than two branches do exist, but are not discussed here.

An ordered table could be represented as the tree shown below:

Traversing the branches of the tree as shown by the arrows, traces the table entries in alphabetical order: A, B, C, D, E, F, G. The symbol D at the root position is at the alphabetic center of the table. Referring to Algorithm 2 in Part 1, the ordered table binary search begins at the name in the middle of the table. Similarly, the root of the tree corresponds to the middle of the table and is used as the starting position for the binary tree search.

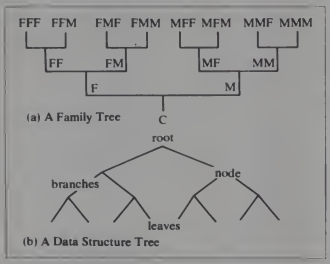


Figure (6). The family tree in (a) shows the relationships among family members. The child, C, is at the root of the tree, with his parents just above. The child's father's father is shown at the extreme upper left. Similar relationships are shown elsewhere in the tree. In data structures, a tree is usually represented upside down, so that C would be on the top with his father and mother just beneath. At (b) the parts of a tree are labelled using data structure terminology.

Placing the names from Part 1, Figure 3 into a tree gives the structure shown in Figure 7. In Part 1, a detailed example was given to search for the name ERIC within an ordered table. That search began with the name ERIKA at the midpoint of the ordered table. Since ERIC was alphabetically less than ERIKA, all names greater than or equal to ERIKA could be removed from further consideration.

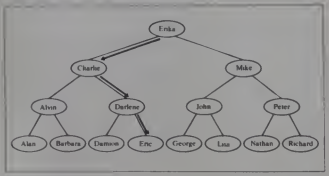
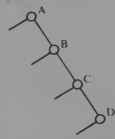


Figure 7. Searching a binary tree for ERIC. Starting at the root, ERIC is less than ERIKA so the name must lie along the left branch. But since ERIKA is greater than CHARLIE it must be to the right of CHARLIE. Eventually the search finds ERIC to the right of DARLENE in just four tries.

When the table is a tree structure, the binary search begins at the root of the tree, where ERIKA appears. Since the names appearing on the right branch from ERIKA are all alphabetically greater than ERIC, that entire branch may be removed from further consideration. The search then descends down the left branch to CHARLIE. Comparing CHARLIE to ERIC, the algorithm chooses the right subbranch as the only possibility, so it descends to DARLENE. But since ERIC is greater than DARLENE, the search descends to the right where ERIC is found. The branches within the tree lead directly to the next guess, just as arithmetic is used to select the next guess when using the binary ordered table search.

Let's see what happens when we search for EDWARD, a name which does not appear in the tree. The search starts in the same way as does the search for ERIC, descending down the left branch from ERIKA to CHARLIE, from CHARLIE to DARLENE, and from DARLENE to ERIC. At ERIC the search tries the left but since the left branch doesn't exist, the algorithm concludes that EDWARD is not in the table.

Adding a name to the tree is simple. Since the algorithm expects to find EDWARD to the left of ERIC, it attaches a new leaf and places EDWARD at that point. If the names are entered into the tree in a bad order, such as alphabetical order, the tree can become extremely lopsided, taking on the appearance of a list:



Fortunately, Knuth has shown that if we assume the names to be entered in random order, the tree will probably organize into a structure that is close to being optimum.

A Practical Application

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is this person's great-great-great grandfather and where was he born?" may need answering. Actually, that question is ambiguous because each person has 16 ancestors who qualify as "great-great-great grandfather." The same question could be phrased as "one's father's father's father's father's father." Using that notation, each of the 16 ancestors can be uniquely identified. For example, "mother's father's father's father's father's father," or "father's father's mother's mother's father."

Questions such as these are easily answered by using a tree-structured genealogical database such as a pedigree chart.

Figures 6(a) and 8(a) show what one family tree might look like. Three functions are needed to use the database. "Add" adds a new ancestor to the tree. "Print" displays the information on one or several ancestors. "Change" modifies the information in the database. For example, you may discover that a name is misspelled or the date of birth is incorrect. A delete function is not needed; deleting your ancestors would have fatal consequences for all subsequent offspring.

A tree is a logical representation for the data.

Listing 1 shows the system in operation. A special notation references the ancestor by his or her relation to the person at the root of the tree. If the family tree has your ancestry, then your grandmother, or your mother's mother, is denoted by MM. Similarly, your mother's father is specified by MF.

When searching back several generations, typing long sequences of M and F is tedious. Instead, a short hand notation must be provided. For example, F5 can be equivalent to FFFFF. A trailing digit indicates a repeat factor for the previous character. Some more examples:

F = your father
M = your mother
FF = your grandfather
FO or MO = your self (0th father or mother)
F3M5F = FFFMMMMMF

When the program is run the first time, the database is empty. The only name that can be added is your own (see Listing 1). To add other names, you must specify the relationship to yourself. The next name after yourself may be either your father or mother, identified by either F or M.

When printing information from the tree, the program prompts for the relationship of the person whose data record you would like to see. For example, entering F2 refers to your grandfather. You can also see all of the ancestors for that particular person. Or you may wish to print the names of your grandfather's father and mother.

The number of generations to display is indicated by appending a plus sign. For example, FF1 tells the program to display your grandfather's record plus one additional generation. FF2 displays two generations beyond your grandfather. If no digit follows the plus (FF) all generations previous to the one specified are shown. Several examples of the program in operation are presented in Listing 1.

A tree is a logical representation for the data. The database is made from a series of records kept in a data file on disk. Each record contains a name, birth date and place, death date and place, and pointers to the corresponding father and

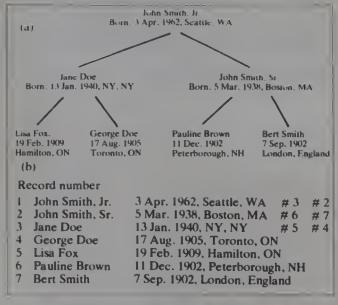

Figure 8. At (a) is a small family tree showing birth date and place for each of the family members. At (b) is the same information but translated into data records for keeping on a disk file. The numbers at the right of records 1 through 4 point to the corresponding mother and father records.

mother records. The first record in the database always corresponds to the youngest person. All other records are linked in by their father and mother pointers. The source listing for the program appears next month in Part 3, written in MicroSoft Basic 5.21.

Figure 8(a) shows a small family tree. When programmed in Basic, all of the data at each node are placed in a single record. Each record contains pointers to the ancestor records. The family tree in 8(a) appears as a data file in 8(b). Part 3 provides additional information on representing tree structures in Basic.

Listing 1.

```
Geneological Pedigree Chart Maker

Enter:  A(dd  P(rint  C(hange  Q(uit ? A

Enter your name -

Enter name ? JOHN SMITH, JR
Enter birth date ? 3 APR 1962
Enter Place of Birth ? SEATTLE, WASH
Enter Death Date ?
Enter Place of Death ?

Specify relationship (CR=Exit) ? M
Enter name ? JANE DOE
Enter birth date ? 13 JAN 1940
Enter Place of Birth ? NY
Enter Death Date ?
Enter Place of Death ?

Specify relationship (CR=Exit) ? F
Enter name ? JOHN SMITH, SR
Enter birth date ? 5 MAR 1938
Enter Place of Birth ? BOSTON
Enter Death Date ?
Enter Place of Death ?

Specify relationship (CR=Exit) ?

Enter:  A(dd  P(rint  C(hange  Q(uit ? P

Print Pedigree Chart
```

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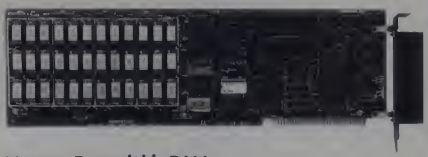

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CIRCLE 240 ON READER SERVICE CARD

An Intro to Data Structure, continued...

Listing 1, continued...

```
Enter relationship (* for all, CR=Exit) ? *
     JOHN SMITH, SR
JOHN SMITH, JR
     JANE DOE


Enter relationship (* for all, CR=Exit) ? F

JOHN SMITH, SR
Born: 5 Mar 1938   Place:
Died:              Place:

Enter relationship (* for all, CR=Exit) ?

Enter: A(dd  P(rint  C(hange  D(uit ? A

Add New Ancestor

Specify relationship (CR=Exit) ? FM
Enter name ? PAULINE BROWN
Enter birth date ? 11 DEC 1902
Enter Place of birth ? PETERBOROUGH, NH


Enter Death Date ?
Enter Place of Death ?

Specify relationship (CR=Exit) ?

Enter: A(dd  P(rint  C(hange  D(uit ? P

Print Pedigree Chart

Enter relationship (* for all, CR=Exit) ? *
     JOHN SMITH, SR
          PAULINE BROWN
JOHN SMITH, JR
     JANE DOE

Enter relationship (* for all, CR=Exit) ?

Enter: A(dd  P(rint  C(hange  D(uit ? D
OK
```

Summary

By viewing the memory of a computer as an organized collection of data, rather than mere bits and bytes, simple and complex data structures are created. Many problems can not be solved unless the proper representation for the data is used.

Lists are structures that grow and contract dynamically, and provide for rapid insertion, deletion, and rearranging of the list elements. The self-organizing list is only one example of how a list might be used. In fact, the entire programming language Lisp is based on the use of list structures.

Stacks are necessary for subroutine calls and provide a direct method of evaluating RPN expressions or converting algebraic notation into RPN notation. Several computer systems have been built based on *stack architectures*. Among these are the Burroughs B5500 and the UCSD P-Machine, simulated on the UCSD Pascal System. In addition, the computer language Forth uses a stack and an RPN-like notation for all of its operations.

Binary trees and other tree structures are especially important in database systems and file systems. They are often used to show relationships among members of a group (a family tree) and to organize data alphabetically or in some other collating sequence. The binary search algorithms have the interesting side effect of sorting their input into alphabetical order, and are sometimes used for the "Insertion Sorts," which will be described in Part 4.

Part 3 shows how these structures can be programmed in the Basic language and includes the source listing for the genealogical relationships program. Part 4 describes several sorting techniques, including Shellsort and Quicksort. Quicksort is an especially fast sort algorithm, well suited to sorting large tables of randomly distributed data. □

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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.
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Pilot-to-Basic Translator

M.R. Smith

In the development of courseware, the instructor really only needs to do three things: type a message to a student, receive the student's answer to check whether it is right, and jump to different parts of the lesson depending on whether the student's response was what was expected.

More complicated things are needed only about 5% of the time. Authoring languages, of which Pilot is an example, are designed to allow the instructor to develop courseware without bothering with the "computational details."

This article is divided into three parts. Part 1 details the Pilot commands and provides examples. Part 2 gives a description of how each Pilot command is turned into the equivalent Basic commands. Modifications can be made to adjust the Pilot commands to the needs of each courseware writer if that is desired. Suggested improvements and extensions are given. Part 3 describes how to choose a suitable text editor.

The program described here is designed to take care of those computational details. It takes a series of Pilot commands and turns them into a valid Basic program. Although the Basic programs that it writes are not tremendous, they perform the function of allowing the courseware to be effectively and simply made. If the writer of the courseware wants to take the Basic programs generated by this translator and do a little pruning, then he is welcome to do so and is able to do so very easily.

For this program to operate, it is necessary for the Pilot lesson to be on a disk TEXT file PILOT.LESSON NAME. This program takes each Pilot command and generates the equivalent series of Basic statements stored in a program called LESSON NAME where LESSON NAME is any lesson name.

When you are typing in this program be very careful of the syntax. The mixture of valid Basic statements inside apparently invalid PRINT statements can lead to reading and typing errors.

Pilot Commands

This section is rather terse. It is intended to show the simple richness of the Pilot language rather than give great detail on how to use the language. The tutorials that follow will perform that function.

M.R. Smith, 304, 86th Ave., SE, Calgary, Alberta, Canada T2H 1N7.

T: Type a line.

TC: Clear the page before typing.

TV: Vertical tab down a page. TV:5 would start at the fifth line.

TI: Type this line in inverse characters.

TH: Type this line and don't add a carriage return.

A: Accept a student answer.

M: Match the student's last response. M: A,B would compare student answer with A and B as letters or match against some known value. M:$N1$ would compare the student's last answer against what is stored in $N1$.

Y and N modifiers are used to perform an instruction depending on whether the last month instruction (M:) was true or not. For example, TN: Type this line if the last match was not true or MY: SECOND-ITEM try a second match if the last one was true.

* is used to start a lesson part.

E is used to finish the lesson. For example:

```
*:lesson 1
T:line 1 lesson 1
*:lesson 2
T:line 1 lesson 2
E:end of the lessons
```

U:is used to jump to a USER routine. The USER routine should start after the end of the main lesson. On completing the user routine, the program returns to the lesson part from which it came. Each user routine must end with the E: command so that it can be identified. For example:

```
*:main lesson
T:line 1
U:USER
T:line 1 of next bit of main lesson
U:USER
T:etc
.....
E:End of main lesson
*:USER
TH:Press return to continue
A:
E:
```

J: or jump command can be used to move different parts of a lesson. You may jump to a lesson part or to a label. The labels are local, meaning that they are valid only between two

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lesson part names. The labels can be from 1 to 9. The command J:10 jumps to the next E: command. For example:

```
*:START
T:What lesson? Vowels or Numbers?
A:
M:V
JY: VOWELS
JN:1
I*:NUMBERS lesson
....
....
J:START
*:VOWELS
....
J:1
```

IR: Previous statement jumps here. This label 1 can be used by any JUMP command after the lesson part VOWELS

```
....
J:START
```

L: is a link instruction which causes the running of another Basic program.

B: is any valid Basic instruction. (B: SPEED=120)

X: Checks whether this statement is true (Boolean algebra). Acts as a match instruction with more power. Sets the Y and N modifiers. (X: T < 3).

R: is a remark statement. It is used to place a remark or comment statement in the program (R:This is a remark).

G: is a graphics command. The graphics screen is divided into a grid 100 units long by 100 units wide. The bottom left-hand corner is the starting point (0,0).

GC: Clears the graphics screen.
GL: Draws a line.
GO: Turns on the graphics mode.
GP: Plots a point.

Program Description

This part of the article is for those experts who know they can improve upon my code. For people just interested in using Pilot, the only advantage of reading it is to get some idea of the limitations of this version of Pilot.

Each Pilot instruction is converted into its Basic equivalent and stored as a TEXT file on the disk. In Applesoft it is possible to EXEC this file straight into memory. EXECing a file means using a TEXT file as a series of commands as though you were typing the commands directly on the keyboard.

The translator beeps twice when it finds an error. Since a text file is being written to the disk, it is not possible to get a beep by typing PRINT CHR$(7) as this would get into the file. Instead, a standard Apple machine language call (CALL -1059) is used.

The start of a program (*:command) establishes a REM statement and a jump from the current line number to line number +20. The ten lines after the REM statement are used for GOTOs to the line number of a label. For example the following sequence of statements would produce the following Basic

```
*:start          1000 GOTO 1020 : REM START
J:1              1020 GOTO 1001
J:5              1030 GOTO 1005
1T:              1040 PRINT
                 1001 GOTO 1040
E:               1050 STOP
                 1005 STOP: REM NO LABEL 5
```

The E: statement is used to tidy up and check for undefined labels. The next lesson start (*:) has the same effect. The very final E: statement of a program checks to see if any jumps to procedures have not been defined. For example

```
*:START          1000 GOTO 1020 : REM START
U:USER
T:TYPE           1030 PRINT
U:ANOTHER
E:               1050 STOP
*:USER           3000 GOTO 3020
T:               3020 PRINT
E:               3030 RETURN
                 1020 GOSUB 3000
                 1040 STOP : REM NO PROCEDURE U:
                  ANOTHER
```

All errors in syntax are turned into statements starting in a STOP. This has the advantage that the writer can go in and make a modification to that statement without having to recompile the whole Pilot program.

The modify commands Y and N generate rather poor code but it works. The match instruction sets a FLAG that is checked for a 1 or a 0.

```
TY:PRINT         1000 IF FLAG THEN 1010
                 1010 PRINT
                 1001 GOTO 1020
TN:PRINT         1020 IF NOT FLAG THEN 1030
                 1030 PRINT
                 1021 GOTO 1040
```

The accept instruction is implemented by a subroutine starting at line 70 of the generated Basic program. The student's answer is stored in a variable ANS$. The input routine is user-friendly. Backspaces and line delete (control-x) are supported.

```
A:               1000 PRINT BELL$;: GOSUB 70
A: $N1$          1010 PRINT BELL$;: GOSUB 70 :
                  NAME$ = ANS$
```

The match instruction is implemented by a subroutine starting at line 10 in the generated Basic program. The value to be checked is stored in a variable called CHECK$ and then compared to the answer stored in ANS$.

```
M:A              1000 FLAG = 0
                 1010 CHECK$ = "A" : GOSUB 10 :
                  IF FLAG = 1 THEN 1020
M:A,B,$N1$       1020 FLAG = 0
                 1030 CHECK$ = "A" : GOSUB 10 :
                  IF FLAG = 1 THEN 1060
                 1040 CHECK$ = "B" : GOSUB 10 :
                  IF FLAG = 1 THEN 1060
                 1050 CHECK$ = N1$ : GOSUB 10 :
                  IF FLAG = 1 THEN 1060
```

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CIRCLE 212 ON READER SERVICE CARD

The Boolean check (X: instruction) is turned into a Basic statement that sets the FLAG

```
X:T = 3
1000 IF (T = 3) THEN FLAG = 1
```

The other commands are implemented in a straightforward manner.

Subroutine Location

20 Get a file name.

140 Load the statements needed to initialize the Basic program being generated.

170 Generate the Basic program.

200 Clear up any undefined labels or lesson part names.

430 Make and execute the EXEC file.

1000 Find out which Pilot command is to be evaluated.

1070 Check on labels and the presence of a colon.

1170 Check if need to use the Y and N modifiers.

1260 Turn the Pilot command into a Basic statement.

24040 Performs the conversion of the accept (A:) command.

21010 Performs the conversion of the Basic (B:) command. Any apostrophes become quotation marks. For example B:PRINT 'PRINT THIS LINE' becomes 1000 PRINT "PRINT 'THIS LINE'". This is a useful function if trying to get a $ printed. The presence of a $ in a type (T:) statement is assumed to be the start of a variable name.

20160 Converts the end (E:) command and clears up any undefined labels.

40010 Converts the graphics (G:) command. If this is the first graphics call then a HGR (call high res graphics) is performed.

29010 Converts the jump (J:) command. If the lesson name has not yet been used (i.e. not defined) the name is stored in NEED$(NEED,0) and the line number at which it is required is stored in NEED$(NEED,1).

23010 Converts the link (L:) instruction.

25010 Converts the match (M:) instruction.

20510 Converts the remark (R:) instruction.

35010 Converts the sound (S:) instruction. If this is the first sound instruction in the program, then the machine language subroutine needed to generate the sounds is loaded into the Basic program being made.

26000 Converts the type (T:) instruction. I have found that on a 40-character screen, it makes easier reading if every line of text is separated by a blank line. This is achieved by

```
T: line one
T:
T: line two
```

You might find it more convenient to automatically supply a blank line after each Type instruction. To do this change line 26210 to

```
26210 PRINT ": PRINT "
```

27010 Converts the user (U:) instruction. If the procedure being called is not found, then its name is stored in NEED$(NEED, 0) and the negative of the line number where it is needed is stored in NEED$(NEED,1). By storing the negative of the line number, it is possible for the routine at line 200 to decide whether it is clearing up a jump or a user instruction.

22010 Converts the Boolean (X:) instruction.

30010 Converts the lesson part (*:) instruction. This clears up any undefined labels if that has not already been done by a preceding E: instruction. Lesson part names are stored in NP$(J,0) and the line numbers at which they start in NP$(J,1).

50000 This performs the loading of the match and accept subroutines into the Basic program being generated.

60000 Performs the initialization and description of the variables used in the program.

Suggested Extensions to Pilot

A link and chain instruction would be useful to allow the passing of variables, such as a student's name or number of questions correct, between programs. However, the problem of initializing the new program must be solved. A routine must recognize whether a program has been chained or called straight into memory, and adjust the initialization accordingly.

The code here for multiple matches works but could be made more elegant.

At the moment the Y and N must come second in a command or they are not implemented. This means that the command TY!: is compiled correctly, but "type this line in inverse if last match was true," is treated the same as T!:.

Syntax checking for the correct number of dollar signs in the match and type commands could be made more fool proof. At the moment no effort is made to see if the variable name is a valid one. For example, $LONG$ would generate a RUN-time error because of the presence of the ON in the middle of LONG.

When a Pilot statement is found with syntax errors, e.g. missing labels, a REM statement is formed, preceded by a STOP. It might be convenient to put the REM statement in inverse print to enable it to be spotted more easily.

Choosing a Text Editor

The presence of the colon in the middle of each Pilot command creates problems. Check your editor to see if it will work. The Apple DOS-Toolkit recognizes the colon as a command and will not let you enter it into a file. Other editors will let you enter it into a file but the Pilot-to-Basic program may not read it in properly. It expects all lines in a file to be stored as "LINE," i.e. a line surrounded by quotes. This means the line can be read in by an INPUT statement, giving slightly faster disk access than a GET statement.

If you find that your editor will read and reload files satisfactorily but Pilot-to-Basic will not read them, make the following modifications.

Replace line 1030 with:

```
1030 SENT$ = ""
1032 GET A1$ : IF A1$ = CHR$(13) THEN 1036
1034 SENT$ = SENT$ + A1$ : GOTO 1032
1036 IF FFLAG = 0 THEN PRINT D$;"WRITE "ENAME$
```

The text editor which I will describe in a forthcoming issue of *Creative Computing* does not need this modification. In addition, the text editor checks each statement as it is entered to check that it starts with a valid Pilot command. This removes many simple syntax errors at a time when they are easy to change. In addition, it converts all quotation marks to apostrophes, which removes another potential problem.

If you would like an Applesoft disk containing this program, a copy of the editor and a series of Pilot tutorial lessons, send a stamped addressed envelope, containing a 5" disk labelled with your name and address together with sufficient padding to protect the disk. Please enclose an additional $5 to cover my time and the wear and tear on my disk drives. To quote Chuck Carpenter, "If you don't send the stamped addressed envelope and the money, then I'll hang onto your disk until you do." If you live outside Canada, please enclose the money equivalent of the postage as the Post Office will not accept foreign postage. ($2.50 for a disk plus packing going First Class to the U.S.) □

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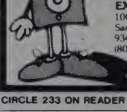

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1  REM  PILDT->BASIC CONVERTOR
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3  REM  M.R.SMITH  NDV 19B1
4  REM
5  REM  304, 86TH AVENUE SE, CALGARY
6  REM  ALBERTA, CANADA T2H 1N7
7  REM
10  CLEAR : GOTO 60020
20  HOME : VTAB 10: PRINT "PILDT -> BASIC": PRINT : PRINT : PRINT
 "TRANSLATE WHAT FILE"BELL$
30  ONERR  GOTO 60
40  INPUT NAME$:N=LEN$ =  LEFT$ (NAME$ + "                ",14)
50  PRINT O$;"RUN PILDT."NAME$
60 X =  PEEK (222): POKE 216,0: IF K < > 13 THEN  INVERSE : PRINT "
 PILDT."NAME$" DOES NOT EXIST"BELL$BELL$: PRINT : NORMAL : INPUT "
 PRESS RETURN TD CDNTINUE";A$: GOTO 20
70 ENAME$ = "TEMP": GOSUB 62010: IF PFLAG = 1 THEN 110: REM
 PRINT TO SCREEN ON PFLAG
80  ONERR  GOTO 100: PRINT D$;"UNLDCK EXEC."ENAME$
90  PRINT O$;"DELETE EXEC."ENAME$
100  POKE 216,0
110 NAME$ = "PILDT." + NAME$:ENAME$ = "EXEC." + ENAME$
120  PRINT O$;"OPEN "NAME$
130  IF PFLAG = 0 THEN  PRINT D$;"DPEN "ENAME$
140  GOSUB 50020: REM  LOAD THE TITLE PAGE AND THE MATCH SUBROUTINE
150  PRINT O$;"MONDN C,I,O"
160  IF PFLAG = 0 THEN  PRINT D$;"MON C,I,O"
170  ONERR  GOTO 200
180  GOTO 101: REM  GO AWAY TILL ERROR OCCURS
190  REM *****
200  POKE 216,0: IF PFLAG = 0 THEN  PRINT O$;"WRITE "ENAME$: REM
 CLOSE OUT
210  FDR K = 1 TD 9: REM   LDCAL LABELS
220  IF NL(K) = 1 THEN  PRINT CPRDC + K"STDP: REM ND LABEL "K:BAD =
  BAD + 1: CALL  - 1059: CALL  - 1059
230  NEXT
240  IF NL(10) = 1 THEN  PRINT CPRDC + 10" GDTD "LNUM: REM  DIRECT
 END JUMPS
250  PRINT LNUM" STOP"
260  IF NEED = 0 THEN 370
270  IF NP = 0 THEN 360: REM     ND PRDCEDURES NAMED
280  FDR K = 1 TD NEED:SENT$ = NEED$(K,0)
290  FDR J = 1 TO NP
300  IF SENT$ = NP$(J,0) THEN  GDSUB 340: GDTD 320
310  NEXT J: PRINT  ABS ( VAL (NEED$(K,1)))" STOP: REM NO PROCEDURE
 CALLED "SENT$:BAD = BAD + 1: CALL  - 1059: CALL  - 1059
320  NEXT K
330  GOTD 370
340  PRINT  ABS ( VAL (NEED$(K,1)));: IF  VAL (NEED$(NEED,1)) < 0 THEN
  PRINT " GDSUB "NP$(J,1): RETURN
350  PRINT " GDTD "NP$(J,1): RETURN
360  FDR K = 1 TD NEED: PRINT  ABS ( VAL (NEED$(K,1))" STDP:REM NO
 PRDCEDURE CALLED "NEED$(K,0): NEXT :BAD = BAD + 1: CALL  - 1059: CALL
  - 1059
370 NNAME$ =  RIGHT$ (NAME$, LEN (NAME$) - 6)
380  IF PFLAG = 0 THEN 430

390  PRINT : PRINT : PRINT : PRINT NAME$

400  IF BAD <  > 0 THEN  PRINT " HAD "BAD" SYNTAX ERRDRS"

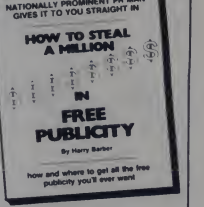
410  IF BAD = 0 THEN  PRINT " HAD NO ERRORS"
420  STOP
430  PRINT "SAVE "NNAME$: PRINT "LDCK "NNAME$: PRINT "RUN"
440  PRINT O$;"CLOSE "ENAME$
450  IF BAD = 0 THEN 500
460  HOME : VTAB 10: PRINT NAME$" HAD "BAD" SYNTAX ERRORS "!: PRINT :
 PRINT "USE THE FILE ANY WAY "BELL$: INPUT A$
470  IF A$ = "" THEN  PRINT BELL$BELL$: GOTO 470
480 A$ =  LEFT$ (A$,1): IF A$ = "N" THEN  STDP
490  IF A$ < > "Y" THEN  GDTD 460
500  HOME : INVERSE : PRINT "RUN OF "NNAME$: NORMAL : VTAB 3: PDKE
 34,2
510  ONERR  GOTD 540
520  PRINT D$;"UNLDCK"NNAME$
530  PRINT D$;"DELETE"NNAME$
540  POKE 216,0
550  PRINT D$;"EXEC "ENAME$
560  STOP
1000  REM *****
1010  PRINT D$;"READ "NAME$: INPUT SENT
1020  PRINT D$;"READ "NAME$
1030  INPUT SENT$: IF PFLAG = 0 THEN  PRINT D$;"WRITE "ENAME$
1040  IF PFLAG = 1 THEN  INVERSE : PRINT SENT$: NORMAL
1050 SIZE =  LEN (SENT$): IF SENT$ = "END" THEN 200: REM     NATURAL
 FILE END
1060  IF SIZE < 2 THEN 1020: REM      IGNDRE TDD SHORT LINES
```

```
1070 K =  VAL (SENT$):MSENT$ = SENT$: REM  THIS IS A LABEL?
1080  IF K < 1 THEN 1130
1090  IF K > 9 THEN  PRINT LNUM"STOP: REM BAD LABEL "SENT$:LNUM =
   LNUM + 10:BAD = BAD + 1: CALL  - 1059: CALL  - 1059: GOTO 1020
1100  IF NL(K) = 2 THEN  PRINT LNUM"STOP:REM DUP. LABEL ";SENT$:LNUM
   = LNUM + 10: GOTO 1020
1110 NL(K) = 2: PRINT CPROC + K;"GOTO ";LNUM
1120 SIZE = SIZE - 1:MSENT$ =  RIGHT$ (MSENT$,SIZE)
1130  GOSUB 1140: GOTO 1020: REM  INTERPRETE PILOT INSTRUCTION
1140 K = 4: IF SIZE < K THEN K = SIZE
1150 FOR L = 1 TO K: IF  MID$ (MSENT$,L,1) = "(" THEN 1170
1160  NEXT L: PRINT LNUM"STOP: REM NO COLON "SENT$:BAO = BAO + 1: CALL
   - 1059: CALL  - 1059:LNUM = LNUM + 10: RETURN
1170 A$ =  MID$ (MSENT$,2,1): IF A$ <  > "N" AND A$ <  > "Y" THEN A$
   =  LEFT$ (MSENT$,1): GOTO 1220: REM  HANDLE Y/N PART
1180  IF L < 3 THEN 1290: REM  BAO SYNTAAX
1190  PRINT LNUM;:FLAG = LNUM + 1:LNUM = LNUM + 10: IF A$ = "Y" THEN
   PRINT "IF FLAG THEN ";LNUM
1200  IF A$ = "N" THEN  PRINT "IF NOT FLAG THEN";LNUM
1210 SIZE = SIZE - 1:MSENT$ =  LEFT$ (MSENT$,1) +  RIGHT$
   (MSENT$,SIZE - 1):L = L - 1:A$ =  LEFT$ (MSENT$,1)
1220  IF L < 2 THEN 1290: REM  BAD SYNTAX
1230  IF A$ = "I" THEN  GOSUB 26010: GOTO 1300: REM  I COMMAND
1240  IF A$ = "G" THEN  GOSUB 40010: GOTO 1300: REM  G COMMAND
1250 M$ = "ABEGJLNRSTUX="
1260  FOR K = 1 TO 13
1270  IF A$ =  MID$ (M$,K,1) THEN 2001O: REM  VALID COMMAND
1280  NEXT K
1290  PRINT LNUM" STOP:REM SYNTAX "SENT$:BAO = BAO + 1: CALL  - 1059
   : CALL  - 1059
1300 LNUM = LNUM + 10: IF FLAG <  > 0 THEN  PRINT FLAG" GOTO "LNUM: REM
    HANDLE ERROR OF Y/N INSTRUCTIONS

1310 FLAG = 0: RETURN

20000  REM xxxxx
20010 SIZE = SIZE - 1: IF SIZE < 1 THEN MSENT$ = "": GOTO 20030
20020 MSENT$ =  RIGHT$ (SENT$,SIZE): REM  GET ACTUAL COMMAND
20030  IF A$ = "A" THEN  GOSUB 24040: GOTO 20160
20040  IF A$ = "B" THEN  GOSUB 21010: GOTO 20160
20050  IF A$ = "E" THEN  GOSUB 28010: GOTO 20160
20060  IF A$ = "G" THEN  STOP : REM  CAN'T REACH HERE
20070  IF A$ = "J" THEN  GOSUB 29010: GOTO 20160
20080  IF A$ = "L" THEN  GOSUB 23010: GOTO 20160
20090  IF A$ = "M" THEN  GOSUBB 25010: GOTO 20160
20100  IF A$ = "R" THEN  GOSUB 20510: GOTO 20160
20110  IF A$ = "S" THEN  GOSUB 35010: GOTO 20160
20120  IF A$ = "T" THEN  STOP : REM  CAN'T REACH HERE
20130  IF A$ = "U" THEN  GOSUB 27010: GOTO 20160
20140  IF A$ = "X" THEN  GOSUB 22010: GOTO 20160
20150  IF A$ = "=" THEN  GOSUB 30010: GOTO 20160
20160 LNUM = LNUM + 10: IF FLAG <  > 0 THEN  PRINT FLAG" GOTO "LNUM:
    REM  HANDLE Y/N INSTRUCTIONS
20170 FLAG = 0: RETURN
20500  REM xxxxx
20510  PRINT LNUM"REM "MSENT$: RETURN : REM  R-COMMAND
21000  REM xxxxx
21010 M1$ = "": FOR COUNT = 1 TO  LEN (MSENT$):M$ =  MID$ (MSENT$,
   COUNT,1): IF M$ = "/" THEN M$ = GU$
21020 M1$ = M1$ + M$: NEXT : REM  CHANGE ' TO "
21030  PRINT LNUM;M1$: RETURN : REM  B-COMMAND
22000  REM xxxxx
22010  PRINT LNUM"FLAG=0:IF("MSENT$")THEN FLAG=1": RETURN : REM  X C
   OMMAND
23000  REM xxxxx
23010  PRINT LNUM"PRINT D$;"QU$"RUN "MSENT$QU$: RETURN : REM
   L-COMMAND
24030  REM xxxxx
24040  PRINT LNUM"PRINT BELL$;:";: IF SIZE = 0 THEN  PRINT "GOSUB70"
   : RETURN : REM  A-COMMAND
24050  IF SIZE < 3 OR  LEFT$ (MSENT$,1) <  > "$" THEN  PRINT " STOP:
   REM SYNTAX "SENT$:BAO = BAO + 1: CALL  - 1059: CALL  - 1059: RETURN

24060 MSENT$ =  RIGHT$ (MSENT$,SIZE - 1): IF  RIGHT$ (MSENT$,1) =
   "$" THEN MSENT$ = MSENT$ + "$": REM  ADD $ IF NEEDED
24070  PRINT "GOSUB 70:"MSENT$"=ANS$": RETURN
25000  REM xxxxx
25010  IF MSENT$ = "" THEN  PRINT LNUM"FLAG=1": RETURN : REM  EMPTY
   MATCH ALWAYS MATCHES
25020 N = 11:M$(1) = ""
25030  FOR K = 1 TO SIZE: REM  FIND WHAT NEEDS MATCHING
25040 M1$ =  MID$ (MSENT$,K,1): IF M1$ = "," THEN M$(N) = GU$ +
   M$(N) + GU$:N = N + 1:M$(N) = "": GOTO 25070
25050  IF M1$ = "$" THEN  GOSUB 25130: GOTO 25070
25060 M$(N) = M$(N) + M1$
25070  NEXT : IF M1$ <  > "$" THEN M$(N) = GU$ + M$(N) + GU$:N =
   N + 1
```

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Pilot-To-Basic, continued...

```
25080 N = N - 1: IF N = 0 THEN  RETURN
25090  PRINT LNUM" FLAG=0":LNUM = LNUM + 10
25100 JPT = LNUM + N x 10: REM  JUMP WHEN MATCHED
25110  FOR K = 1 TO N: PRINT LNUM" CHECK="  "M$(K)";:GOSUB 10: IF FLAG
   =1 THEN "JPT:LNUM = LNUM + 10: NEXT :LNUM = LNUM  10: RETURN
25120  REM  HANDLE VARIABLES
25130 K = K + 11 IF K  SIZE THEN  RETURN
25140  FOR K1 = K TO SIZE:M1$ =  MID$ (MSENT$,K1,1):: IF M1$ = "," THEN
   K = K1 + 11 GOTO 25170
25150  IF M1$ = "$" THEN K = K1 + 2: GOTO 25170
25160 M$(N) = M$(N) + M1$: NEXT 1K = K1 + 1
25170 M$(N) = M$(N) + "$":: IF  LEN (M$(N)) = 1 THEN M$(N) = "":M1$ =
   "$"!! RETURN ! REM   PROBABLY A SYNTAX ERROR THAT IS IGNORABLE
25180 N = N + 11M$(N) = "":M1$ = "$": RETURN
26000  REM *****
26010 HANG  0:REVERSE = 0: PRINT LNUM;: REM      T INSTRUCTION
26020  IF L = 2 THEN 26100
26030 A$ =  MID$ (MSENT$,2,1): IF A$ = "C" THEN  PRINT "HOME:":: GOTO
   26100
26040  IF A$ = "I" THEN  PRINT "INVERSE:":REVERSE = 1: GOTO 26100
26050  IF A$ = "H" THEN HANG = 1: GOTO 26100
26060  IF  LEN (MSENT$)  4 OR A$  "S" OR A$  "U" THEN 26090
26070 MSENT$ =  RIGHT$ (MSENT$, LEN (MSENT$) - 3):MSENT =  VAL (MSENT$):
   IF MSENT  1 OR MSENT  20 THEN 26090
26080  PRINT "VTAB "MSENT + 3: RETURN
26090  PRINT "STOP:REM SYNTAX "SENT$:BAD = BAD + 1:  CALL  - 1059: CALL
   -1059: RETURN
26100  IF L = SIZE THEN  PRINT "PRINT": RETURN ! REM  BLANK LINE
26110 M$ = SIZE - LIM$:M$ =  RIGHT$ (MSENT$,SIZE)
26120 N = 1:M$ = QU$: PRINT "PRINT";:QU = 1: REM      WATCH THE QUOTES
26130  IF  LEFT$ (MSENT$,1)  "$" THEN M$ = QU$:QU = 1
26140  FOR K = 1 TO SIZE:M1$ =  MID$ (MSENT$,K,1): IF M1$  "$" THEN
   M$ = M$ + M1$: GOTO 26170
26150  IF QU = 1 THEN QU = 0:M$ = M$ + QU$: GOTO 26170
26160 QU = 1:M$ = M$ + M1$ + QU$
26170  NEXT
26180  IF  RIGHT$ (SENT$,1)  "$" AND QU = 1 THEN M$ = M$ + QU$: GOTO
   26200
26190  IF  RIGHT$ (SENT$,1)  "$" AND QU = 0 THEN M$ = M$ + "$"
26200  PRINT M$;: IF HANG = 1 THEN  PRINT QU$" "QU$";": GOTO 26220
26210  PRINT
26220  IF REVERSE = 1 THEN LNUM = LNUM + 10: PRINT LNUM"NORMAL"
26230  RETURN
27000  REM *****
27010  IF NP = 0 THEN  GOTO 27040: REM  U-COMMAND
27020  FOR K = 1 TO NP: IF NP$(K,0) = MSENT$ THEN  PRINT LNUM"GOSUB
   "NP$(K,1):: RETURN
27030  NEXT K
27040 NEED = NEED + 1:NEED$(NEED,0) = MSENT$:NEED$(NEED,1) =  STR$
   ( - LNUM): RETURN ! REM   STORE THE NOT-FOUND PROCEDURE LABEL
28000  REM *****
28010  FOR K = 1 TO 9: REM  E-INSTRUCTION CLOSE OFF LABELS
28020  IF NL(K) = 1 THEN  PRINT CPROC + K!"STOP: REM NO LABEL "K:BAD
   = BAD + 1:  CALL  - 1059: CALL  - 1059
28030 NL(K) = 0: NEXT
28040  IF NL(10) = 2 THEN  PRINT CPROC + 10" GOTO "LNUM:NL(10) = 3: REM
   DIRECT END JUMPS
28050  REM  END OF MAIN PROCEDURE?
28060  IF LNUM  30000 THEN  PRINT LNUM" PRINT O$'OU$"RUN HELLO"OU$:
   LNUM = 30000  10: RETURN
28070  PRINT LNUM;"RETURN":LNUM = 1000 x  INT ((LNUM + 1000) / 1000)
   10: RETURN
29000  REM *****
29010 K = VAL (MSENT$): REM   J INSTRUCTION
29020  IF K  1 THEN 29070: REM  FOUND PROCEDURE CALL
29030  IF K  9 THEN  PRINT LNUM" STOP: REM BAD LABEL "SENT$:BAD =
   BAD + 1:  CALL  - 1059: CALL  - 1059: RETURN
29040  PRINT LNUM" GOTO "CPROC + K
29050  IF NL(K)  2 THEN NL(K) = 1: REM  SHOW THAT LABEL USED
29060  RETURN
29070  IF MSENT$ = "E" THEN  PRINT LNUM" GOTO "CPROC + 10:NL(10) = 2
   : RETURN ! REM  JUMP TO AN END
29080  IF NP = 0 THEN 29110: REM  FIND THE PROCEDURE
29090  FOR K = 1 TO NP: IF NP$(K,0) = MSENT$ THEN  PRINT LNUM" GOTO
   "NP$(K,1): RETURN
29100  NEXT
29110 NEED = NEED + 1:NEED$(NEED,0) = MSENT$:NEED$(NEED,1) =  STR$
   (LNUM): RETURN ! REM   STORE THE NOT-FOUND PROCEDURE LABEL
29120  REM  STORE NOT FOUND PROCEDURE
30000  REM *****
30010  FOR K = 1 TO 9: REM  x-COMMAND
30020  IF NL(K) = 1 THEN  PRINT CPROC + K!" STOP: REM NO LABEL "K":
   BAD=BAD+1:CALL-1059:CALL-1059
30030 NL(K) = 0: NEXT
30040  IF NL(10) = 1 THEN  PRINT CPROC + 10" GOTO "LNUM: REM  DIRECT
   END JUMP
30050 NL(10) = 0:CPROC = LNUM
30060  IF NP = 0 THEN 30090
```

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Pilot-To-Basic, continued...

```
30070  FOR K = 1 TO NP: IF NP$(K,0) = MSENT$ THEN  PRINT LNUM" @TOP:
   REM DUP PROCEDURE "SENT$:BAD = BAD + 1: CALL   1059: CALL   105
   9: RETURN
30080  NEXT
30090  NP = NP + 1
30100  NP$(NP,0) = MSENT$:NP$(NP,1) =  STR$ (LNUM):? LNUM"GOTO"
   LNUM + 20":REM PROCEDURE "MSENT$
30110  LNUM = LNUM + 10: RETURN
31010  Y =  LEN (MSENT$): IF Y   2 THEN 40230
35000  REM xxxxx
35010  IF SOUND = 1 THEN 35040
35015  PRINT"1949 SOUND=770:FOR K=0TO21:READX:POKE54300+K,X:NEXTK"
35020  PRINT 1950"DATA 169,20,133,7,173,48,192,136,208,4,198,7,240,7
   ,202,208,246,162,23,208,239,96:REM LOAD SOUND ROUTINE"
35030  PRINT LNUM;: CONSUME 40200: IF OK = 0 THEN  RETURN : REM  ERROR
35040  PRINT "POKE(SOUND+10),"X":POKE (SOUND+1),"Y":CALL SOUND": RETURN
40000  REM xxxxx
40010  PRINT LNUM;:A$ =  MID$ (MSENT$,2,1): IF  LEN (MSENT$)   4 THEN
   40150
40020  SIZE = SIZE - 1:MSENT$ =  RIGHT$ (MSENT$,SIZE)
40030  IF A$ <  "S" THEN 40080
40040  PRINT "ONERR GOTO "LNUM + 30: PRINT LNUM + 20"PRINTCHR$(4);" CHR$
   (34)"BLOAD "MSENT$ CHR$ (34)"(SCTO "LNUM + 50: REM   BE ABLE TO
   ERROR RECOVER
40050  PRINT LNUM + 30"PRINT "OU$"PICTURE "MSENT$" NOT FOUND "OU$":FOR
   K=1TO2000:NEXTK"
40060  IF LNUM > 30000 THEN  PRINT LNUM + 40"CALL 768": REM   APPLESOFT
   PATCH FOR ERROR RECOVER IN SUBROUTINE
40070  LNUM = LNUM + 50: PRINT LNUM"POKE 216,0": RETURN
40080  IF A$ <  "P" AND A$ >  "L" THEN 40180
40090  GOSUB 40200: IF OK = 0 THEN  RETURN : REM  GET VALUES
40100  IF X < 0 OR X > 100 THEN X = 0
40110  IF Y < 0 OR Y > 100 THEN Y = 0
40120  X = X * 2.751: Y = 140   Y * 1.55
40130  IF A$ = "P" THEN  PRINT "HPLOT "X","Y": RETURN
40140  IF A$ = "L" THEN  PRINT "HPLOT TO "X","Y": RETURN
40150  IF A$ = "Q" THEN  PRINT "TEXT": RETURN
40160  IF A$ = "C" THEN  PRINT "HGR": RETURN
40170  IF A$ = "O" THEN  PRINT "HGR : HCOLOR=3:VTAB21": RETURN
40180  PRINT "STOP": REM SYNTAX ERROR "SENT$: CALL   1059: CALL   1
   059:BAD = BAD + 1: RETURN
40190  REM  FIND TWO NUMBERS INSIDE MSENT$ SEPARATED BY BLANK OR COMMA
40200  OK = 1:X =  VAL (MSENT$)
40210  Y =  LEN (MSENT$):I = IF Y   1 GOTO 40230
40220  OK = 0: PRINT "STOP :REM NEEDS TWO NUMBER "SENT$:BAD = BAD +
   1: CALL   1059: CALL   1059: RETURN
40230  FOR J = 1 TO Y   1: IF  MID$ (MSENT$,J,1)    " " THEN 40250
40240  NEXT J:GOTO 40220: REM  ERROR
40250  FOR K = J TO Y   1:M$ =  MID$ (MSENT$,K,1): IF M$ = " " OR M$
   = "," THEN Y =  VAL ( RIGHT$ (MSENT$,Y   K)): RETURN
40260  NEXT K: GOTO 40220
50000  REM xxxxx
50010  REM  CAUSE THE LOADING OF MATCH SUBROUTINE
50020  IF PFLAG = 1 THEN  RETURN
50030  IF PFLAG = 0 THEN  PRINT O$;"WRITE "ENAME$
50040  PRINT "NEW":: PRINT "1SPEED=160: POKE34,0: HOME : INVERSE : PR
   INT"OU$"LESSON " RIGHT$ (NAME$, LEN (NAME$)   6)OU$":VTAB:POKE34,3:
   NORMAL:GOTO60000"
50050  PRINT "10 FLAG=0: LCHECK=LEN(CHECK$):LANS=LEN(ANS$):REM MATCH
   SUBROUTINE"
50060  PRINT "20 IF LANS=0 OR LCHECK=0 OR LANS   LCHECK THEN RETURN"

50070  PRINT "30 IF ANS$=CHECK$ THEN FLAG=1:RETURN"
50080  PRINT "40 FOR L1=1 TO LANS-LCHECK+1: FOR L2=1 TO LCHECK"
50090  PRINT "50 IF MID$(CHECK$,L2,1)<>MID$(ANS$,L1-1+L2,1)THEN NEXT
   L1:RETURN"
50100  PRINT "60 NEXT L2:FLAG=1:L1=1000:NEXTL1:RETURN"
50110  PRINT "70ANS$="OU$OU$
50120  PRINT "80GETA$:IFA$="OU$OU$"THEN80"
50125  PRINT "85 IF ((LEN(ANS$) = 0) AND(A$=CHR$(8)))THEN 80"
50130  PRINT "110 IF A$=CHR$(8) THEN PRINT"OU$" "
   OU$"CHR$(8);:ANS$=LEFT$(ANS$,LEN(ANS$)-1):GOTO80"
50140  PRINT 100"IF(A$<CHR$(8)ORA$=CHR$(24))ANDLEN(ANS$)<2THEN70"
50150  PRINT "110IFA$=CHR$(8)THENPRINTCHR$(8)"OU$" "OU$"CHR$(8):ANS$
   =LEFT$(ANS$,LEN(ANS$)-1):GOTO80"
50160  PRINT "120 IF A$=CHR$(24)THENFORJ=1TOLEN(ANS$):PRINTCHR$(8)"Q
   U$" "OU$"CHR$(8);:NEXT:GOTO70"
50170  PRINT "130ANS$=ANS$+A$:GOTO80"
50180  PRINT "1900 GOTO 1920":LNUM = 2000
50190  PRINT "60000 HOME:VTAB 6:PRINT"OU$"LESSON " RIGHT$ (NAME$, LEN
   (NAME$)   6)OU$
50200  PRINT "60010 VTAB10:PRINT "OU$"GENERATED USING PILOT->BASIC"O
   U$":PRINT :PRINT"OU$"H. SMITH FEB 1982"OU$
50210  PRINT "60020 FOR J=1 TO 3000:NEXTJ"
50220  K = 60030
50230  PRINT K"BELL$=CHR$(7): REM BELL CHARACTER":K = K + 10
50240  PRINT K"O$ =CHR$(4):REM OISK CONTROL":K = K + 10
50250  PRINT 1920"FOR K = 0 TO 9 : READ X: POKE (760 + K),X:NEXTK"
```

```
50260  PRINT 1930"DATA104,168,104,166,223,154,72,152,72,96:REM ONERR
    PATCH"
50280  PRINT K" HOME: GOTO 1900": RETURN
59900  STOP
60000  REM *****
60010  REM  NAMES AND INITIALIZATION
60020 SENT$ = "": REM  CURRENT PILOT SENTENCE
60030 MSENT$ = "": REM  MODIFIED SENTENCE
60040  IZE = 0: REM   LENGTH(MSENT$)
60050 LNUM = 1900: REM    CURRENT LINE NUMBER
60060 J = 0:K = 0:L = 0:N = 0:X = 0: REM  DUMMY VARIABLES
60070  FOR K = 1 TO 10:NL(K) = 0: NLXT : REM   LABELS IN USE
60080 CPROC = 1900: REM   CURRENT PROCEDURE
60090 A$ = "": REM  DUMMY VARIABLE
60100 FLAG = 0: REM  FLAG CONTROL OF Y/N INSTRUCTION
60110 BAD = 0: REM  FLAG FOR BAD SYNTAX
60120 D$ = CHR$ (4): REM   CONTROL D
60130 QU = 0: REM  CHECK ON PAIRS OF QUOTES
60140 QU$ = CHR$ (34): REM  QUOTE "
60150 BELL$ = CHR$ (7): REM  BELL
60160 HANG = 0: REM  CONTROL OF  CR  IN T INSTRUCTION
60170  DIM M$(30): REM  DUMMY STORAGE USED IN M INSTRUCTION
60180 M1$ = "": REM  DUMMY VARIABLE USED IN M INSTRUCTION
60190 NP = 0: REM  NUMBER OF PROCEDURES DEFINED
60200  DIM NP$(30,1): REM  PROCEDURE NAMES AND LINENUMS
60210 NEED = 0: REM   UNDEFINED PROC
60220  DIM NEED$(60,1): REM  UNDEFINED PROC AND WHERE CALLED.  +VE
   CALL NEEDS GOTO, -VE CALL NEEDS GOSUB
60230 NAME$ = "": REM  PILOT.NAME$ IS CURRENT PROGRAM NAME
60240 ENAME$ = "": REM  EXEC.ENAME$ IS CURRENT OUTPUT FILE
60250 PFLAG = 0: REM  PRINTS TO SCREEN AS OUTPUT WHEN SET
60260 LW = 2000: REM     LOOP WAIT FOR LOOPS
60270 SOUND = 0: REM  CONTROLS LOADING OF SOUND ROUTINES
60280 REVERSE = 0: REM  CONTROLS INVERSE USE IN T INSTRUCTION
61000  HOME : VTAB 10: PRINT "PILOT-BASIC CONVERTER": PRINT : PRINT
   "M.R.SMITH   FEB 1982"BELL$BELL$: FOR J = 1 TO LW: NEXT J
61010  HOME : VTAB 10: GOTO 20
62000  REM *****
62010  HOME : VTAB 10: PRINT "CHECK SYNTAX ONLY "BELL$;: INPUT A$: IF
    LEFT$ (A$,1) = "Y" THEN PFLAG = 1: RETURN
62020  IF  LEFT$ (A$,1)      "N" THEN  PRINT BELL$BELL$: GOTO 62010
62030 PFLAG = 0: RETURN
```


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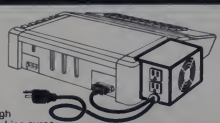

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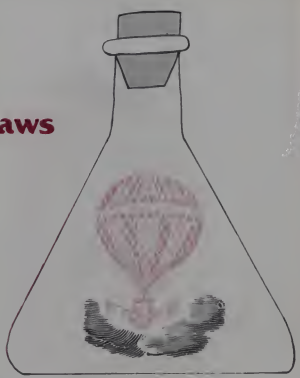
CIRCLE 305 ON READER SERVICE CARD

Demonstrating the Gas Laws

David A. Holko



Gas laws frequently present problems for students studying General Chemistry. One reason for the difficulty is the student's inexperience in working with gases in a laboratory.

The concepts involving an ideal gas confined to a container where pressure on the gas, temperature of the gas, or number of moles of gas can be controlled remain nebulous even when examples of tire pumps, aerosol cans, balloons or lab bottles are explained.

This program, when used as a student activity, attempts to demonstrate the relationship between volume and pressure for Boyle's Law, volume and temperature for Charles's Law, or volume and moles of gas for Avagadro's Law.

Initially, the student selects the law which is to be demonstrated. The video monitor shows a simple cylinder, and positions the piston, which traps a volume of gas and is ready to respond to changes in temperature, pressure, or moles of gas confined respective of the law chosen.

When an increase or decrease is entered, the piston moves, correspondingly, showing the effect on the volume of confined gas. The changes are calculated using the ideal gas law V = nRT/P where V is volume, n is the number of moles of gas, R the universal gas constant, T the temperature and P the pressure.

If the student graphs the computer calculated values, checks the values by doing hand calculations, or closely analyzes the values calculated by the computer, the relationship of molar gas volume at Standard Temperature and Pressure may become obvious.

The advanced student, via graphing and analysis, can be led to determine the actual value of R, the Universal Gas constant, by using the computer simulation as an experimental apparatus.

There is a minimum volume the cylinder will hold. This design was effected to allow graphic extrapolation of the data to determine the value of Absolute Zero with Charles's Law.

The programming is simple and short, written to aid and reinforce the student's application of the gas laws and equate a simulated moving piston to theoretical values derived using the ideal gas law. □

```
  1 'GAS LAWS VERSION 3.0  WRITTEN BY DAVID A. HOLKO
 2 CLS:
 .  E$="###.###":
   PP=1:
   P=.092056:
   N=1:
   T=275.15:
   N(1)=1:
   N(2)=40:
   N(3)=1:
   U$(1)="GAS PRESSURE":
   U$(2)="GAS TEMPERATURE":
   U$(3)="MOLES OF GAS":
   F(1)=.01:
   F(2)=9:
   F(3)=.025
 3 PRINT"1 BOYLES LAW":
   PRINT"2 CHARLES LAW":
   PRINT"3 AVOGADRO'S LAW":
   INPUT"CHOOSE FROM THE ABOVE LAWS";C:
   IFC>3ORC<1THENCLS:
   GOTO3    ELSECLS
 4 PRINT@70,"GAS CYLINDER WITH PISTON  ":
   PRINTCHR$(92);:
 5 FORX=1TO20:
   SET(X,8):
   SET(X,14):
   NEXTX:
   FORX=9TO14:
   SET(1,X):
   SET(2,X):
   NEXTX
```

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Gas Laws, continued...

```
 6 IFC=1THENPRINT@778,"PPESSURE     ";:
   PRINTUSINGB$;N(C);:
   PRINT"  ATM";
 7 PRINT@714,"VOLUME       ";:
   PRINTUSINGB$;V;:
   PRINT"  LITERS";
 8 IFC=2THENPRINT@778,"TEMPEPATURE ";:
   PRINTUSINGB$;N(C);:
   PRINT"  DEGREES K";
 9 IFC=3THENPRINT@778,"MOLES OF GAS";:
   PRINTUSINGB$;N(C);:
   PRINT"  MOLES";
10 PRINT@900,"TYPE (I) TO INCREASE OR (D) TO DECREASE THE ";V$
   (C);".";
11 R$(1)="THE PRESSURE ON THE GAS IS APPLIED BY THE PISTON."
12 R$(3)="THE MASS OF GAS IN THE CYLINDER CAN BE CHANGED."
13 H$(3)="PRESSURE & TEMPERATURE ARE HELD CONSTANT AT STF."
14 R$(2)="THE TEMPERATURE OF THE CYLINDER HOLDING THE GAS CAN
   BE CHANGED."
15 H$(2)="ONE MOLE OF GAS & STD. PRESSURE ARE HELD CONSTANT."
16 H$(1)="ONE MOLE OF GAS & STD. TEMPEPATURE ARE HELD CONSTANT
   ."
17 PPINT@448,R$(C);:
   PPINT@512,H$(C):
   IFZZ=0THENGOTO21
18 PPINT@980,"TYPE (R) TO RERUN PROGRAM.";
19 A$=INKEY$:
   IFLEN(A$)=0:
   GOTO19
20 IFA$="I"THENN(C)=N(C)+F(C)ELSEIFA$="D"THENN(C)=N(C)-F(C)ELS
   EIFA$="R"THENPUNELSEGOTO19
21 IFC=1THENV=(N*R*T)/N(1)
22 IFC=2THENV=(N*R*N(C))/PP
23 IFC=3THENV=(N(C)*P*T)/PP
24 ZZ=1:
   P=V+200:
   IFP<201THENGOTO26   ELSEIFP>245THENGOTO27   ELSEGOSUB25   :
   GOTO6
```


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```
25 PRINT@P,CHR$(191);:
   PRINT@P+64,CHR$(191);:
   PRINT@P-1,CHR$(128);:
   PRINT@P+63,CHR$(176);:
   PRINT@P+1,CHR$(128);:
   PRINT@P+65,CHR$(176);:
   PRINT@P+1,CHR$(176);CHR$(93)" PISTON  ";:
   PRINT@P+120,"  ";CHR$(91);" TRAPPED GAS ";:
   RETURN
26 IFC=3ORC=2THENPRINT@512,"THE MINIMUM VOLUME OF THIS CYLINDE
   R HAS BEEN REACHED.";:
   GOTO19   ELSEPRINT@512,"THE MAXIMUM PRESSURE THIS PISTON CA
   N EXERT HAS BEEN REACHED.";:
   GOTO19
27 PRINT@512,"THE MAXIMUM VOLUME FOR THIS CYLINDER HAS BEEN RE
   ACHED.";:
   GOTO19
```

```
      GAS CYLINDER WITH PISTON  \
##############################################################
##                              ###] PISTON
##############################################################
                        [ TRAPPED GAS

THE PRESSURE ON THE GAS IS APPLIED BY THE PISTON.
ONE MOLE OF GAS & STD. TEMPERATURE ARE HELD CONSTANT.


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                    BOYLE'S LAW SCREEN


      GAS CYLINDER WITH PISTON  \
##############################################################
##          ###] PISTON
##############################################################
     [ TRAPPED GAS

THE TEMPERATURE OF THE CYLINDER HOLDING THE GAS CAN BE CHANGED.
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      GAS CYLINDER WITH PISTON  \
##############################################################
##                              ###] PISTON
##############################################################
                        [ TRAPRED GAS

THE MASS OF GAS IN THE CYLINDER CAN BE CHANGED.
PRESSURE & TEMPERATURE ARE HELD CONSTANT AT STP.


          VOLUME        22.414  LITERS
          MOLES OF GAS   1.000  MOLES

    TYPE (I) TO INCREASE OR (D) TO DECREASE THE MOLES OF GAS.
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CIRCLE 233 ON READER SERVICE CARD

Animath

Jerry Wright and Lloyd Ollman, Jr.

The graphics potential of the Atari personal computer is a powerful educational tool. It can be used to transform the chores of learning into the fun of learning.

A growing number of companies now produce educational software for the Atari computer, but the quality of this software varies widely. A good children's educational program draws children to play with it, and allows learning to happen along with the fun.

When you think back to your school days (assuming you're not still there), what did you find to be the worst part of the learning process? For us it was drill and practice. Here's a children's educational program that makes addition practice enjoyable using an interesting type of animation.

The program is called Animath, for animated math program, and it uses a modified character set to create a sauntering gorilla. Player/missile graphics are also used to spice up the game.

There are several commercial programs which can be used to create modified character sets. Perhaps the best-known of these is *Fontedit*, from Iridis #2. We used a program similar to this to write a "gorilla" font to disk. The original version of this program called the font from disk and loaded it into memory. The Atari character set is a part of ROM, so the font must be moved to RAM, where it can be modified by the appropriate POKEs into memory.

We knew that many Atari owners utilize cassette storage, so we wrote a little utility to save the font as data statements at the end of the program. There are 24 modified characters, represented as 24 data statements. Because the characters are set up in 8 x 8 blocks, each of the eight numbers in the individual data statements is one 8-bit word, or byte.

After the gorilla is POKEd into RAM, he can be animated by the POSITION command. By changing the positions of his arms and legs, we simulate motion, and the gorilla is able to run down the screen to the first problem.

Thanks to Basic A+ from Optimized Systems Software, we were able to get an accurate list of variables. The first list we generated contained several variables we couldn't find. After listing the program to disk and entering it back in the computer, we came up with an accurate variable table, without all the variables that had been eliminated in earlier incarnations of the program. It's always wise to LIST, then ENTER programs when they are finished, to clear the Atari variable table of all but the variables actually being used.

Jerry Wright, 18812 116 Ave. SE, Renton, WA 98055.

Variable Table

NU$—String holding answer input by player
TN$—String holding randomly generated top number
BN$—String holding randomly generated bottom number
A$—String to hold player input to questions
P—Horizontal position of individual number input by player as an answer
START—Beginning location of character set in the operating system
NOW—Variable loop pointing to next character in the character set
CH—ATASCII number of character set
Q—Location of RAMTOP (PEEK (106))
I—Location of PLAYER/MISSILE Base Address
T—Variable for top end of volume in motion sounds
L—Number of problems completed
X—Horizontal position variable
WAL—Gorilla movement subroutine
PR—Number of problems chosen
W—Number of problems successfully completed
TN—Actual top number of problem
BN—Actual bottom number of problem
D—Decreasing pitch used in booming sound
E—Timing loop variable
A—Vertical position of gorilla or erase pattern
K—ATASCII number input from keyboard
N—Actual number input from keyboard
AMT—Answer: total of answer numbers in the ones, tens, and hundreds columns
J—Sum of top number (TN) and bottom number (BN)

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CIRCLE 223 ON READER SERVICE CARD

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C—Number of times gorilla goes through movement routine
B—Volume of motion sound routine ending in variable T, also wait routine
F—Flag set to 0: input character set. Flag set to 1: jump directly to main body of program
WT—Wait routine

The Program

Lines 0 through 4 introduce our authors, and set up our new character set. Line 2 DIMensions the various strings we will need, and makes sure that the string to hold the answer is empty.

In line 3 we find the top of our available memory by PEEKing RAMTOP, which is location (106) in memory. Then we fool the operating system into believing that the available memory is five pages smaller than it actually is, so we won't accidentally load our program on top of the changes we are going to make.

We then get an even number above our new RAMTOP (by adding 1) and multiply this number by 256. This new value of Q gives us the starting location of our new character set.

We use the number 256 because the Atari 6502 microprocessor divides memory into 256-byte "pages," and we must start the new character set at the beginning of an even page mark.

Line 4 begins the river sound and jumps to the introduction and instructions.

The subroutine at 6100 prints out the name of the program, and the authors. Then there is a pause at line 6120, so the title can be read, followed by a jump to the section asking for the number of problems desired—line 6000.

If this is the first time the program has been run, the F flag is set at 0 and a message asks the player to wait while the character set is set up. The program then returns to line 5.

The Atari character set can't actually be changed, because it is permanently embedded in ROM starting at address 57344. So we must move it into RAM. We do this in line 3 by PEEKing the character set and then POKEing it into the space we have set aside above RAMTOP.

Line 6 reads the DATA defining the new characters and POKEs it into our new locations. In line 11 we POKE the location of our new character set into location (756), just above RAMTOP in the Character Base Register.

There is a stream in our graphics jungle. In line 8 we create this by turning on two Players and setting their location just below RAMTOP then POKEing this into the Player/Missile Base address 52479.

Jumping to line 15, the horizontal position of Player 0 is POKEd into 53248, Player 1 into 53249. POKEs (704) and (705) set the color, POKEs (53261) and

```
0 REM ANIMATH BY LLOYD ULLMANN  AND JERRY WRIGHT (C)
1981 BY LJ SOFTWARE
2 DIM NU$(5),TN$(3),BN$(3),A$(1):NU$=" ":F=4:POKE 764,255
3 Q=PEEK(106):Q=Q-5:POKE 106,Q:Q=Q+1:Q=Q*256
4 SOUND 0,8,8,4:GOSUB 6100
5 START=57344:FOR NOW=0 TO 1023:CH=PEEK(START+NOW):POKE
Q+NOW,CH:NEXT NOW
6 FOR NOW=264 TO 463:READ CH:POKE Q+NOW,CH:NEXT NOW
8 I=PEEK(106)-8:POKE 54279,I
11 GRAPHICS 17:POKE 756,Q/256:SETCOLOR 4,1,2
12 T=20:SETCOLOR 2,0,0
15 POKE 53248,95:POKE 53249,127:POKE 704,117:POKE 705,117:
POKE 53261,255:POKE 53262,255:POKE 53256,3:POKE 53257,3
35 L=-1:X=1:WAL=500
40 POSITION X+1,21? #6;"{ABJ}";:POSITION X+1,3;
#6;"{CD}";:POSITION X+1,4;? #6;"{EF}";
55 TN$(2,2)=STR$(INT(RND(1)*10))
:BN$(2,2)=STR$(INT(RND(1)*10)):L=L+1:IF L=FR THEN GOTO 7000
56 POSITION 2,0;? #6;W;"/";L;
57 TN$(1,1)=STR$(INT(RND(1)*10))
:BN$(1,1)=STR$(INT(RND(1)*10))
58 TN=VAL(TN$):BN=VAL(BN$)
60 POSITION X+1,20;? #6;TN$;:POSITION X,21;?
#6;"+";BN$;:POSITION X,22;? #6;"  ";
70 POSITION X,23;? #6;"  ";:GOSUB WAL
100 SOUND 0,8,8,4
120 IF RND(1)>0.95 THEN FOR D=10 TO 5 STEP -1:SOUND
1,D,10,INT(RND(1)*10):NEXT D:SOUND 1,0,0,0
140 GOSUB 600
180 IF RND(1)>0.95 THEN FOR D=10 TO 5 STEP -1:SOUND
1,D,10,8:NEXT D:SOUND 1,0,0,0
184 GOSUB 600
185 IF RND(1)>0.95 THEN FOR D=15 TO 0 STEP -1:SOUND
1,100,8,D:FOR E=1 TO 20:NEXT E:NEXT D:SOUND 1,0,0,0
195 GOSUB 600
200 GOTO 120
500 FOR A=2 TO 17
501 GOSUB 2000
535 NEXT A
```

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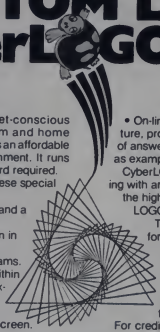

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CIRCLE 152 ON READER SERVICE CARD

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CIRCLE 306 ON READER SERVICE CARD

(53262) set up the shape and POKEs (53256) and (53257) set up Player size.

We keep track of the number of times the Gorilla finds a problem with the variable L, and use the variable X as the X coordinate of our gorilla's location. Atari Basic accepts names as well as line numbers in GOTOs and GOSUBs, so we give the movement subroutine a name, WAL.

Line 40 sets the starting location of the animal by using a position statement in X/Y coordinate form. Line 55 then randomly selects a top number which is placed in TN$ and a bottom number, placed in BN$.

Line 56 places the number of problems successfully answered next to the number of problems tried, and line 57 gets more numbers for the number strings. Line 58 gets the value of the strings and places them into variables TN and BN.

Line 60 places the numbers in their proper positions at the bottom of the screen.

In line 60 we jump to the gorilla animation section. This time WAL=500 so in line 500 we find the vertical positions for the gorilla in a FOR/NEXT loop and jump to the actual movement subroutine at line 2000.

Lines 2000 through 2009 draw the gorilla and move his arms and legs, while making the movement sound. Then the subroutine jumps back to line 501 where it gets a new position from the variable A in the FOR/NEXT loop. It then goes back to the movement routine until it reaches vertical position 17 on the screen. Next we jump back to line 100 for a sound routine and then jump to line 600.

This is the keyboard routine—where we PEEK location (764) to find the internal code of the last key pressed. The computer runs through a series of IF/THEN statements to determine which key has been pressed by the player, and compares it to a list of valid inputs. The first number input goes into the ones column, the second into the tens column, the third into the hundreds column, and the fourth into the thousands column.

This is done by setting up a number holding string (NU$). The position of the number in the string is determined by line 700, which starts with P=4, so the first number is placed in the fourth position of NU$, the second number in the third position and so on. Line 705 prints the NU$ on the screen and then the Atari loops around to line 120 and back through the keyboard routine until Return is pressed at line 660.

Line 670 allows you to recover if a mistake is made. All you have to do is press Delete/Backspace or the Space Bar, the NU$ is cleared, and you start back at the ones column. You then repeat the

```
540 RETURN
600 TRAP 840:X=PEEK(764)
610 IF K=31 THEN N=1:GOTO 700
615 IF K=30 THEN N=2:GOTO 700
620 IF K=26 THEN N=3:GOTO 700
625 IF K=24 THEN N=4:GOTO 700
630 IF K=29 THEN N=5:GOTO 700
635 IF K=27 THEN N=6:GOTO 700
640 IF K=51 THEN N=7:GOTO 700
645 IF K=53 THEN N=8:GOTO 700
650 IF K=48 THEN N=9:GOTO 700
655 IF K=50 THEN N=0:GOTO 700
660 IF K=12 THEN AMT=VAL(NU$):GOTO 800
670 IF K=33 THEN NU$="      ":P=4:GOTO 705
690 RETURN
700 P=P-1:IF P=1 THEN K=33:GOTO 670
701 NU$(P,P)=STR$(N):POKE 764,255
705 POSITION X,23:? #6;NU$:RETURN
800 J=TN+BN
810 NU$="      ":P=4:POKE 764,255:POSITION X,23:? #6;NU$
820 POSITION X+1,21:? #6;"  ":POSITION X+1,31:? #6;"
":POSITION X+1,41:? #6;"  ":
830 POSITION X+1,81:? #6;"  ":POSITION X,81+1:? #6;"
":POSITION X,8+21:? #6;"  ":
835 IF AMT=J THEN WAL=500:W=W+1:GOTO 1000
840 POKE 764,255:X=8:WAL=900:GOSUB 1010:GOTO 4000
900 T=30:FOR A=2 TO 17:GOSUB 5000:NEXT A:T=20:RETURN
1000 IF X=8 THEN 5000
1005 X=1:T=10:A=17:FOR C=1 TO 20:GOSUB 2000:NEXT
C:T=20:FOR B=1 TO 200:NEXT B:GOSUB 1010:GOTO 55
1010 FOR A=17 TO 23:POSITION 0,A:? #6;
":NEXT A:RETURN
2000 POSITION X+1,A-1:? #6;"  ":
2005 POSITION X+1,A:? #6;"[NO]":POSITION X+1,A+1:?
#6;"[PO]":POSITION X+1,A+2:? #6;"[RS]":
2006 FOR B=1 TO T:SOUND 3,200,8,B:NEXT B
2007 POSITION X+1,A:? #6;"[TU]":POSITION X+1,A+1:?
#6;"[YV]":POSITION X+1,A+2:? #6;"[WX]":
2008 FOR B=1 TO T:SOUND 3,200,8,B:NEXT B
2009 POSITION X+1,A:? #6;"[AB]":POSITION X+1,A+1:?
#6;"[CD]":POSITION X+1,A+2:? #6;"[EF]":SOUND
3,0,0,0:RETURN
3000 POSITION X+1,A-1:? #6;"  ":
```

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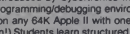

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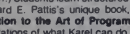

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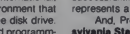

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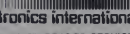

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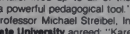

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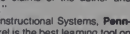

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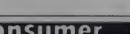

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CIRCLE 146 ON READER SERVICE CARD

Animath, continued...

procedure until you have what you feel is the correct answer.

Pressing Return takes you out of the loop at line 660 where this time the value of the numbers in NU$ is transferred to the variable AMT. We then jump to 800 to find out if the answer is correct.

Line 810 clears NU$ and resets location (764) by POKEing in 255.

Lines 820 and 830 blank out the standing gorilla, then 835 determines if the answer is right. If it is, the gorilla walking routine (WAL) jumps back to line 500, adds 1 to the amount answered correctly, and jumps to line 1000.

If AMT doesn't equal J, then the gorilla movement subroutine is set to 900, the horizontal position (X) is moved over 8 places, and the gorilla runs through the subroutine at line 400 which forces him into the river. A reverse FOR/NEXT loop carries him downstream in subroutine 3000. Then the program jumps back to line 55 where the new value of X swims him upstream with the subroutine at line 900, and gives him a new addition problem to answer.

If the question was answered correctly, the program jumps to the subroutine at 2000 through 2009, where the gorilla jumps up and down with joy. The routine then sets the sound volume variable T to 20 and the horizontal position variable X to 1 and then jumps back to the main program loop at line 55.

When the number of problems chosen (PR) equals the number actually done (L), the program goes to line 7000 where it displays a score and offers a chance to play again.

We hope this program and accompanying explanation have given you an idea of some of the things that can be achieved with the Atari Personal Computer. We enjoy this system thoroughly, and hope that many more people will soon see the Atari as a computer with truly incredible possibilities.

Instructions

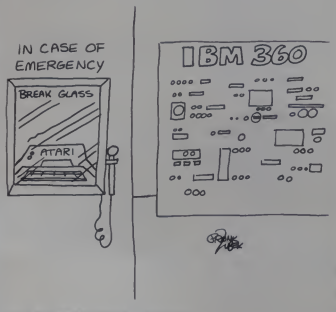
After the program is loaded and the player has chosen the number of problems, the gorilla will come on the screen and run down to the first problem. The answer should be typed in with the first number in the ones column, the second in the tens column, and the third in the hundreds.

If you make a mistake, just press the space bar. When you have the correct answer, press the return key. The gorilla will tell you if you are right.

In the listing that follows, several characters are in square brackets. These should be typed in as inverse characters. The Epson MX-80 prints a "] " instead of a clear sign, so when you see that symbol type Escape, then Control and Clear together. □

```
3001 POSITION X+1,A:? #6;"NO";:POSITION X+1,A+1:? #6;"[illegible]";
3002 FOR B=1 TO T:SOUND 3,170,8,B:NEXT B
3003 POSITION X+1,A:? #6;"TU";:POSITION X+1,A+1:? #6;"[illegible]";
3004 FOR B=1 TO T:SOUND 3,170,8,B:NEXT B
3005 POSITION X+1,A:? #6;"AB";:POSITION X+1,A+1:?
#6;"CD";:SOUND 3,0,0,0:RETURN
4000 T=10:FOR A=1 TO 2 STEP -1:GOSUB [illegible]
8,A+1:? #6;"  ";:NEXT A:T=20:GOTO 55
5000 GOSUB 1010:T=20:X=1:GOTO 55
6000 ? "}HOW MANY PROBLEMS WOULD YOU LIKE";:INPUT PR
6005 IF F=1 THEN 11
6010 ? "}JUST A MINUTE, WHILE I LET THE GORILLA
OUT OF HIS CAGE.":RETURN
6100 GRAPHICS 1:SETCOLOR 2,0,0:POSITION 6,4:?
#6;"[animath]":POKE 752,1:? "          A MATH PROGRAM BY"
6110 ? "   LLOYD OLLMANN AND JERRY WRIGHT":? "   CHARACTER
DESIGN   MIKE POTTER":POKE 752,1
6120 FOR WT=1 TO 1000:NEXT WT:? "}":GOSUB 6000:RETURN
7000 GRAPHICS 0:POKE 704,0:POKE 705,0:POKE 710,0
7010 ? "THIS TIME YOU GOT ";W;" OUT OF ";L:? "RIGHT.":?
"DO YOU WANT TO TRY AGAIN? (Y/N)":INPUT A$
7020 IF A$ >"Y" THEN END
7030 W=0:L=0:F=1:GOTO 6000
10000 DATA 0,0,0,0,1,3,6,52
10010 DATA 0,0,0,0,128,192,96,44
10020 DATA 124,254,255,239,239,231,231,199
10030 DATA 62,127,255,247,247,231,231,227
10040 DATA 71,83,115,6,6,4,2,14
10050 DATA 226,202,206,96,96,32,64,112
10060 DATA 255,255,255,255,255,255,255,255
10070 DATA 15,15,15,15,15,15,15,15
10080 DATA 240,240,240,240,240,240,240,240
10090 DATA 1,1,1,1,1,1,1,1
10100 DATA 128,128,128,128,128,128,128,128
10110 DATA 3,3,3,3,3,3,3,3
10120 DATA 192,192,192,192,192,192,192,192
10130 DATA 0,0,0,0,1,3,6,4
10140 DATA 0,0,0,0,128,198,110,63
10150 DATA 28,126,255,239,239,255,59,3
10160 DATA 63,127,255,227,227,227,231,[illegible]
10170 DATA 199,239,126,60,24,0,0,0
10180 DATA 224,224,112,48,48,60,60,0
10190 DATA 0,0,0,0,1,99,118,252
10200 DATA 0,0,0,0,128,192,96,32
```

```
10210 DATA 56,126,255,247,247,255,126,192
10220 DATA 7,7,14,12,12,14,124,0
10230 DATA 227,247,62,60,24,0,0,0
10240 DATA 252,254,255,199,199,199,254,119
20000 DATA 0,0,0,0,0,0,1,7
20010 DATA 0,62,0,0,0,0,0,128,192
20020 DATA 96,44,124,254,255,239,239,231
20030 DATA 231,199,62,127,255,247,247,231
20040 DATA 231,227,71,83,115,6,6,4
20050 DATA 2,14,126,202,206,96,96,32
20060 DATA 64,112,255,255,255,255,255,255
20070 DATA 255,255,15,15,15,15,15,15
20080 DATA 15,15,240,240,240,240,240,240
20090 DATA 240,240,1,1,1,1,1,1
20100 DATA 1,1,128,128,128,128,128,128
20110 DATA 128,128,7,7,7,7,7,7
20120 DATA 7,7,192,192,192,192,192,192
20130 DATA 192,192,0,0,0,0,1,7
20140 DATA 6,4,0,0,0,0,128,198
20150 DATA 110,63,28,126,255,239,239,255
20160 DATA 59,3,63,127,255,255,255,255
20170 DATA 231,238,199,239,126,60,24,0
20180 DATA 0,0,224,224,112,48,48,60
20190 DATA 60,0,0,0,0,0,0,1,99
20200 DATA 118,252,0,0,0,0,128,192
20210 DATA 96,32,56,126,255,247,247,255
20220 DATA 220,192,7,7,14,12,12,124
20230 DATA 124,0,227,247,62,60,24,0
20240 DATA 0,0,252,254,255,199,199,199
```



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CIRCLE 267 ON READER SERVICE CARD

A Mortgage Amortization Program for the Atari

Marijane Green

I wrote the following program for the Atari 400 or 800 while learning the ins and outs of Basic. It uses a standard banking formula to compute the mortage payment due when given the amount of the loan, interest rate and time period. It also displays the payment number, loan balance, amount of payment applied to the principle and the amount of interest charged that month.

In addition, the total annual interest is displayed for each calendar year. If only the annual interest payments are wanted, the following changes will cause the printing of the monthly figures to be suppressed.

Delete lines 130 and 140
170 X=X+1:TMI=TMI+MI
180 ?"INTEREST FOR YEAR ";Y;
"IS";TMI □

Marijane Green, 4801 N.E. 16 Ave., Ft. Lauderdale, FL 33334.

```
2 GRAPHICS 2:? #6;" MORTGAGE"!? #6;"      AMORTIZATION"!? #6;"""
3 ? #6;" BY MARIJANE GREEN"                          These instructions display a title on the screen.
5 FOR T=1 TO 5000:NEXT T:GRAPHICS 0
10 REM THIS IS A MORTGAGE PROGRAM
20 ? !? "THIS PROGRAM WILL COMPUTE THE"      The instructions on lines 20 to 36 merely tell the user what the program will do.
21 ? "MONTHLY PAYMENT DUE, GIVEN THE"
22 ? "AMOUNT OF LOAN, INTEREST RATE"
23 ? "AND THE TIME PERIOD."
30 ? !? "IN ADDITION A LISTING BY MONTH"
31 ? "WILL GIVE THE LOAN BALANCE, THE"
32 ? "AMOUNT OF PAYMENT APPLIED TO THE"
33 ? "PRINCIPLE FOR THAT MONTH AND THE"
34 ? "AMOUNT OF INTEREST PAID THAT MONTH."
35 ? !? "THE ANNUAL INTEREST PAYMENT WILL"
36 ? "BE PRINTED"!?
40 ? "AMOUNT OF LOAN IS ";:INPUT A                    Enter loan amount in dollars.
50 ? "RATE OF INTEREST IS ";:INPUT I                 Enter interest rate in %, i.e. 10.12.
60 ? "LENGTH OF TIME IN MONTHS IS ";:INPUT M         Enter number of months.
65 DIM F$(3):DIM MO$(3)                              Set up to accept a three-letter abbreviation for first month. See
70 ? "MONTH FIRST PAYMENT IS DUE IS ";:INPUT F$        DATA for spelling
80 ? "YEAR FIRST PAYMENT IS DUE IS ";:INPUT Y        Enter year as 19xx, or 20xx.
90 FOR X=1 TO 12:READ MO$:IF MO$=F$ THEN 110         X=number of months loan held in first year.
100 NEXT X:? "CHECK SPELLING!":GOTO 70               Abbreviation for month not correct.
110 R=I/1200:V=(R+1)^M:P=(R*V*A)/(V-1)               See note at end.
120 F=INT(P*100+0.5)/100:? !? "MONTHLY PAYMENT IS ";F  Round payment to nearest cent and print.
130 ? "MONTH","BALANCE","AMOUNT APPLIEDTO"           Set headings.
140 ? "  ","DUE","PRINC.","INTEREST"
150 FOR T=1 TO M:MI=A*R                              Start loop. Get monthly interest (MI).
160 MI=INT(MI*100+0.5)/100:S=P-MI:B=A-S:A=B          Round interest to nearest cent. Adjust values for display.
170 ? T,B,S,MI:X=X-1:TMI=TMI+MI                     Display table. Adjust X. Get total interest to date for this year.
172 IF X=0 THEN 180                                  Time to print yearly interest.
174 NEXT T
176 ? !? "INTEREST FOR YEAR ";Y;". IS ";TMI:END
180 ? !? !? "PAYMENT IS ";F:? "INTEREST FOR YEAR ";Y;" IS ";TMI:? !?   Print interest for last year.
190 X=12:Y=Y+1:TMI=0:GOTO 174                        Reset
200 DATA DEC,NOV,OCT,SEP,AUG,JUL,JUN,MAY,APR,MAR,FEB,JAN
```

NOTE: In line 110 the formula for computing the payment was taken from "How to Profit from Your Personal Computer" by T.G. Lewis, page 72. Payment=(i*VA)/(V-1)where i=monthly interest rate in fraction form; A=amount of loan, M=length of loan in months, V=amount of interest on $1 when compounded by adding interest fees; V=(i+1)M.

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14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIR1	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DAYDEVAL	Equivalent & nonequivalent dated values for oblig
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAPI	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLOK	Computes weeks total hours from timeclock info
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMJSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPROH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
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CIRCLE 136 ON READER SERVICE CARD

CROSS DOUBLE

Emily G. Johnston

Game programs are fine, but playing games with a computer wears a little thin after a while. How about a program that helps you create a game — a crossword puzzle, to be precise?

First, let me describe the puzzle. Most of you are familiar with a standard American crossword puzzle, in which words are inserted in a matrix diagram so that every letter is "keyed" — i.e., each letter is contained in two words. (English puzzles allow unkeyed letters, which makes them much harder.)

The kind of puzzle I am interested in is quite different — it's called a "double-crosstic" (D-C, for short). In these, the diagram is linear. Each square is numbered consecutively and words are formed along the line, not up and down. Each square has a letter code, which refers to a list of 'words,' and each 'word' has a definition. The puzzle-solver guesses the 'words' from their definitions and fills them into a set of dashes provided. Under each dash is a number which tells you where in the diagram the letter belongs.

When the puzzle is finished, the diagram will contain a quotation, and the initial letters of each 'word' will spell out the author's name and title of the work from which the quotation was taken.

For an example, look in the Sunday *New York Times Magazine* or in the back of any issue of *Saturday Review*. Many Sunday newspapers have them in their magazine supplements, also.

For some reason, these puzzles are rather addictive. I have been working them for years and have become rather expert at solving them (although not as expert as my father, who does them in ink!). Finally, I got the idea to try to make up some of my own.

To understand the creation of a D-C, we consider the problem in reverse. Choose a quotation. Write down the author's name and title of the source in a vertical list. Anagram the entire quote into a set of words beginning with those letters. Assign the cross-correspondence between letters in the words and letters in the quotation. Draw up the diagram and put all the numbers and code letters in. Think up some definitions for your words, and you are all done.

It's as much fun to make them up as to work them, but there are quite a few complications. It is very easy to miscount the letters. Generating the cross-correspondence is time-consuming and incredibly boring. Another problem is what I call the "end-game" — you get the whole thing almost done only to discover that you are left with two Q's, one R, three I's, and a Z. So, you return six or eight words to the letter pile and do it over. And over, and over. Finally, if you persevere, you will get a collection of decent words.

These puzzles are rather addictive. I have been working them for years and have become rather expert at solving them.

Professional puzzle-makers use Scrabble tiles to make up these puzzles. They get five or six sets, and put them into a box with 26 pigeonholes. (Go to a hardware store and try to find a box with 26 compartments in it.) Then they construct the quotation using the tiles and lay it out on the dining room table. The source letter box is put away and another box with 26 pigeonholes is used to collect the letters from the quote. Take out the letters for author-title and put them on the table. Start making up words, forming them with the tiles and putting them on the table.

About the time you are halfway through, the cat jumps on the table and scatters the tiles all over the room! The tiles solve the problem of miscounting or overlooking letters, but that's about all.

After making up a half-dozen or so, I decided that a computer program was definitely in order here. Besides eliminating the cat problem, it can keep a running count on all the letters, tell you when you have used a letter you do not have, compute the average number of letters per word required at any time, and — AND — do the cross-correspondence when you are finished.

There are probably all of four professional D-C puzzlemakers in the whole United States. They get maybe $50 per published puzzle, and have cornered what market there already is for them. Obviously, none of us are going to get rich off either the puzzles or the program. I wrote to the puzzlemakers I know of asking if there was an interest in such a program. I only got one reply, and he didn't know what the devil I was talking about.

Undaunted, I wrote the program anyway. It's called "DBLX," and it's so neat I have to share it with somebody. The puzzlemakers are too set in their ways to try our stuff, so here is a tool for you to try theirs.

DBLX is written in DEC PDP-11 Basic-Plus and is heavily dependent on the string manipulation features of that language. The code runs about 450 printed lines. The current version contains most of the bells and whistles, but there are a couple of limitations yet to be removed.

Emily Johnston, Director, Computer Center, Western Maryland College, Westminster, MD 21157.

The most severe limitation is that the input quotation can contain a maximum of 256 characters. This is due to the input buffering characteristics of Basic-Plus (and perhaps other Basics, too). This is not really long enough, although most quotations contain about that number of letters, the spaces between words and the punctuation need to be retained for readability, and for the cross-correspondence. There are a number of ways around this restriction, but none of them are attractive to a novice computer user.

Some improvements are also necessary. There is no mechanism yet for changing a word in the quotation in order to obtain one of the letters present in the author's name or title of the work. While this practice is not strictly kosher, it is sometimes done in order to use an interesting quote.

The cross-correspondence algorithm is not very smart either. One of the tacit rules of D-C's is that no two letters from the same 'word' should end up in the same word of the quote. One puzzle-maker to whom I showed the program pointed out that he likes to skip at least three words in the quotation between assignments and counts as words for this purpose things like standard phrases and hyphenated words. Although my algorithm makes a token effort to satisfy this, there are a number of violations.

Ultimately, I would like to add a graphics section which will produce the diagram and the list of blanks for the 'words.' That would eliminate the last piece of drudgery in what is otherwise a very entertaining pastime.

In the following scenario, the quotation has been entered from a file. It is possible to enter a complete word list via file also, so that the program essentially gets used just for creating the cross-correspondence. The program that generated this was run on a PDP-11/60 under RSTS/E. I have added a list of my definitions for the 'words' at the end, just for the fun of it. The example is from a puzzle I made up using tiles some time ago.

The puzzlemakers are too set in their ways to try our stuff, so here is a tool for you to try theirs.

If you would like to have a copy of the program, please send me a self-addressed, stamped envelope (large), and I will send you a listing. Or, if you have access to it, send a mag-tape (not cassette), format instructions, and enough postage for me to mail it back to you.

My definitions were:

A. Should you do these on bended knee? (2 words)
B. Proper compensation, some say. (4 words)
C. This is an odd number (comp.)
D. Bubbly.
E. Do this to your cat and you're in for big trouble. (4 words)
F. Traveling singing group, popular with country folk. (3 words)
G. NASA's newest bird. (2 words)
H. Penn's woods. (3 words)
I. Philippine city.
J. But it sounds like the opposite of straight-legged. (2 words)
K. Site of a college with the same name. (word & abbr.)
L. Looks OK, but you really can't tell.
M. Sounds from trains indicate they may use this to control the gears. (2 words)
N. Bubbly (again).
O. Something for nothing (colloq., 2 words)
P. No-good genuine shoe part. (2 words)
Q. You must ask this before taking any steps. (3 words)
R. Concurrently. (poetic; contr. & word) □

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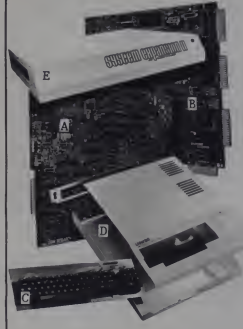

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CIRCLE 195 ON READER SERVICE CARD

```
RUN DBLX
DOUBLE-CROSSTIC -- VER 1.1

DO YOU WANT INSTRUCTIONS? YES
 ** DBLX ('DOUBLE-CROSS') INSTRUCTIONS **

DBLX HAS THREE PHASES: 1- QUOTE ENTRY AND INITIALIZATION,
2- WORD ENTRY, 3- CROSS-CORRESPONDENCE ASSIGNMENT.
PHASE 1: IN RESPONSE TO THE PROMPT, TYPE IN YOUR QUOTE.
         A MAXIMUM OF 256 CHARACTERS COUNTING ALL SPACES AND
         PUNCTUATION IS ALLOWED.  SPACES AND PUNCTUATION ARE
         NOT REQUIRED.  HOWEVER, PHASE 3 USES THE SPACES TO
         DECIDE HOW TO ASSIGN THE CORRESPONDENCES.  IF YOU
         WANT TO SKIP 2 WORDS BETWEEN ASSIGNMENTS, FOR EXAMPLE,
         YOU SHOULD ENTER A SPACE EVERY THIRD WORD IN YOUR
         QUOTE.  IF YOU ARE FAMILIAR WITH THE COMPUTER SYSTEM,
         YOU MAY CONSTRUCT A FILE CONTAINING YOUR QUOTE USING
         ANY OF THE AVAILABLE EDITORS.  THEN, WHEN ASKED FOR
         THE QUOTE BY DBLX, ANSWER '@FILENM.EXT', WHERE
         FILENM.EXT IS THE NAME OF YOUR FILE.

         DBLX WILL ASK NEXT FOR THE AUTHOR'S NAME AND THE
         TITLE OF THE WORK, WHICH FORM THE INITIAL LETTERS FOR
         THE WORDS YOU MUST CONSTRUCT.  IF YOU WANT ONLY ONE OR
         THE OTHER, ENTER IT IN RESPONSE TO THE 'AUTHOR' PROMPT.
         A MAXIMUM OF 30 LETTERS IS ALLOWED.  THESE NAMES MUST BE
         ENTERED IN SINGLE QUOTES IF THERE ARE ANY EMBEDDED SPACES
         CONTAINED IN THEM.  SPACES ARE NOT REQUIRED.

AFTER THE QUOTE AND AUTHOR/TITLE HAVE BEEN ENTERED, THE PROGRAM
WILL PRINT SOME PRELIMINARY STATISTICS AND THEN ENTER PHASE 2,
THE WORD-ENTRY MODE.

PHASE 2: ENTER THE WORDS FOR THE PUZZLE, OR EXECUTE
         VARIOUS DBLX COMMANDS.  FOR A LIST OF THE COMMANDS,
         TYPE THE COMMAND '#HELP' ONCE YOU ARE IN THIS PHASE.
         ALL COMMANDS ARE PREFACED BY '#' TO DISTINGUISH THEM
         FROM THE WORDS.  DBLX WILL TELL YOU IF YOU ARE OUT OF
         ANY LETTER, IF THERE IS NO INITIAL LETTER FOR THE WORD,
         OR IF THE WORDLIST IS FULL.  THE '#CHANGE' COMMAND
         ALLOWS YOU TO DELETE WORDS AT ANY TIME.

PHASE 3: WHEN THE WORDLIST IS FULL AND ALL LETTERS HAVE BEEN
         USED, YOU ARE READY TO HAVE THE CROSS-CORRESPONDENCE
         COMPUTED.  THERE IS NO DIALOG.  WHEN YOU GET THE NEXT
         PROMPT, TYPE THE COMMAND '#PRINT' FOR THE RESULTS.
         IN RESPONSE TO THE QUESTION 'WHERE?', ANSWER EITHER
         'KB' FOR YOUR TERMINAL, OR WITH A FILE NAME.

END INSTRUCTIONS
ENTER QUOTATION - END WITH 'CR' (MAX 256 CHARS)
? @QUOTE2.TXT
QUOTATION IS:

I DO NOT BELIEVE THAT FRIENDS ARE NECESSARILY THE PEOPLE YOU LIKE
BEST, THEY ARE MERELY THE PEOPLE WHO GOT THERE FIRST. YOU ARE
STUCK WITH MOST OF THEM FOR LIFE, OFTEN WITH PEOPLE WHO ARE
ENTIRELY REPREHENSIBLE, UNRELIABLE, AND EVEN SPITEFUL.

ENTER AUTHOR'S NAME? 'PETER USTINOV'

ENTER TITLE OF WORK? 'DEAR ME'
   LETTERBANK:
TOTAL REMAINING LETTERS:  177
A -  7    F -  7    K -  2    P -  7    U -  4
B -  4    G -  1    L -  13   Q -  0    V -  1
C -  2    H -  11   M -  2    R -  12   W -  4
D -  2    I -  12   N -  8    S -  8    X -  0
E -  35   J -  0    O -  13   T -  16   Y -  6
                                       Z -  0

PRELIMINARY STATISTICS:

 # LETTERS IN QUOTE: 195  # LETTERS IN A/T: 18
AVERAGE # LETTERS PER WORD REQUIRED: 10
INITIAL FREQUENCY DISTRIBUTION:
ENGLISH: E T A O N I H S R D L U M C F Y W G P B V K X Q J Z

QUOTE:   E T L O I R H N S A F P Y B U W C D K M G V

END INITIALIZATION PHASE
** WORD ENTRY MODE **

? PROPOSAL EFFORTS

? RUB THE WRONG WAY

? SPACE SHUTTLE

? OBERLIN OH

? VERISIMILITUDE

? #WORDLIST

  PROPOSAL EFFORTS              N
  E                             OBERLIN OH
  T                             VERISIMILITUDE
  E                             D
  RUB THE WRONG WAY             E
  U                             A
  SPACE SHUTTLE                 R
  T                             M
  I                             E

? #HELP

 AVAILABLE COMMANDS ARE:
   #EXPAND  --- EXPAND LETTERBANK
   #HELP    --- PRINT THIS MESSAGE
   #STATISTICS  ---DISPLAY VARIOUS STATISTICS
   #QUIT    --- TERMINATE PROGRAM
   #LETTERBANK  --- DISPLAY LETTERBANK
   #WORDLIST    --- DISPLAY WORDLIST
   #ASSIGN   --- COMPUTE CROSS CORRESPONDENCE
```

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CIRCLE 228 ON READER SERVICE CARD

```
  *PRINT    --- PRINT WORDLIST AND DIAGRAM W/CORRESPONDENCES
  *CHANGE   ---DELETE WORDS FROM WORDLIST
 NOTE: THE FIRST TWO LETTERS OF THE COMMANDS MAY BE USED

? EYE FOR AN EYE

? THIRTYTHREE

? EFFERVESCENT

? EBULLIENT

? EEN WHILE

? *WO

  PROPOSAL EFFORTS              N
  EYE FOR AN EYE                OBERLIN OH
  THIRTYTHREE                   VERISIMILITUDE
  EFFERVESCENT                  D
  RUB THE WRONG WAY             EBULLIENT
  U                             A
  SPACE SHUTTLE                 R
  T                             M
  I                             EEN WHILE

? *STAT
 # LETTERS REMAINING:  72
 # WORDLIST OPENINGS:  8
 AVERAGE # LETTERS/WORD NEEDED:  9

CURRENT FREQUENCY DISTRIBUTION:

ENGLISH: E T A O N I H S R D L U M C F Y W G P B V K X Q J Z

QUOTE:   E T O L H P I R S A N F Y K B W D M


? UP WITH PEOPLE

? THE KEYSTONE STATE

? NOT KNEED

? PLEASE
NO START LETTER FOR THIS WORD - WORD DELETED

? ASK
LETTERBANK HAS NO K WORD ASK DELETED

? *LETTERBANK
   LETTERBANK:
TOTAL REMAINING LETTERS:  39
A - 2    F - 2    K - 0    P - 2    U - 0
B - 1    G - 0    L - 5    Q - 0    V - 0
C - 0    H - 3    M - 1    R - 3    W - 0
D - 0    I - 3    N - 0    S - 1    X - 0
E - 9    J - 0    O - 4    T - 2    Y - 1
                                    Z - 0
```

```
? *EXPAND
AA B   EEEEEEEEE FF  HHH III   LLLLL M  OOOO PP  RRR S TT     Y
? DOPPLER SHIFT

? A FREEBEE

? REAL HEEL

? *EX
A    E   H II   LL M  OOO   R  T     Y
? *WO
  PROPOSAL EFFORTS              NOT KNEED
  EYE FOR AN EYE                OBERLIN OH
  THIRTYTHREE                   VERISIMILITUDE
  EFFERVESCENT                  DOPPLER SHIFT
  RUB THE WRONG WAY             EBULLIENT
  UP WITH PEOPLE                A FREEBEE
  SPACE SHUTTLE                 REAL HEEL
  THE KEYSTONE STATE            M
  I                             EEN WHILE

? MOTHER MAY I

? ILOILO
WORDLIST FULL

? *CHANGE
AFTER THE PROMPT 'WORD?' ENTER THE WORD TO BE DELETED
WHEN FINISHED, ANSWER WITH <CR>
WORD? THIRTYTHREE
WORD?

? *EX
   EE   HH I        RR  TT     Y
? *WO

  PROPOSAL EFFORTS              NOT KNEED
  EYE FOR AN EYE                OBERLIN OH
  T                             VERISIMILITUDE
  EFFERVESCENT                  DOPPLER SHIFT
  RUB THE WRONG WAY             EBULLIENT
  UP WITH PEOPLE                A FREEBEE
  SPACE SHUTTLE                 REAL HEEL
  THE KEYSTONE STATE            MOTHER MAY I
  ILOILO                        EEN WHILE

? THIRTYTHREE
WORDLIST FULL

? *ASSIGN

? *PRINT
WHERE? PUZZL2.OUT
** OUTPUT TO PUZZL2.OUT COMPLETE

? *PRINT
WHERE? KB:
```

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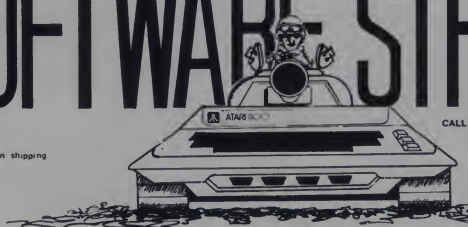

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D.    E   F   F   E   R   V   E   S   C   E   N   T
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      152 163 174 53  56  71  103 118 123 172 186 33  39  63  86  89

I.    I   L   O   I   L   O
      109 142 3   10  37  49

J.    N   O   T   K   N   E   E   D
      182 5   17  107 187 11  21  183

K.    O   B   E   R   L   I   N   O   H
      85  168 180 19  46  52  4   116 119

L.    V   E   R   I   S   I   M   I   L   I   T   U   D   E
      12  27  35  126 57  135 66  167 179 190 6   50  2   13

M.    D   O   P   P   L   E   R   S   H   I   F   T
      23  129 75  78  156 164 173 114 137 176 127 87

N.    E   B   U   L   L   I   E   N   T
      150 178 194 9   51  1   29  22  96

O.    A   F   R   E   E   B   E   E
      100 130 158 31  61  55  65  67

P.    R   E   A   L   H   E   E   L
      161 69  25  70  88  155 170 79

Q.    M   O   T   H   E   R   M   A   Y   I
      112 140 104 111 74  26  121 34  97  20

R.    E   E   N   W   H   I   L   E
      76  91  28  134 145 36  169 80

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DIAGRAM CORRESPONDENCE:
 1 ,N   2 ,L  3 ,I   4 ,K  5 ,J  6 ,L   7 ,E  8 ,D  9 ,N  10 ,I  11 ,J  12 ,L  13 ,L   14 ,E  15 ,F  16 ,G  17 ,J   18 ,A
 19 ,K  20 ,Q  21 ,J  22 ,N  23 ,M  24 ,D   25 ,P  26 ,Q  27 ,L   28 ,R  29 ,N  30 ,D  31 ,O  32 ,G  33 ,H  34 ,Q  35 ,L  36 ,R
 37 ,I  38 ,B   39 ,H  40 ,E  41 ,B   42 ,A  43 ,D  44 ,A  45 ,F  46 ,K  47 ,E   48 ,C  49 ,I  50 ,L   51 ,N  52 ,K  53 ,H
 54 ,F   55 ,O  56 ,H  57 ,L  58 ,C   59 ,C  60 ,C  61 ,O  62 ,E   63 ,H  64 ,A  65 ,O   66 ,L  67 ,O  68 ,A  69 ,P  70 ,P
 71 ,H   72 ,A  73 ,C  74 ,Q   75 ,M  76 ,R  77 ,A  78 ,M  79 ,P  80 ,R   81 ,E  82 ,G  83 ,F   84 ,E  85 ,K  86 ,H   87 ,M
 88 ,P  89 ,H  90 ,C  91 ,R   92 ,B  93 ,C  94 ,E  95 ,A  96 ,N   97 ,Q  98 ,B  99 ,F   100 ,O  101 ,B  102 ,B   103 ,H  104 ,O
 105 ,G  106 ,G  107 ,J   108 ,E  109 ,I  110 ,G  111 ,Q   112 ,Q  113 ,E  114 ,M  115 ,G   116 ,K  117 ,D   118 ,H  119 ,K
 120 ,C  121 ,Q   122 ,D  123 ,H  124 ,C   125 ,G  126 ,L  127 ,M  128 ,C   129 ,M  130 ,O  131 ,C  132 ,D  133 ,D   134 ,R
 135 ,L  136 ,D  137 ,M   138 ,A  139 ,D  140 ,Q  141 ,F  142 ,I  143 ,G   144 ,F  145 ,R  146 ,A   147 ,B  148 ,D  149 ,G
  150 ,N  151 ,B  152 ,H  153 ,F  154 ,E  155 ,P  156 ,M  157 ,B   158 ,O  159 ,B  160 ,F  161 ,P  162 ,B  163 ,H  164 ,M
 165 ,E  166 ,A  167 ,L  168 ,K  169 ,R  170 ,P   171 ,E  172 ,H  173 ,M  174 ,H  175 ,F  176 ,M  177 ,A  178 ,N  179 ,L  180 ,K
  181 ,E  182 ,J  183 ,J   184 ,F  185 ,D  186 ,H  187 ,J   188 ,G  189 ,G  190 ,L  191 ,F  192 ,A  193 ,A  194 ,N  195 ,A


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Valley Bomber

Tim Basham

In this game you are the pilot of a bomber. Your mission is to destroy the valley, but not the mountain. The mountain is depicted with x's and the valley with white spaces.

Tim Basham, 6040 Janet, Taylor, MI 48180.

Press the space bar to release the bomb. Points are given for hitting the valley. If you hit part of the mountain, the points are doubled and subtracted from your score.

The game ends when a bomb misses completely. Press Enter at the end of the game to play again. □

```
10 X=256:CLS:ONERRORGOTO5000
20 S=0
100 A$=" "+CHR$(142)+CHR$(140)+CHR$(140)+CHR$(140)+CHR$(188)+CHR$(140)+CHR$(140)+CHR$(140)
:B$=CHR$(140)
105 C$=CHR$(191)
110 PRINT@576,"XXXXX";:PRINT@633,"XXXXX";:PRINT@640,"XXXXXXXX";:PRINT@695,"XXXX
XXX";:PRINT@704,"XXXXXXXXXX";:PRINT@755,"XXXXXXXXXX";
120 PRINT@768,"XXXXXXXXXX";:PRINT@815,"XXXXXXXXXXXXX";:PRINT@872,"XXXXXXX
XXXXXXXXX";:PRINT@876,"XXXXXXXXXXXXXXXX";:PRINT@896,"XXXXXXXXXXXXXXXXXXXX
";:PRINT@975,"XXXXXXXXXXXXXXXXXXXXXX";:PRINT@960,"XXXXXXXXXXXXXXXXXXXXXXX";
130 PRINT@996,"XXXXXXXXXXXXXXXXXXXXXX";
140 FORN=582TO637:PRINT@N,C$;:NEXT:FORN=648TO694:PRINT@N,C$;:NEXT:FORN=715TO754:
PRINT@N,C$;:NEXT:FORN=783TO814:PRINT@N,C$;:NEXT:FORN=850TO875:PRINT@N,C$;:NEXT:F
ORN=919TO934:PRINT@N,C$;:NEXT:FORN=986TO995:PRINT@N,C$;:NEXT
145 IFU=1THEN200
150 GOSUB6000
200 O$=INKEY$:IFO$=" "THEN300
210 GOSUB1000
220 GOTO200
300 A=X+67:FORN=ATO1022STEP65
310 PRINT@N,B$;
311 ONERRORGOTO5000
315 Z=PEEK(15360+N+65):IFZ=240RZ=88THENJ=1:GOTO400
320 IFPEEK(15360+N+65)<>32ANDPEEK(15360+N+65)<>58THEN400
340 GOSUB1000:PRINT@N," ";:NEXT:GOTO200
400 PRINT@N," ";:PRINT@N+64," ";:N=N+64:IFN>576THENP=5
410 IFN<640THENP=25
420 IFN<704THENP=50
430 IFN<768THENP=75
440 IFN<832THENP=100
450 IFN<896THENP=200
460 IFN>960THENP=500
470 GOTO500
500 IFJ=1THENP=P*2:S=S-P:PRINT@0,"","THIS BOMB","TOTAL SCORE";:PRINT@64,"" -P,S:
:J=0:GOTO200
510 S=S+P:PRINT@0,"","THIS BOMB","TOTAL SCORE";:PRINT@64,"",P,S:GOTO200
1000 X=X+1:IFX>310THENPRINT@X,"                ";:X=256
1010 PRINT@X,A$;
1020 RETURN
5000 IFS>THENR=S:PRINT@407,"";:INPUT"WHAT IS YOUR NAME";X$:PRINT@384,CHR$(30);
5010 PRINT@384,"SCORE TO BEAT   ::   GAME OVER!   ::  "X$;" ";R;
5020 FORN=32TO78:PRINT@N,"#";:NEXT:IFINKEY$=CHR$(13)THENU=0:RESUME10
5030 FORN=510TO448STEP-1:PRINT@N,"$";:NEXT:IFINKEY$=CHR$(13)THENU=0:RESUME10
5040 FORN=32TO782:PRINT@N," ";:NEXT:FORN=510TO448STEP-1:PRINT@N," ";:NEXT:IFINK
EY$=CHR$(13)THENU=0:RESUME10
5050 GOTO5020
6000 FOR=0TO20:PRINT@X," VALLEY BOMBER-"+A$:NEXT
6010 FOR=74TO54:PRINT@X,A$;:NEXT:PRINT@54,"          ";
6020 PRINT:PRINT:PRINT"THE OBJECT OF THE GAME IS TO BOMB AWAY THE VALLEY BUT NOT
 ";:PRINT"THE MOUNTAIN.";:PRINT"EACH LAYER HAS DIFFERENT POINTS (GIVEN BELOW).";:PRI
NT"THE GAME ENDS WHEN YOU MISS COMPLETELY (THROUGH THE BOTTOM).":
6030 PRINT:PRINT:PRINT"PRESS ENTER TO CONTINUE.                GOOD LUCK!!!!!";
6040 PRINT@606," 5 ";:PRINT@638," 25 ";:PRINT@734," 50 ";:PRINT@798," 75 ";:PRI
NT@862," 100";:PRINT@926," 200";:PRINT@990," 500";
6070 IFINKEY$=""THEN6070
6080 U=1:GOTO10
```

apple

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side...the other side...the

Guy Kewney

Only one thing really puzzles me about the new Basis computer. That is: when the German firm took the normal Apple II and added a Z-80 and CP/M and an 80-column display, and an RS-232 and a parallel I/O port and DOS 3.3 in ROM all for around $2000, why didn't they put it in a portable case like the Osborne?

That paragraph represented a brave attempt to pretend that Sinclair's ZX Spectrum is not the biggest news in Europe since Clive launched the ZX81 last year. It is.

What the Spectrum is not, however, is the greatest machine Sinclair could have been expected to launch, even though he has promised the $100 floppy disk with it.

The machine itself probably looks more impressive to an Englishman than to an American because of the context. Here, the British Broadcasting Corporation sponsored microcomputer has been getting all the attention. First because of its very attractive spec, and second, because of all the foul-ups in getting it into production and distribution.

Sinclair feels that his ZX81 was the ideal micro for anybody who was planning a TV series on understanding computers. He felt that with a few tweaks and adjustments, that machine could have been turned into a colour display machine with nicer features, and for a lot less money, than the design the BBC picked.

And he thinks that he's done it.

For someone accustomed to machines like the Atari 400 and aware of Commodore's new Ultimax game machine, the Spectrum might seem almost ordinary. In Europe, however, the Atari 400 has been priced at unreasonably high levels by distributors, even given the now honourable tradition of overpricing imported micros. And the Ultimax is not yet available.

So Sinclair's claim that his £125 16K machine provides more colour display, better Basic and costs less than half the BBC micro's £300 plus, makes it attractive to many buyers.

It has its own faults. It is not quite the slowest machine on the market; there are few slower. Its colour display may be high resolution, but it isn't high definition—a good colour television is wasted on it, and a monitor would only be needed to eliminate what is known as "dot crawl" on the PAL encoding system used in much of Europe for colour TV broadcasting.

As a games machine, it needs a paddle socket, and doesn't have one. Sinclair expects this to be simple enough to do, since he has provided two commands (IN and OUT) in the operating software to do the equivalent of PEEK and POKE to the external port. But simple or not, it isn't there, and will cost extra.

Apparently, it has a BEEP command giving good sound and tone generation ability, but unless the machine is tested in total silence, few can hear it. And while its ability to store programs and data on audio tape may be worlds better than Sinclair's previous machine, the ZX81, all that really proves is how ropey the ZX81 was (is) at tape handling.

No, as the thing stands, it is a threat to the Commodore VIC and apart from that, only to the ZX81. When it starts getting really interesting will be when Sinclair launches his Microdrive.

(*Editor's note: See the Fall 1982 Creative Computing Buyer's Guide to Personal Computers, Peripherals and Electronic Games for a review of the Spectrum.*)

The Microdrive

The Microdrive is still a matter for speculation only. Sinclair says it is a 100K diskette with true random access, on which it would be possible to run CP/M. That, however, doesn't prove a thing. It could be a tape loop.

Sinclair is known to have been talking to the Hungarian firm which has announced a three-inch cartridge diskette, selling for around £60 in Britain.

According to the distributors of the Hungarian drive, it was developed in 1974, and the Japanese microfloppy is based on that design. "The reason the Japanese design hasn't appeared in Europe, and the reason it has been held up so long, is that the Japanese have been trying to find a way around our patents," claimed the distributor.

Sinclair's deal with the Hungarian firm fell through when they offered to supply a simplified version of the product for £20, say sources. Sinclair apparently wanted a £12 cost, and so went off to design his own.

These sources say that the Sinclair Microdrive is not a diskette in the conventional sense. Instead, it uses a spiral tracking arm, which takes either 3.5 or seven seconds to traverse the diskette surface from start to finish, and reads serial data.

A cursory look at the bit rate, capacity and other known parameters of the drive would appear to bear this theory out. Until Sinclair files his patents and launches the device, theory is all we have to go on, because he isn't saying.

More Atomic Particles

Back at Sinclair's successful rival, the company that actually did design the BBC micro, the Spectrum is to be emulated. Acorn has named all its machines after atomic particles: the first was the Atom, then the Proton (became the BBC micro) and now the Electron and the Gluon are on the way.

Games players will be interested in the Gluon. It is a cut-down version of the classy BBC micro, in a cheap little box like Sinclair's Spectrum, and without a few of the more expensive BBC features. It will run most software that is sold for its big brothers, and will sell for the same price as the Spectrum.

One thing it will have, however, is a fully "soft" keyboard with every key

programmable to generate whatever character (or in some cases, string of characters) the user desires.

Whether this is all good news remains to be seen. I've had enormous fun playing with Chuck Peddle's machine, the Sirius/Victor, where every key and every displayed character is soft. One careless character sent to screen or keyboard configuration sections of memory, and the most entertaining screw-ups can be arranged—and you don't even need machine code programming experience to succeed! Try using the TYPE command on a few files...

The main thing about the BBC micro, however, is not the fact that the Spectrum and the Electron can be made to mimic its features at half the price, but the fact that it can be turned into the world's first 32-bit microcomputer.

Well, not yet. But sooner than you probably think. National Semiconductor has gone out and told the world that it has a family of new microprocessor chips called the 16000, and that the 16032 has now been selected by a handful of customers for their next generation machinery.

From the perspective ofo anybody who doesn't know the BBC microcomputer, the concept is probably a yawn. For those who have seen the Tube on the BBC machine, it sounds like tomorrow's world today.

The BBC micro has the ability to turn itself into a "slave" processor, handling disk, keyboard and display operations plus networking and anything else of that nature. Most of these facilities are already arranged in the operating software of the standard machine.

The Torch Tube

At the moment, the Tube is used by a company called Torch, which has plugged a Z-80 processor in as the master. Users speak of this as a very elegant and efficient design, since the BBC micro has a bewilderingly large choice of display modes plus very efficient disk and network handling abilities.

With the National Semiconductor chip, however, the Tube allows the user of a 32-bit microprocessor with a very sophisticated instruction set and a range of languages and operating software due out within 12 months, to start running programs today, using the BBC display and disk routines.

Acorn is so delighted with the success of this notion, that it has decided to extend it to Apple, Commodore and Radio Shack users. They, poor things, cannot use the ultra-high speed Tube for data and control operations; instead they use an ordinary RS-232 link.

"But we are looking at ways of implementing the Tube on those micros. And if we can do it, we can offer American users a $3500 upgrade to their systems with Unix, 32-bit file structures, 256K of standard memory, and a hard disk," said Chris Curry, marketing boss of Acorn, recently.

It may not wipe out anybody else, but it should get Acorn into the US within a year.

One little irony to end on: the Osborne microcomputer may be heading for something of a price scandal. It is still selling (quite well) at £1500 including local taxation. The difference between this and the American $1800 price hasn't really struck home yet, because people still don't believe the machine can be produced for £1500.

But bulk-buy deals are starting to be talked about, and unit prices of £500 for the bigger orders (for 1500 Osborne 1 machines) make the standard retail price look rather different. And it is only three years since Adam Osborne himself stood up at a hobbyist conference in London, and told delegates they were fools to be conned by US exporters into paying inflated "import" costs on top of the US price. I agree with Adam. □

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CIRCLE 237 ON READER SERVICE CARD

The Graph Paper

Part Four: End of The Beginning

David Lubar

Last month, we covered basic animation and a bit of page flipping. Rounding out the topic this month, I will discuss collision detection and paddle control and other areas related to animation from Basic. Then we will take a look at some ways to alter the whole hi-res screen from Applesoft.

This will be the last portion of the series to use Basic. Starting next month, we will consider machine language exclusively. It really isn't any harder—just different. Meanwhile, let's get on to those collisions.

Crash, Pow

In almost any game, objects interact, and the program must be able to determine when and where these interactions occur. There are two methods with which I am familiar: coordinate checking and bit checking.

Coordinate checking is rather straightforward. You know the size of each object in your program, and you know its location. To see if one object hits another, you merely check whether their edges are within striking range. A simple example of this occurred in the animation program from last month. Each time the square was plotted, its X and Y locations were checked to see if it had "collided" with the border.

For two moving objects, just subtract the X coordinate of one from the X coordinate of the other and take the absolute value. If this is less than half the total width of the two objects, they are sharing an X location. The same check is made for the Y coordinates. If two objects are sharing some portion of both X and Y, they are touching.

Assume that one object has a width of 10 and another has a width of 8. If the difference between their X coordinates is less than 9 (one half the total width), then they overlap along the X axis. Unfortunately, while this method works well enough for squares, it fails to fully handle objects with irregular shapes. In this case, a bit check is required.

When an object is plotted, you must check whether one of its pixels has been placed on a spot where there is already a set pixel. If so, it has collided with something. If there is more than one possible object with which to collide, the program must make a coordinate check, but at least the existence of a collision has been verified by the bit check.

While Applesoft has no specific command for this, the ROM routines do contain a collision counter. This routine checks each pixel placed on the screen and increments a counter if there has been a collision. The counter is at location $EA (234 decimal), and it is updated after every DRAW or XDRAW.

Any shape drawn at a fixed scale, color, and rotation will always return the same value when placed on a black background. If the number changes, the shape has interacted with something.

The collision counts for DRAW and XDRAW work, in slightly different manners, but each will be constant until there is a collision.

For DRAW, the value is 0 until there is a collision. For XDRAW, the value is equal to the number of pixels in the shape when it is drawn on a black background. Since the collision counter is changed whenever a shape is drawn, its value is only valid for the most recent DRAW or XDRAW.

If you have several objects to plot, the collision count should be checked, or saved for later checking, after each shape is drawn. When we start doing machine language animation, we will develop routines that perform collision checks.

Under Control

All games require player input, usually through the keyboard or with paddles. For paddle control, we will look at the general case of a ship moving at the bottom of the screen. The paddle returns a value between 0 and 255 (though Apple paddles are notorious for dropping out below the high range). Your program can use this number to move objects in three ways: directional indication, absolute positioning, and delayed absolute positioning. In each case, the value of the paddle determines what happens to the X coordinate of the player's ship.

Directional indication breaks the paddle into three divisions. If the paddle is left (counterclockwise) of center, the ship moves to the left. If it is right of center, the ship moves right, and if it is in the central area, the ship stops. A subroutine for this method is shown in Listing 1. It simply uses the paddle value to determine the sign of DX.

Absolute positioning is the simplest method. Here, the X location of the object is based directly on the paddle value.

There are two limitations with this method. First, since the paddle range is only 0-255, the range of X locations is limited to 256 positions. This is no problem if you put a border around the playing field. The other problem is that, in Basic, where the paddle isn't read that frequently

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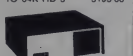

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CIRCLE 170 ON READER SERVICE CARD

the object will appear to jump when the paddle position is changed by a large amount.

This brings us to the third method. In delayed absolute positioning, the object moves toward the absolute position indicated by the paddle, but the movement is in small, fixed increments. For instance, suppose that the X location of the ship is 45. If the next paddle reading is 100, the absolute method would place the ship there. The delayed method would place it at 46, then 47, and so on until it reached 100. Many games use this method, which gives the player a good deal of control. See Listing 2 for an example.

The delayed and directional methods can be modified by adding acceleration. In this case, the object moves slowly at first, then moves in greater steps as it continues in any direction. Accelerating control is good for games where a player might have to make fine adjustments in his position, but might also want to get across the screen quickly.

A joystick is just two paddles. If you want to move an object in both horizontal and vertical directions, use a joystick and treat the X and Y coordinates separately.

The keyboard is used in the directional manner. Press one key to move left, another to move right, and a third to stop. An alternative is to make each keypress produce a small movement. This requires repeated presses on the part of the player, but also gives a feeling of control. The method used depends on the nature of the game.

The best way to read the keyboard is by directly PEEKing location -16384. If the value there is greater than 127, a key has been pressed. The value returned by the PEEK is the ASCII value of the letter. The quickest way to find the ASCII value of a letter is to ask the Apple with PRINT ASC ("X"), where X stands for the letter in question. This is much faster than using a chart.

Listing 1.

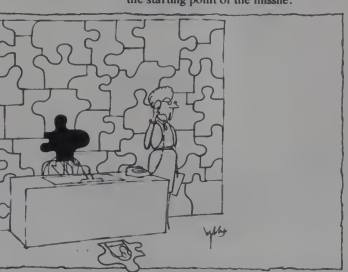
```
10 P = PDL (0)
15 REM  CONVERT PADDLE VALUE TO
    RANGE FROM -1 TO +1
16 REM  WHOLE FUNCTION CAN BE DO
   NE ON ONE LINE BY REPLACING
   P WITH PDL(0) IN LINE 20
20 DX = DX +  INT (P / 86) - 1
```

Once the keyboard has been read and a value greater than 127 found, the keyboard should be cleared with a POKE -16368,0. While the choice of which keys to use is up to you, most games use either I, J, K, and M or A, Z, left arrow and right arrow for movement, with the spacebar being used for stopping motion. Most high quality games also allow the user to redefine these keys.

Gun Control

Many readers wanted to know how to program a missile being shot from an object. This month's winning question comes from Michael P. Mariotti, who asks, "How do you fire from one or more points on an object that you are controlling, using as your weapons dots, lines, etc., and hit an object that is also moving?"

There are two parts to doing this: getting the missile started at the proper location, and making it move in the right direction. The starting point of the missile is based on the location of the ship firing the missile and the size of the ship. One way to simplify matters is to define the ship with the nose as the starting point. That way, the coordinates used to DRAW or XDRAW the ship will be the same as those used for the starting point of the missile. If this is not done, you will have to determine how much to add or subtract from the coordinates of the ship to find the starting point of the missile.



"...can you call back?...he just dropped out..."

Listing 2.

```
1  REM  X IS OBJECT LOCATION, DX
     IS CHANGE TO MOVE TO X
10 P =  PDL (0)
20  IF X  > P THEN DX = -1
30  IF X  < P THEN DX =  1
```

Just count the distance from the start of the shape to the firing point, and add the proper offset to each variable. For instance, if a ship has been defined starting in the upper left corner, and the nose of the ship is four pixels to the left and two down from the corner, the X location of the missile would be four greater than that of the ship, and the Y location would be two greater.

A missile is moved just like anything else. It needs a change in X and a change in Y. Using standard Apple screen coordinates if DX is 0 and DY is -1, the missile will move diagonally toward the lower right corner. To speed up the missile, use values greater than 1.

To create a line rather than a dot, you can use HPLOT to start the line, then move it by adding a dot to the front while taking one away from the end. (This is an important concept. If you are moving something that is homogeneous, such as a line, there is no need to move the whole thing. Just lop off one end and add to the other.)

The one problem with using integers for DX and DY is that it gives a very limited number of angles at which the bullet can travel. That brings us to the topic of fractional values.

While you can't plot an X location of 23.5, you can add .5 to an X value. This will produce a change of 1 every second time the missile is moved. A simple program to demonstrate fractional values for DX and DY is given in Listing 3. This concept is used extensively in machine language animation.

A quick way to use fractional values in a Basic program is to put them in an array. Then use the rotation of the ship as an index into the array. For example, if the ROT of the ship is 16, you would use DX=DX(16), the value of which has to be calculated by you (tedious but necessary).

Speaking of rotation, many people wanted to know whether there is any way to prevent the gross distortion produced by rotating a shape. The only way is to use several shapes, defining one shape for each rotational view of the object. Shapes can be reused when the rotation is 180 degrees, but even a 90 degree rotation will produce a slight distortion since the width of a pixel is approximately 1.5 times its height.

All this talk of shapes has brought about the urge to preach. Bear with me for a moment. Shape tables are great for playing around and for doing light-weight

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Graph Paper, continued...

Listing 3.

```
1  REM  DEMONSTRATION OF FRACTION
      AL DX AND DY
2  REM  TRY DIFFERENT VALUES SUCH
      AS .1, -2.5, ETC.
3  REM  ONCE AGAIN, THIS IS JUST
      A FRAMEWORK. FEATURES SUCH A
     S ERROR TRAPPING HAVE BEEN L
     EFT OUT.
10  HGR
20  HCOLOR= 3
30 X = 140:Y = 80
40  HPLOT X,Y
50  HOME : VTAB 21
60  INPUT "ENTER DX VALUE ";A$
70 DX =  VAL (A$)
80  INPUT "ENTER DY VALUE ";A$
90 DY =  VAL (A$)
100  HCOLOR= 0
105  REM  TO SEE A FULL LINE INST
     EAD OF A MOVING DOT, TAKE OU
     T LINE 110
110  HPLOT X,Y
120 X = X + DX:Y = Y + DY
130  IF X < 0 OR X  > 279 OR Y < 0
      OR Y  > 159 THEN 200
140  HCOLOR= 3
150  HPLOT X,Y
155  FOR I = 1 TO 20: NEXT I: REM
      DELAY TO LEAVE DOT ON SCRE
     EN BETWEEN ERASURES
160  GOTO 100
200  PRINT "AGAIN ";
210  GET A$
220  IF A$ = "Y" THEN 30
```

graphics. The topic is worth covering, and we will see a bit more of it next month when delving into Applesoft ROM routines. But Applesoft shape tables are nearly useless when it comes to doing games with fast animation. They are very slow and very limited. They belong to the past. We will be leaving them behind soon and seeing how to make the Apple do things your way. We will be creating our own graphics subroutines. And once you get a taste of that, there is no turning back. You will be hooked, I promise.

Screening Room

Besides using standard graphics commands, you can manipulate the screen with POKEs. Listing 4 changes the hi bits of all the bytes in the hi-res screen. It is a bit slow, but it should give you an idea of what can be done. Remember, each byte on the screen consists of seven bits that are used for plotting, and one that determines color.

Another interesting trick is to turn all on bits off and vice versa. One way to do this is shown in Listing 5. There is

Listing 5.

```
10  POKE 49232,0: POKE 49236,0: POKE
     49239,0: REM  TURN ON HI-RES
     SCREEN
20  FOR I = 8192 TO 16383
30 D = 128:GNU = 0
40 OLD =  PEEK (I)
50  IF OLD < D THEN GNU = GNU + D

55  IF OLD >  = D THEN OLD = OLD -
     D
60 D = D / 2: IF D >  = 1 THEN 50

70  POKE I,GNU
80  NEXT I
```

Listing 4.

```
10  POKE 49232,0: POKE 49236,0: POKE
     49239,0: REM  TURN ON HI-RES
     SCREEN
20  FOR I = 8192 TO 16383
30 BYTE =  PEEK (I)
40  IF BYTE < 128 THEN  POKE I,BY
     TE + 128
50  IF BYTE > 127 THEN  POKE I,BY
     TE - 128
60  NEXT I
```

undoubtedly a faster algorithm. See if you can find one. This type of manipulation can't help being slow, but it does serve as good introduction to techniques that will be used later in machine language.

Later on, we will redo programs 4 and 5 in machine language as an exercise in translation. For now, see what other effects you can accomplish by POKEing to the hi-res screen.

Odds and Ends

The sine wave program mentioned a few months ago is beginning to haunt me. I promised a version with moving rungs, and will produce it this month, but I must explain the down side of this whole affair.

As I mentioned, the programs were produced during an evening of hacking with a fellow programmer, and the results were interesting. Unfortunately, the disk containing the programs has eluded discovery for the last month or so (suspicion runs high that is was left in a cabin in Lake Tahoe by the aforementioned fellow programmer). Anyhow, I re-created one of the programs, but re-creations just don't ever seem to equal the original.

Listing 6 is a program that does move the rungs of the sine wave. The program was made faster than the one listed several months ago by doing most of the calculation beforehand. While this produces a wait before the first image appears, it reduces the time required from then on. If the disk turns up, I will list some of the niftier variations in a future article. The lesson is obvious; either make backups of everything or don't let your hacking partner go to Tahoe.

Well, that's a wrapup for this month. Next time, we'll dive into ROM routines and begin the trek away from Basic. □

Listing 6.

```
10  HGR
15  DIM YX(200)
20  FOR I =  - 10 TO 10 STEP .1
30 YX(100 + (I * 10)) =  SIN (I) *
     20
35  NEXT I
36 Q = 5:T = 1
37  FOR I = T TO 190 STEP 5
46  HCOLOR= 0: HPLOT I - 1,YX(I -
     1) + 100 TO I + 19,YX(I - 1)
     + 100: HCOLOR= 3: HPLOT I,Y
     X(I) + 100 TO I + 20,YX(I) +
     100
50  NEXT I
60 Q = Q + 1: IF Q = 10 THEN Q =
     5
65 T = T + 1: IF T = 6 THEN T = 1

70  GOTO 37
```

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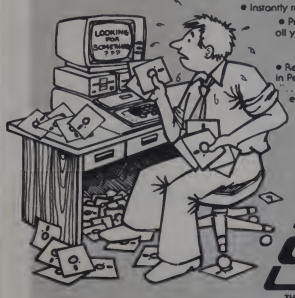

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Will Fastie

I was fortunate enough to attend the National Computer Conference (NCC) this year in Houston, as I did last year in Chicago. Last year I was stunned at the number of Z80- or 8085-based, CP/M compatible computer systems displayed. It just seemed as though everybody had one.

This year was different. This year, everybody seemed to have a 16-bit machine of some description. What really surprised me was that most of these systems were built around the 8088 or 8086 CPU, the same one used in the IBM Personal Computer. Not only that, but of those that did have the 8088/8086, most offered MS-DOS (read IBM DOS) as the operating environment. It looks like the IBM PC has really paved the way.

There were three machines that I found particularly interesting. One is special, and deserves a special mention. It is the Compass Computer, from Grid Systems. It is a 9-pound portable computer that folds into a very small package. A primary size advantage comes from the flat screen which displays a full screen of text or graphics with a 240 x 320 resolution. Nonetheless, it packs a full-size keyboard, 256K of main memory, 256K of bubble memory, integral modems and other communications adapters, the 8086 processor, and the 8087 numerics processor. There were some spectacular (for their speed) graphics demonstration programs running on the machine.

The Compass does not have any mass storage other than the bubble, as it is intended as a remote terminal and processor device which connects with central processing systems. All this for only $8150. I covet one. Just think, I could talk to my IBM Personal from remote locations . . . .

Photo 1. The Wang Professional Computer.

The other two systems that impressed me were the Digital Equipment Corporation (DEC) Personal Computers and the Wang Professional Computer. The Wang really caught my eye.

What Wang announced is a small system based on the 8086 with a socket for the 8087. The basic system includes 128K of memory, a monochrome display, and one 320K floppy disk drive. The price of this system is $3395. A second floppy is $400. The 8086 runs faster than the 8088 in the IBM PC—8MHz vs. 5. In addition, Wang announced a 5 megabyte, 5-1/4" Winchester hard disk for $2000!

The system comes with MS-DOS and a user-friendly "shell" which Wang designed. (A shell is a program that "surrounds" the operating system and provides an interface to it. Wang's is menu-driven.)

So, what we have here is a system which is largely compatible with the IBM PC, but about $400 lower in price, and faster to boot. It is also (and I hate to admit this as I stare directly into my machine) very attractively styled — more so than the IBM. The price for the hard disk is *incredibly* aggressive, and is sure to set the pace for hard disk pricing from the big companies.

Wang is providing two software packages initially. The first is word processing (what a surprise) which is compatible with other Wang WP systems. The second is the Multiplan spreadsheet program from Microsoft. Both packages are priced at $500.

The DEC systems simply cannot be ignored because of the company, although my reaction to them is somewhat mixed. DEC actually offered three systems, and not just models, but different *families* of

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Photo 2. The DEC Rainbow 100 Personal Computer. (The system unit is not visible.)

systems. The Professional 300 series is based on the PDP-11 instruction set, and I think it is, therefore, most interesting to DEC users as a machine at the low end.

The DecMate II is primarily a word processing system, and is based on the PDP-8 instruction set. (Incredible. DEC just seems to keep selling PDP-8's.) The Rainbow 100 is the "personal" computer offering, and is very interesting.

The Rainbow 100 comes with two processors, the 8085 and the 8088. A special attraction of the machine is the operating system, dubbed CP/M-80 86, which is simply CP/M-80 and CP/M-86 rolled into one. DEC has put the system together so that the software can tell which CPU to use with a feature they call "softsense," which detects which CPU the program requires. Quietly, in the fine print, DEC mentions that MS-DOS is supported. The price of the Rainbow 100 is $3495. (For an in-depth evaluation of the Rainbow 100, see the November 1982 issue of *Creative Computing*.)

DEC produced a book called *Guide to Personal Computing* and handed out copies at the NCC. Of course, it's really a guide to *DEC* personal computing, but it is very well done. The book includes a section that explains how things like printers and graphics displays work — topics that are especially helpful for the novice.

There were some interesting announcements at Comdex/Spring in Atlantic City which I learned about just in time for the column. The first was that *Multi-Plan*, a powerful spreadsheet program and the first of the "Multi-Tool" series from Microsoft, is now available to end-users. Previously the package had only been sold to OEMs. However, while a host of computer systems are supported, there is no indication that the tool is available to owners of the IBM Personal Computer!

Multi-Plan is available for computers based on the 8088/8086 and running MS-DOS, but not the PC? Well, here's what I think this means. Whenever IBM enters into negotiations with a firm about anything, the firm must agree not to discuss the discussions with anybody else. I consider it very likely that IBM will announce the product soon (if not by the time you read this). I asked IBM directly, and got the standard, but polite, refusal to speculate.

Interesting Comdex announcement #2 is the Hyperion Portable computer from Dynalogic, a Canadian company. The standard system, weighing 20 pounds and including a full keyboard, two 320K diskette drives, a 7" CRT, the 8088 processor, and 256K of RAM costs $4995. What is really interesting about this machine is the company's claim of full IBM PC software compatibility.

The operating system is MS-DOS, the Basic is Microsoft Basic, the processor runs at 4.77 MHz (same as the PC), the keyboard layout includes all the same keys in a slightly different layout; in short, a tiny IBM PC. The price is even competitive with the IBM, if you factor in reasonably priced memory and communications adapters. This machine will be very interesting to owners of multiple IBM units, such as Fortune 1000 companies, who have a need for portable computers as well.

Why have I spent so much time in an IBM column talking about other computers? Because I'm about to indulge, once again, in

Some Speculation

Here we sit, a little less than a year after the introduction of the IBM PC (that is, at the time of writing), with a market flooded with competition for the IBM. The Wang in particular, I think, is in a very good position. By many comparisons, the IBM has dulled.

The Wang is aggressively priced. DEC offers the dual-processor as a standard feature. And a host of other companies, including Commodore, Vector Graphic, North Star, Zenith (Heath), Sony, and others less well-known, have introduced systems based on the 8088 or 8086 processor and supporting MS-DOS. To me, it all means just one thing: it is time for IBM to strike.

First prediction: an IBM hard disk, 5 megabytes, in the last quarter of this year. This will probably be the point at which IBM DOS (MS-DOS) Version 2.0 will be announced, and that alone represents an important step forward. (More on MS-DOS 2.0 in subsequent columns, but rumor has it that Microsoft has already delivered Version 2.0 to IBM.)

I hope (and expect) that the disk will be aggressively priced. I would like to see some kind of innovation from IBM here, like a big bubble memory or large quantities of RAM at disk prices, but I guess it will just be a Winchester.

Second prediction: an IBM letter-quality printer before the end of the year. This is certainly an easy task for IBM; they simply have to give up the notion that the DisplayWriter and the DataMaster can be protected. What I would also like to see, but don't think will happen, is a dual-mode matrix printer, one capable of higher speeds (200 cps) for normal printing but very high quality printing at slower speeds (40 cps).

Third prediction: *Multi-Plan* from IBM before the end of the year.

Fourth prediction: 3270 and 2780/3780 emulation hardware and software from IBM, by late this year or early next. I just don't see how IBM can go on for long without having this stuff, because at least half the Personal Computers sold are going into IBM National Accounts, those serviced by the Data Processing Division (or whatever it is currently called).

With that many systems going into companies with installed mainframes, third parties will provide this product if IBM does not, and I don't think IBM wants to appear foolish by not supporting its own big systems, especially when these functions can be touted as "Office Automation" capabilities.

Final prediction: another model of the PC. The two possibilities are a system selling for under $1000 (maybe even $500!) and oriented to the consumer market, or a repackaged version, styled and configured to compete more effectively with the likes of Wang and DEC in the $4000+ market segment. Since IBM has stated their intention to address the business market first

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and the consumer market last, I think the repackaged system is likely by early in 1983. Somewhere in this scenario, I predict that the 8087 Numerics Processor and the big brother of the 8088, the 8086 CPU, will get plugged in.

Well, I went pretty far off the deep end that time. Please, don't keep score!

A Graphics Dump Program

I know what you are thinking. You are saying "Sure, Will. Just like you've been promising since who knows when." Yeah. But I finally delivered.

Listing 1 is my program to dump a medium resolution graphics image to the IBM 80 cps printer with Graftrax-80 or Graftrax-Plus installed, or a similarly equipped Epson MX-80 or MX-100. The program produces a horizontal image on the paper and will produce a printed image of either black and white or color displays.

The technique used by the program is simple. After creating a graphic display, the program uses the Basic function POINT to read the setting of each of the 64,000 dots that make up the medium resolution image. These settings are saved in the array LINES for later printing. They must be saved because the printer prints eight rows of dots at a time, and my program collects information one row at a time. I could have written the program to collect eight points at a time and send that value to the printer, but the technique of saving the data is more conducive to other orientations of the picture, which I will discuss in a minute.

The LINES array is organized as 25 lines of 320 elements. When the collection of data is complete, each element of the array contains the setting of eight dots taken from the eight vertical positions present in each column of each row. This data representation also happens to be just what the printer needs to produce the horizontal picture. It is, thus, a simple matter to place the printer into graphics mode and transmit the lines, one at a time.

Well, not quite. In Version 1.0 of IBM Basic, all PRINT statements interpret the string they print. This is quickly evident when a program tries to LPRINT CHR$(7). The expectation is that a character with value 7 will be transmitted to the printer, but the effect is that the system beeps (code 7 is a bell character) and nothing goes to the printer. Basic Version 1.1 is supposed to have this capability, but I haven't had a chance to test it.

So to get the data to the printer without risk of interpretation, I had one of two choices. The most obvious (at least to me) was to write an assembly language interface to the printer routine in the ROM BIOS. Although this would have been easy for me, it would have resulted in a fairly cryptic Basic program — one not

Listing 1.

```
1000 ' GPRINT - Graphics Dump Program for the IBM Personal Computer
1010 ' Will Fastie -- Original version Feb 82, revised June 82
1020 '
1030 ' This program transfers the contents of the Color/Graphics Adapter
1040 ' memory to a GRAFTRAX-80 or GRAFTRAX-Plus equipped IBM 80 CPS or
1050 ' EPSON MX-80 printer, to an EPSON MX-100 printer, or to a new
1060 ' generation EPSON MX-80 or 100 printer (for which GRAFTRAX-Plus is a
1070 ' standard feature).  Medium resolution images (200 x 320) are
1080 ' converted, whether in black and white or in color.  Color
1090 ' images, which can be displayed using a 4 color set, are printed
1100 ' in black and white.
1110 '
1120 ' The program assumes that the program is executed on a machine
1130 ' equipped with the Color/Graphics Adapter only.  If both
1140 ' display adapters are present, switch to the Color/Graphics
1150 ' adapter first, then run this program.
1160 '
1170 ' -- Global program declarations
1180 DEFINT A-Z
1190 DIM PIN.MASKS(8)
1200 FOR PIN = 0 TO 7
1210   PIN.MASKS(PIN) = 2^(7-PIN)
1220 NEXT PIN
1230 ESC = 27
1240 CR = 13
1250 '
1260 ' This section should be written to suit your particular needs.  For
1270 ' demonstration purposes, it loads a previously stored image from the
1280 ' disk into the memory of the Color/Graphics Adapter.  You could
1290 ' generate the image here instead.
1300 '
1310 KEY OFF: CLS
1320 INPUT "Enter filename of image:  ",F$
1330 SCREEN 1,0                         'Medium resolution, color enabled
1340 DEF SEG = &HB800                   'Base address of CB/A memory
1350 BLOAD F$, 0
1360 '
1370 ' This section converts the image in memory to a numeric array
1380 ' containing the information required for the printer.
1390 '
1400 ' -- Declare an array to hold the data
1410 NR.ROWS = 200:  NR.COLS = 320
1420 ROWS.PER.PRINTED.LINE = 8
1430 NR.LINES = NR.ROWS/ROWS.PER.PRINTED.LINE
1440 DIM LINES(NR.LINES, NR.COLS)
1450 '
1460 '-- Initialize the array to 0
1470 FOR L = 0 TO NR.LINES-1
1480   FOR COL = 0 TO NR.COLS-1
1490     LINES(L, COL) = 0
1500   NEXT COL
1510 NEXT L
1520 '
1530 ' This section reads each point from the video memory, translates
1540 ' the points to a black and white representation, and builds
1550 ' the data for the printer.
1560 ' The ROW and COL variables are used to calculate the position in
1570 ' which the point value should be placed.  The positions 0 through 7
1580 ' represent the printer's print head pins, from top to bottom.  The
1590 ' value in each position in the array corresponds to these pin
1600 ' positions.
1610 '
1620 FOR ROW = 0 TO NR.ROWS-1
1630   L = ROW\ROWS.PER.PRINTED.LINE
1640   FOR COL = 0 TO NR.COLS-1
1650     IF POINT(COL, ROW) = 0 THEN GOTO 1670
1660       LINES(L, COL) = LINES(L, COL) OR PIN.MASKS(ROW MOD 8)
1670   NEXT COL
1680   BEEP
1690 NEXT ROW
1700 '
1710 ' This section prints the data by line to the printer.  No assumption
1720 ' is made about the postion of the paper.
1730 '
1740 GOSUB 2110                                 'establish line spacing
1750 FOR L = 0 TO NR.LINES-1
1760   N = NR.COLS: GOSUB 2170                  'put printer in graphics mode
1770   FOR COL = 0 TO NR.COLS-1
1780     C = LINES(L, COL): GOSUB 2000
1790   NEXT COL
1800   C = CR: GOSUB 2000                       'advance the paper
1810 NEXT L
1820 LPRINT: LPRINT                             'space between this and next
1830 '
1840 END
1850 '
1860 ' This routine transmits the value in C to the printer.
1870 ' A routine like this is necessary because PRINT in BASIC interprets
```

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```
1880 ' some characters, and therefore cannot transmit arbitrary values.
1890 '
1900 ' This program uses the Printer Port on the IBM Monochrome Display
1910 ' and Parallel Printer Adapter.  If you just have the Printer Adapter,
1920 ' you must change the port values in this routine according to this table.
1930 '
1940 '    Port Name              MD & PPA          Just PPA
1950 '    ---------              --------          --------
1960 '    DATA in/out            &H3BC             &H378
1970 '    Printer Latch          &H3BE             &H37A
1980 '    Status Register        &H3BD             &H379
1990 '
2000 OUT &H3BE, &H6
2010 IF INP(&H3BD) <> &HDF THEN 2010
2020 OUT &H3BC, C
2030 OUT &H3BE, &H3F
2040 IF INP(&H3BD) <> &HDF THEN 2040
2050 RETURN
2060 '
2070 ' Subroutine to set line spacing to 8/72 of an inch.  Subsequent
2080 ' to this command, the printer moves the paper by this amount
2090 ' whenever a Carriage Return (13) is received.
2100 '
2110 C = ESC: GOSUB 2000: C = ASC("A"): GOSUB 2000: C = 8: GOSUB 2000
2120 RETURN
2130 '
2140 ' Subroutine to command the printer to consider the next N characters
2150 ' as Bit Image Graphics data.
2160 '
2170 C = ESC: GOSUB 2000: C = ASC("K"): GOSUB 2000
2180 IF N > 255 THEN C = N-256: GOSUB 2000: C = 1: GOSUB 2000
                ELSE C = N:     GOSUB 2000: C = 0: GOSUB 2000
2190 RETURN
```

easily understood. Instead, I opted to use the Basic INP and OUT functions to write a direct printer driver. It is not that the printer output routine is any easier to figure out, but at least it is completely written in Basic without resorting to any assembly language.

The printer routine outputs a single character to the printer by outputting it directly to the hardware printer port. The effect of the five-line routine can be simply described as telling the printer you are ready (the first OUT), waiting for the printer to be ready (the INP in the IF statement), sending the character and telling the printer to take it (the next two OUTs), and finally waiting for the printer to be ready (the final IF statement). This is really a brute force approach, but it works.

By the way, I'm grateful to Donald Johnson of Tonawanda, NY, for sending me his graphics dump program. He also resorted to this approach for the printer, and it was nice to have the confirmation that the technique works.

This program has one drawback: it is pathetically slow. My first version of the program took something like 40 minutes to construct the array and print the image. By carefully rewriting the program, I was able to reduce the time to under 15 minutes. However, this is still terrible. The time can be improved somewhat by resorting to PEEKs to get the screen data, but it will still be slow.

By comparison, the commercially available products which I will describe momentarily can get the same image out in one or two minutes because they are written in assembly language and run considerably faster than Basic. That single fact makes the available programs worth every penny you pay for them. The slow speed of my program is the reason for the BLEEP statement. It is there to let you (and me) know that the program is still running.

My program is rather simple, but it can be rewritten to produce any of the images

Figure 1. Two images printed by Will's program. Haves is reversed, and somewhat squashed. The Micro-Z logo is printed as a medium resolution image, even though it was saved in high resolution.

the commercial programs can generate. As you will see, those programs can vary the intensity of the print, print vertically or horizontally, and print different sized pictures. To do this, you need only change the way the data read by POINT is stored in LINES and choose the appropriate Epson mode. It may also be necessary to revise the program so that it prints more than one dot per picture element in order to produce an image with the proper "aspect ratio."

Aspect ratio refers to the ratio of the width and height of the image. For example, suppose you drew a square, but the aspect ratio of the height to the width was 1/2. What you would see is a rectangle, half as tall as it was wide.

The problem with the printer is to get the same ratio for the printed image as is presented by the graphics display. I have completely ignored this issue in my program, and if you compare the output from my program, shown in Figure 1, with the comparable output from the commercial programs, you will see the Rutherford Hayes is squashed.

Graftrax-80

One of the things I had to do to write this program and test the four products was to add the graphics capability to my printer. Rick Thomas, of Ratcom, was nice enough to send along a Graftrax-80 kit for me to use.

I thus have the experience of installing the kit in the IBM version of the Epson, and as you can see from the figures it worked just fine. The printer must be opened, a chip removed, and the three Graftrax chips installed. Also, a wire must be cut and the printer configuration switches must be reset.

The Epson instructions were complete and mostly clear. The chips were hard to remove and insert, requiring some patience. If this doesn't sound like your cup of tea, your dealer will probably be willing to help you out.

Once installed, the printer gains not only the graphics capability but some new text functions too. For example, it is possible to embed emphasized print within a line. The standard IBM or Epson printer cannot. Graftrax also offers italics, and many other revised and improved features.

Other Graphics Dump Programs

I tested four programs designed to transfer graphics images to the printer. They are *Videograph 88* from Windmill Software ($59.95), the *Graphics Hardcopy System* from Versa Computing, *Print-Graf* from Micro-Z Company ($44.50), and *RatTrax* from Ratcom, Inc. ($25). These packages share one trait in common, but are otherwise dramatically different. The common trait is speed.

The speed is achieved because the programs are not written in Basic. The code

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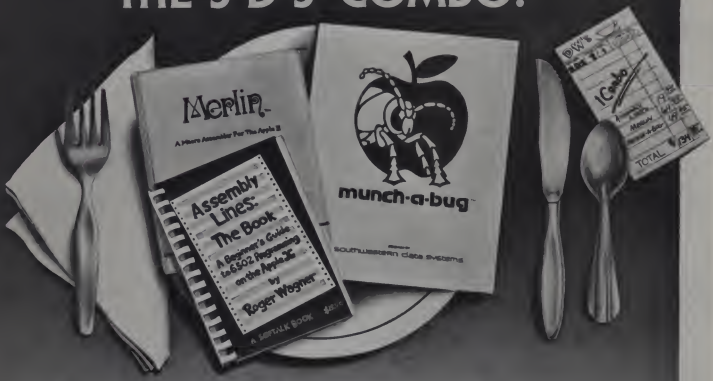

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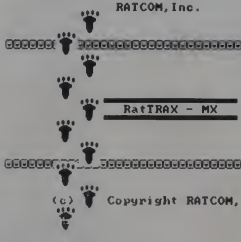
Figure 2. Image printed by RatTrax.



that actually dumps the screen is probably written in assembly language, but could be written in one of the compiled languages. Even so, all the packages have been setup so the graphics printing function can be accessed by a Basic program.

RatTrax is the least expensive of the lot. The MX program, the heart of the system, is written in protected Basic. (A protected Basic program is one which has been saved with the "P" option. It is therefore encoded and cannot be listed or modified.)

All the images produced by *RatTrax* are printed vertically on the screen, and the program provides both density and aspect ratio control. The sample shown in Figure 2 was printed at 960 dots per line, with each picture element represented by four dots.

Ratcom has a unique approach to documentation. A program supplied with *RatTrax* prints two very nice looking pages which can be cut out of the piece of paper and punched to fit in IBM manuals. In fact, the pages are numbered for insertion in the Basic manual. This is very clever, and the two-page result contains all the information you need to use the system.

RatTrax is designed for integration into a Basic program. That part is easy. Running the program is a little tricky — you must have the document near by so you can tell which function keys do what. It was the only program of the four that did not provide menu selection or ask questions.

Figure 3 shows two images of Rutherford B. Hayes as printed by the *Graphics Hardcopy System* (GHS) from Versa Computing. *GHS* prints its images vertically on the page, and can print a full or quarter size image. I printed the two Hayes images in the 1 :4 format, one with normal density and one with double density. A close examination of the image reveals that the density is a function of printing horizontally at either 480 or 960 dots per line. The resolution of the image down the page is constant.

GHS is easy to use, but the instructions must be read fully to be able to exercise the options. The instructions are not as well written as they could be, and nowhere mention what resolution image can be dumped (either, as it turns out). The program is rather poorly human engineered, because it only accepts upper case input and because incorrect responses to questions result in use of the defaults instead of issuance of an error message. A program called Showoff is included on the disk, but is not mentioned in the documentation. It displays the demonstration images supplied with *GHS*; more sample pictures were supplied with this package than any other.

VideoGraph 88, from Windmill Software, was unique in approach. The main program, VIDEO88.COM, is executed after IBM DOS is running, and "patches" the operating system to include the graphics print capability, increasing the size of DOS by 1873 bytes as a side effect. After that, a dump of the screen can be had at *any* time simply by depressing SHIFT-PrtSc.

Information is provided in the well-produced document describing how to invoke the function from Basic, another programming language, or the keyboard. All *VideoGraph 88* images are printed horizontally on the paper, and the aspect ratio for this single-sized image appears close to perfect.

Although utterly simple to use, the program has the slight disadvantage of being transient in nature. Every time you turn on your computer, you must remember to run VIDEO88 before you attempt to print pictures. If this is something you do all the time, you can certainly invoke VIDEO88 automatically with AUTOEXEC.BAT, so it is not too much of a handicap.

Two other slight problems are that the *VideoGraph 88* image is over 8" wide, leaving very little room for margins or binding space, and that the Break key seems to be disabled by the program, making it necessary to use Alt-Ctrl-Del to stop the program once it is in progress.

The package comes with a program called DEMO88.BAS which printed the sample shown in Figure 4.

The fourth program is *Print-Graf* by Micro-Z Company. The program prints vertical or horizontal images. The documentation is excellent and very complete. Operation of the program was simple, and the human engineering was above average. Equipped with these advantages, I managed to have quite a bit of trouble.

The program displays its menus, questions, and instructions in an 80-column format, and appears to use color. I say appears because I use an old 9" black and white television for graphics output, and I had a hard time reading some words which seemed to be displayed in reverse video but were illegible. That was compounded by the poor resolution of my TV for 80-column display. The effect was eyestrain as I tried to make out what the program was asking me. A 40-column display for this program would be a better choice.

Figure 3. Two images printed by the Graphics Hardcopy System *from Versa Computing.*

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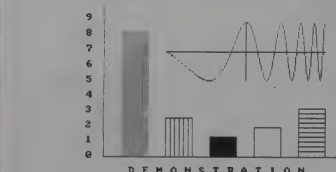

Figure 4. Output from DEMO88, a demonstration supplied with VideoGraph 88.

There are two other complaints. First the program START, which is a menu selection program, does not allow a way back to the operating system. I had to hit Alt-Ctrl-Del to get rolling again. Second, the program only allows two disk drives, which is not a major problem now, but could be in the future as you add more floppy drives or a hard disk.

The Micro-Z software includes the *Print-Graf* program and sample pictures. *Print-Graf* sells for $44.50. For $79.50 Micro-Z offers *Print-Graf* with a companion program, *Micro-Graf*. This program is a data plotting package that I think is quite good.

It allows you to enter a set of points and establish the coordinate system, then displays the data points on the graph. Once the initial data entry is complete, several options, such as a linear regression, curve-fitting, and various plotting options, become available. I particularly like the line and curve-fitting routines.

The program displays the graph, and then draws a straight or curved line to show the function which most closely matches that set of data points. The only drawback of *Micro-Graf* is that the data points cannot be saved. The displayed image can be printed or saved, but the work of entering the points is lost.

Three of the packages tested have the capability to print the image as it appears on the screen (white on black) or reversed (black on white). The default is usually reversed, because white on black seems correct for displays, but backwards for paper. *VideoGraph 88* prints only reversed images.

Aspect ratio is handled well by all the packages. The sole exception is the horizontal image produced by *Print-Graf*, which has precisely the same squashed aspect ratio as the image produced by my Basic program. If you compare the Micro-Z image in Figure 5 with the same image printed by my program (Figure 1b) you will see that they are the same size.

It is hard to call any of the four packages superior to the others. They can all do the job, and, with the exception of *VideoGraph 88*, all offer flexibility. All the programs fall in the $25 to $45 range, so there is not a great deal of price difference.

The packages impressed me evenly, and none had a significant, special characteristic or capability that would cause me to endorse it. If pushed to the wall, I think I would lean ever so lightly toward either *RatTrax* or *Print-Graf*.

IBM External Software Program

I have already reported that IBM has revised its external software submission plan. This month I received a copy of the 40-page "Software Submission Guide" which IBM has just published. It is excellent. It is well-organized and should provide answers to just about any submission question you may have.

The whole program seems *much* more reasonable. For one thing, the Submission Agreement no longer states that you are bound to enter into a contract with IBM if they accept your software. Instead, the Guide says ". . . we will offer a Software Contract which will include such items as royalties, advances, and . . ." The two key words here are "offer" and "royalties," both of which indicate that the process is now more open to negotiation.

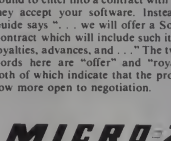

Figure 5. Image from Print-Graf. *Note the finer resolution as compared with Figure 1. Aspect ratio is not quite correct.*

None of this means that IBM will be any less careful or tough, just that they are willing to work something out. That's a step in the right direction.

New Products

Aspen Ribbons carries a broad line of printer ribbons. They offer a ribbon for the IBM 80 CPS (Epson MX-80) for $8.50, almost half of what I paid for my first replacement from IBM. Aspen will also recycle a used ribbon for $3.45. I have one of Aspen's ribbons which I will be trying this coming month.

VisiCorp has announced the *VisiFile*, *VisiTrend/Plot*, *VisiDex*, and *Desktop/Plan* programs for the IBM Personal Computer. *VisiDex* is priced at $250 and the others are $300. According to the press release, Desktop Plan was supposed to be out in May, but I haven't seen it anywhere yet. The others are due in the third quarter of this year, which should mean by the time you read this.

An Advanced Version of *VisiCalc* was announced for the Apple III and was demonstrated at the NCC. Naturally, I made the appropriate inquiries. I think I can say with some certainty that it will be available for the IBM, but I can't say when. New Apple III features include variable column widths, space between columns(!), more powerful replicate capabilities, on-screen help, worksheet consolidation, and greater on-screen and report formatting capabilities.

Micro Focus has announced the availability of their family of software tools, including CIS Cobol, Level II Cobol, Animator, Forms-2, and Slideshow, for the IBM Personal Computer. The Cobol compilers have been widely accepted, and the Level II Cobol compiler has recently been certified at the highest level, and with no errors, by the Federal Compiler Testing Center.

Professional Software Inc. has announced *WordPro-PC*, a new word processor for the IBM. Suggested retail is $395 for the program, apparently a spin-off from the version for Commodore computers. Professional Software claims that over 20,000 copies have been sold worldwide for Commodore systems. Availability is scheduled for September.

The Oasis-16 multi-user operating system, claimed by manufacturer Phase One Systems to be the first for the IBM PC, is now available. Phase One claims direct compatibility with the Z80-based Oasis Basic and C language applications software, making a large body of software immediately available. The system will support Corvus hard disks, and can handle from three to 32 users depending upon system configuration. Phase One offers free applications software directories for prospective OASIS-16 customers. Cost of the system is $1495.

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IBM Images, continued...

Information Unlimited Software, Inc. (IUS) announced several programs for the PC. *General Ledger, Accounts Payable,* and *Accounts Receivable* head the list, which also includes *EasyPlanner,* a new spreadsheet program. Also available from IUS are *EasyWriter II,* IUS' top-of-the-line word processor, the *EasySpeller* spelling checker, and *EasyFiler,* a record management system.

Strategic Simulations has announced *The Warp Factor,* one of their most popular games, for the IBM PC. The game program costs $39.95 and requires 64K of memory. Both IBM display adapters are supported.

Finally, Software Arts, Inc., has broken the silence about their new product, which was demonstrated at the NCC. *TK!Solver* is a program used to solve scientific, engineering, and business problems without programming.

Dan Bricklin says the program will have the same kind of effect upon mathematical problem solving in technical fields as *VisiCalc* has had upon business analysis. *TK!Solver* will be available for the Apple II and IBM Personal Computers late this year. Software Arts is marketing the product themselves, and will also offer prebuilt models in many fields. Early models will include mechanical engineering, architectural design, financial analysis, and high school science.

I got a chance to see a demo of TK!Solver. I don't want to over-react before I have a chance to get my hands dirty, but the program looks great. I was very impressed by the demo. (For an in-depth evaluation of *TK!Solver,* see the November 1982 issue of *Creative Computing.*) □

Firms Mentioned in This Column

Software Arts, Inc.
P.O. Box 527
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Microsoft Corporation
10700 Northup Way
Bellevue, WA 98004
(206) 828-8080

Information Unlimited Software, Inc.
2401 Marinship Way
Sausalito, CA 94965
(415) 525-9452

Phase One Systems, Inc.
7700 Edgewater Dr., Suite 830
Oakland, CA 94621
(415) 562-8085

Professional Software Inc.
51 Fremont St.
Needham, MA 02194
(617) 444-5224

Micro Focus
1601 Civic Center Dr.
Santa Clara, CA 95050
(408) 496-0176

VisiCorp
2895 Zanker Rd.
San Jose, CA 95134
(408) 946-9000

Aspen Ribbons, Inc.
1700 N. 55th St.
Boulder, CO 80301
(800) 525-0646

Micro-Z Electronic Systems
Box 2426
Rolling Hills, CA 90274
(213) 377-1640

Windmill Software
1058 Joan Dr.
Burlington, Ontario
Canada, L7T 3H2

Versa Computing, Inc.
3541 Old Conejo Rd., Suite 104
Newbury Park, CA 91320
(805) 498-1956

Ratcom, Inc.
7620 S.W. 147th Ct.
Miami, FL 33193
(305) 382-3947

Digital Equipment Corporation
Maynard, MA 01754
(617) 897-5111

Wang Laboratories, Inc.
One Industrial Ave.
Lowell, MA 01851
(617) 459-5000

Grid Systems Corporation
2535 Garcia Ave.
Mountain View, CA 94043
(415) 961-6873

Dynalogic Info-Tech Corporation
141 Bentley Ave.
Ottawa, Canada K2E 6T7
(613) 226-1383

Strategic Simulations Inc.
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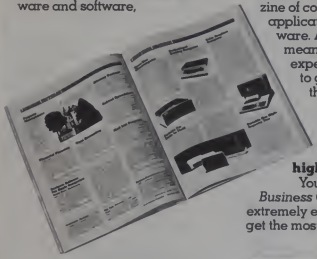

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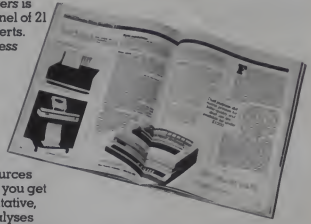

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Stephen B. Gray

Reaching for his .44, Jessie shot six holes in the side of the mailcar, one for each station on this month's TRS-80 track: several solutions to high-resolution graphics; the DOSPLUS alternative to TRSDOS; Radio Shack's *Time Manager* program; those old 800 customer-service numbers; the new 817 numbers; and the new Color Computer. Sorry, no room for a short program; back next month.

High Resolution

If you're into graphics at all, you're probably frustrated by the low resolution of TRS-80 black-and-white graphics, which as a consequence are very limited in the degree of detail they can provide. Lines are straight only when perfectly horizontal or vertical, circles aren't really circles, and most three-dimensional graphics are out of the question.

Most of the problem is the large size of the graphics blocks (called "pixels" in the trade, short for "picture elements"); the rest is their rectangular shape. In a space 7.5" across and 6.625" down, Radio Shack has placed 128 pixels across, and 48 down. Thus each pixel measures 0.0586 by 0.138 inch—about the size of the hole in an IBM card—giving it an aspect ratio of 3:7. A much smaller pixel, preferably a square, would be much better for graphics. However, if Radio Shack had provided more pixels, the price of a TRS-80 would be higher, and most users probably aren't interested enough in graphics to want to pay for more than the 6114 pixels they've got now.

For those who want more pixels, there are several ways to get the higher resolution. Two companies sell install-it-yourself boards. Radio Shack offers high-resolution graphics for the Model II, and as I reported in the previous column, Radio Shack will offer a similar option for the Model III later this year. I said the Model III hi-res would be available this fall, but according to the latest information, it may not be until winter. After all, *SuperScripsit* was supposed to be available by 12/30/81, according to the RSC-6 catalog; right now Fort Worth is saying June 1982. So please don't bug your dealer or Fort Worth with questions about when you'll be able to get Model III hires; it may be a little late.

Let's look at each of the high-resolution systems individually.

Mikeeangelo Graphic System

For $369, you can raise the resolution of your TRS-80 from the standard 128-by-48 pixels, to 384-by-192 or 191-by-192 if you have a Model I, or to 512-by-192 or 256-by-192 pixels if you have a Model III; you choose the resolution you want via software. That's up to twelve times as many pixels for a Model I, or up to sixteen times as many for a Model III.

This is done with the Mikeeangelo Graphic System, from Mikee Electronics Corp. (Box 3813, Bellevue, WA 98009), which provides 12K bytes of memory in an outboarded enclosure that connects to your TRS-80 via a ribbon cable. For the highest resolution, 512 by 192 pixels in a Model III, 98,304 bits are required, which is 12K bytes. Back in 1977, when the Model I was introduced, that 12K would probably have cost you an extra $290. Not many users would have paid that much for high resolution five years ago.

The manual provides large photographs showing exactly how to install Mikeeangelo, which involves opening the TRS-80, making 18 soldered connections and cutting one trace (or one IC pin). A magnifying glass is supplied, to make sure you leave no solder bridges, and that you've made all the right connections. You also remove the Z80 MPU and plug it into the socket on the interface board. However, unless you've had some experience in soldering IC circuits, you may not want to take a chance on making a mess of your TRS-80, although you may know somebody who can handle the job for you. There's also the problem of voiding the warranty if you (or your friend) open the TRS-80 case. Furthermore, if your TRS-80 needs repairs later, Radio Shack may first have to remove Mikeeangelo, and will charge for the removal.

A demo tape comes with Mikeeangelo and includes some plotting applications. A driver program allows you to SET, RESET or test (with POINT) every dot; LINE draws a line between any two dots. Inverse video provides black-on-white graphics (Figure 1). Through output port 254, you select normal, high or very-high resolution with or without inverse video.

Once Mikeeangelo is installed, you write programs in Basic or machine language; examples of both are provided, but not enough to really show you what the system can do.

The Mikeeangelo brochure explains

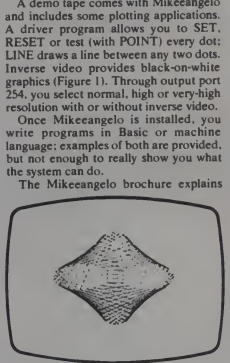

Figure 1. Example of high-resolution graphics, as drawn using the Mikeeangelo board.

why the Model III has higher resolution than the Model I: "The Model III uses an 8 x 12 character matrix instead of the 6 x 12 matrix of the Model I. If you multiply the number of dots along the top of the character cell (eight for the Model III and six for the Model I) by the number of characters per line (64), you get 512 for the Model III and 384 for the Model I. This is the number of dots along the X axis. Next, multiply the number of dots

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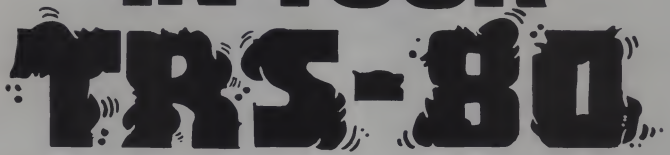

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along the side of the character (12) by the number of lines on the screen (16) and you get 192. This is the number of dots along the Y axis. The Model III has a resolution of 512 x 192 dots and the Model I has a resolution of 384 x 192 dots."

Although the Mikeeangelo manual doesn't give enough programming help, there's another source of software for this hi-res system.

Rescom

Bryan Mumford has come up with a number of firsts in TRS-80 software, such as the first disk-cataloging program, the first print spooler, and the first disassembling single-stepping debugger. There's another one, which I've never seen in his ads, the High Resolution Command Module, perhaps because it's very specialized: it's meant to be used with Mikeeangelo.

The first paragraph of the five-page manual for the module says, "The Mikeeangelo high-resolution interface for the TRS-80 Models I and III is a welcomed product. It is well designed and gives us excellent graphics capability. It is, however, like any high-resolution system, awkward to use without the proper software. The purpose of this *High Resolution Command Module* (hereafter called *Rescom*) is to add a group of graphics commands to the existing Basic language. There are 14 commands available, and they will greatly simplify your high-resolution programming." *Rescom* is $24.95 for either Model I or III, from Mumford Micro Systems, Box 400, Summerland, CA 93067.

Figure 2. Hires graphics for the Model II TRS-80 provides 153,600 pixels plus eleven new graphics commands in Basic.

Included among the 14 *Rescom* commands are: clear the hi-res memory, turn on (or off) one pixel, test one pixel, draw (or erase) a line from one point to another, draw a line from the present point to the past point, print the hi-res image on an MX-100 (or an MX-80 with Graftrax), select hi-res or mid-res, select reverse (or normal) video. That's 12 of the 14; the other two are involved with displaying the hi-res memory, or making it invisible.

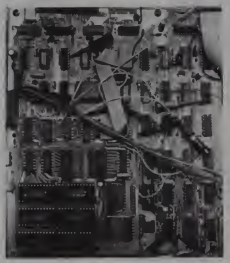

Figure 3. Seven micro-clips connect Micro-Lab's Grafyx Solution board electronically to the TRS-80 Model III's circuit board.

E/RAM

You may have seen, last year, ads for E/RAM hi-res graphics for the Model-I Level-II TRS-80, offering 256 x 192 pixels, for $350 from Vern Street Products: The Computer Store in Tulsa, OK.

Those ads disappeared, and were replaced, early this year, by ads for E/RAM for the Model II, at $495 from Keyline Computer Products (manufacturer of the $350 E/RAM), also of Tulsa. When the Model II ads also disappeared, I called The Computer Store, and was told, "The designer of the hi-res for the Model II gave up when Radio Shack came out with their own hi-res II. He's looked into hi-res for the III, but it was too difficult, no room."

Radio Shack's Model II hi-res (Figure 2), which provides 640 x 240 pixels (for $499 plus installation), is their own design, I understand, and so is the forthcoming Model III hi-res.

There's one more source of hi-res graphics for the Model III, and it requires no soldering.

Grafyx Solution

With the Grafyx Solution add-on circuit board ($299.95 from Micro-Labs Inc., 902 Pinecrest Drive, Richardson, TX 75080), you get three resolutions: high (512 x 192), medium (128 x 192) and low (128 x 96).

There is no soldering with Grafyx Solution, although you do have to cut one trace and remove two ICs from their sockets. Instead of soldering, you clip seven micro-clips onto IC pins; the seven are at the ends of wires connected to the PC board you install in your Model III's innards (Figure 3).

These clips are the "E-Z" type used to connect test instruments into densely-packed circuit boards. You press the plastic plunger, and a little hook slides out; you hook it onto an IC pin or component lead, release the plunger, and the test-lead is firmly attached, with no chance of flailing around, as can happen when hand-held test-prods slip (and sometimes zap ICs). However, you may not care for the idea of seven micro-clips dangling inside your Model III case. In one instance, the manual warns you to "be sure to keep the plastic clip away from the socketed memory in that corner since some brands of ICs get quite warm."

One more thing: you need a hacksaw. Before you install the Grafyx board, you must make room for it by removing the metal RF shield. Afterwards, you make a cut in the shield and bend back part of it a quarter of an inch, so it's out of the way of the new PC board.

Once you've installed the Grafyx Solution, which contains 12K bytes of additional read/write memory, you use the supplied software to add hi-res graphics to Basic programs (Figure 4). There are commands to enable (or turn off) the hi-res display, clear the hi-res screen without affecting the standard text characters (the hi-res graphics screen is displayed on top of the normal character display), set the desired resolution, plot a point, read point status, draw a line between two points, complement every point on the hi-res screen for an inverse

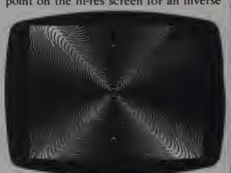

Figure 4. High-resolution graphics using Micro-Lab's Grafyx Solution; note the small size of the dot in this four-way kaleidoscope.

display, copy the contents of the hi-res and text screen to a printer with graphics capabilities, draw a box whose diagonals ends are at two given points, draw a circle with a given radius and center, shade in the shape surrounding a point (half-shade or solid-shade), copy the contents of a screen rectangle into an array, and take the contents of the array and display it at a given position.

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TRS-80 Strings, continued...

Eighteen demonstration programs and eight utilities are supplied, along with a program that provides an 80-character display for business forms and word processing. The manual goes into theory of operation and assembly-language techniques, and ends with a list of five graphics programs available from Micro-Labs: *Bizgraph, Draw, Mathplot, 3Dplot,* and *PCHAR* (for creating character sets). Only two are priced, at $34.95 each.

The Choice

So there you have the three choices: Mikeeangelo at $369 with a top resolution of 512 x 192, with soldering but with Rescom software; Grafyx at $300 with the same top resolution, without soldering but with micro-clips; and, later this year, Radio Shack's own hi-res offering, with an unknown price and resolution. You may want to wait to see what comes out of Fort Worth, but if you can't, you've got two ways to go.

TRSDOS

When you use a TRS-80 without disk drives, the computer is controlled by the internal ROM (read-only memory), which contains the Basic originally written by Microsoft for the TRS-80. The Basic can't be changed without switching ROMs, and anyway, Microsoft Basic is highly efficient. The highly ingenious "tight code" written by Paul Allen and Bill Gates (which was the beginning of the Microsoft empire) takes up much less memory than most (if not all) of the other Basics.

However, when you move up to Disk Basic, you get into TRSDOS, the disk operating system that performs all the housekeeping required to run the system efficiently. TRSDOS, which Radio Shack provides with TRS-80 disk systems, leaves something to be desired. Even Radio Shack has admitted it from time to time, and has had to publish several TRSDOS releases to clear up various goofs. Even then, various features that many TRS-80 owners consider important are missing from TRSDOS, and several software houses have taken advantage of the lacunae.

Three disk operating systems for the TRS-80 were reviewed back in September 1981 (p. 152): NewDOS by Apparat; TRSDOS 2.3 from Radio Shack; and VTOS, which was renamed LDOS by Lobo International. Author Stephen Kimmel noted several "shortcomings" in TRSDOS, remarking that Apparat "had a different answer that was more to my liking," and said VTOS (now LDOS) "is extremely easy to use," having a 40-page operator's guide instead of a 200-page manual. After specifying various features, Kimmel said, "It should be obvious that both VTOS 4.0 and NewDOS/80 offer significant enhancements on TRSDOS and hence offer more commands.

DOSPLUS

Another very popular TRS-80 disk operating system is *DOSPLUS*, found at computer dealers, or available from Micro-Systems Software (5846 Funston St., Hollywood, FL 33023). *DOSPLUS* 3.3, an older version 1 started with last year, offered these features:

- RESTORE: a KILLed file can be brought back to life with this unique utility, unless you've written over it with another file.
- DEVICE: displays on the screen all I/O devices connected to your system, and their driver addresses.
- FORMS: goes TRSDOS FORMS several better by adding a value for number of *printed* lines per page and performs top-of-form on the printer, plus several more.
- CRUNCH: compresses Basic programs by removing unnecessary blanks and remarks.
- SPOOL: permits text printing while enabling the program currently running to proceed to the next step.
- TRANSFER: moves all user files from one disk to another.
- Lower-case detection: automatically displays lower-case letters if the lower-case mod is installed (on Model I systems).
- Built-in screen printer: press two keys (S/P, SHIFT/down-arrow, or SHIFT/CLEAR, depending on model), and the information on the screen will be printed out.

The latest version, at this writing, is DOSPLUS 3.4, which includes all the 3.3 features described, and adds a handful more, including a Basic array sort (multi-key, multi-array), random-access and ASCII modification on diskdump, and a dozen more.

DOSPLUS 3.4 is $149.95, which includes a 240-page manual; you can upgrade from 3.3 to 3.4 for $49.95.

DOSPLUS Basic

Included in DOSPLUS is Disk Basic, which, according to the 3.4 manual, is "a set of enhancements to the Model III ROM Basic, resident upon the disk. It contains features to allow input/output to disk files for data storage and will allow you to load and run Basic programs that are stored on the disk. Disk Basic is completely memory resident on the DOSPLUS system diskette, and comes in two forms—Basic and TBasic."

The DOSPLUS Basic has extended commands and DOS commands, and is less memory-efficient than TBasic (Tiny Basic), which lacks the DOSPLUS system commands and extended features such as extended error messages.

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CIRCLE 294 ON READER SERVICE CARD

TRS-80 Strings, continued...

The advantage of TBasic is simple, according to the 3.3 manual: "In a 48K machine, after loading in DOSPLUS and TBasic, you will have just over 40K of free memory left for your program. With regular extended Basic you only have about 37K."

DOSPLUS FORMAT

After writing this column on a Model III TRS-80 under DOSPLUS, I use the FORMAT utility to set up a disk for single density, and then copy the column and also the book reviews onto this single-density disk. That's because the Alpha-Comp phototypesetting machine at *Creative Computing* uses output from an LNW80 computer, which is electronically identical to a TRS-80 Model I, and thus requires single-density disks. (This phototypesetting system was described in detail in March 1982, p. 200.)

Yes, TRSDOS has a FORMAT utility, but it's for double-density disks only. DOSPLUS asks, in addition to diskette name, master password, and which drive contains the disk to be formatted, two unique questions: how many tracks do you want, and do you want single or double density. That feature, without which I couldn't write this column in a format usable by *Creative Computing*, and the RESTORE utility, which brings back to life those files I didn't mean to KILL or PURGE, are alone enough to make DOSPLUS worth having. But they're only the beginning. If you use a TRS-80 more than an hour or two a week for anything other than simple programs, try DOSPLUS. You might not need the FORMAT or RESTORE commands, but there are others that are bound to be valuable.

Incidentally, if you see a list of DOSPLUS features in a Micro-Systems Software ad, many of these are identical with TRSDOS features; the list is partly meant to show how compatible DOSPLUS is with TRSDOS, usually without pointing out which is which. You'll have to compare features one by one to figure it out.

Time Manager

Radio Shack's *Time Manager* is "a personal calendar/reminder and electronic notebook," according to the RSC-7 catalog. It is designed to help you "organize your time and business information, and create permanent records." For $99.95 you can manage your time and appointments (Figure 5), and track job schedules and costs, as the catalog puts it.

Time Manager "organizes daily schedules, quickly summarizing and displaying appointments, tasks to be done, and project information. It can keep records of expenses or mileage for income-tax reports, document important dates, monitor projects and deadlines, and provide time and expense accounting information for billing or internal reports," according to the press release.

Minimum system requirements are a Model I or III with 48K memory, and two disk drives. Optional equipment recommended includes an 80-column printer, a third disk drive, and an amplifier/speaker "allowing *Time Manager* to provide audio responses."

The program is quite extensive and includes four diskettes (one with the program, one for data, and two for backups), a 76-page manual, and a reference card containing all the commands and a brief definition of each.

Calendar

First you call up a calendar by inputting the month and day. When the calendar for the month is displayed, a cursor indicates the day selected; it can be moved to any other day by using the four arrows. Using the right and left arrows, in conjunction with the shift key, moves the calendar from month to month.

Time Manager has two levels, Month and Day. To move from the Month (the calendar display), press Enter, and the Day level appears, showing, via the sample data diskette provided, daily-agenda entries (if any) for the day selected by the cursor.

Each entry consists of four parts: priority, permanence, category, and text. Priority has five levels. Permanent entries are holidays, birthdays, etc. Any of 26 categories (A through Z) can be assigned; T is suggested for telephone calls to make, H for holidays, Y for personal items, etc.

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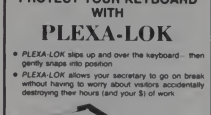

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CIRCLE 189 ON READER SERVICE CARD

TRS-80 Strings, continued...

The text of an entry can be up to 49 characters long.

Up to 127 entries per day can be put into *Time Manager*, although only 11 will be displayed at a time. A message appears on the bottom line of the screen to tell you how many more entries, if any, are not yet displayed for a particular day. New entries are easily made, or old ones modified.

Figure 5. Using Time Manager, this man is scheduling his appointments for next Friday, from "meet with boss at 9 AM" to "call service station."

Now that you've filled out your calendar, you may need to locate an item somewhere on it. To do this, you can select a category, or keyword, or priority, or combinations of the three. Then you can use the automatic scan, which will stop at the first day (forward or backward, as you choose) that contains the type of item you selected.

Totalling and Accounting

Time Manager can also be used for general accounting, and to provide totals for categories such as income received, hours worked and expenses, which sounds like a natural for the self-employed. Up to nine separate accounts can be maintained. Totals for each account can be obtained for a day, a month, the entire year, or any specified time period within the current year.

In the accounting display, there are columns for the account number, account description, sum, multiplier, and total. Running totals are available if desired.

Other Features

With *Time Manager* in Notepad mode, you can fill the screen with miscellaneous information, such as phone numbers, addresses, lists, reports, assignments, etc. Eight Notepad screens are available, along with a screen editor to modify and display them. Each notepad contains up to 15 lines of 64 characters each.

Two methods of printout are provided. Any of the displays can be transferred to a printer via Screen Printing. To print a Day Level display with more than 11 entries, or to print several displays, or a series of selected entries, Global Printing is available; you select start and end points.

An alarm buzzer can be sounded (if you enter the time in the opening screen) to remind you to make a phone call, for example.

Six "flags" can be set to select special features: uppercase only; expert user (suppresses error messages); etc.

The program can display any calendar page from January 1901 to December 2155, a timespan long enough to take care of the all the appointments for five or six generations. The number of days between any two dates can be calculated.

Entries may be moved from one day to another within a month, or copied from one day to another, or moved from one month to another.

TRS-80 Manager Series

There are more features, but these give you a good idea of what can be done with *Time Manager*, which is designed to "talk" to the other two programs in Radio Shack's TRS-80 Manager Series:

Personnel Manager, at $99.95, keeps track of people, by organizing employee information. Files can be searched for a specific person, product or service. Data can be organized to evaluate vendors, or employee performance.

Project Manager, also $99.95, evaluates and schedules projects, by providing TIME, TASK, PERT and GANTT charts. Projects can be viewed graphically with regard to time, sequence, personnel, materials, or resources. The effect each task has on completing the project can be shown, as well as the effects of task changes.

Dates and schedules entered on one of these three interactive manager programs can be transferred to another, updating appropriate information. All three require a 48K two-disk Model I or III; a printer is optional.

About Those 800 Numbers

You may have read, in Radio Shack's *TRS-80 Microcomputer News* for April 1982, that the toll-free 800 numbers for Computer Customer Service were discontinued on the first of June in favor of regular numbers you now have to pay for.

The reason is not because of the cost; the new system will cost Radio Shack more than the 800-number WATS lines. Every time Radio Shack put in more

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TRS-80 Strings, continued...

WATS lines, the volume of calls went up, higher and higher, and even with 57 lines there was the same long wait to talk with somebody. Many of the 800-number calls were "trash calls," from people who wanted to know if they could get a particular item at their local Radio Shack store, or some such question. The new system will hopefully eliminate most of the trash calls, and provide more time to answer "concerned calls," from people with serious questions about their TRS-80 computers.

The 800-number system was expensive, costing Radio Shack well over a million dollars a year. The new way, even though the user pays for the call, will be more expensive for Radio Shack because they've committed themselves to having about 180 people on hand to answer the calls. Radio Shack plans to put a Computer Center "in every major (and many not-so-major) markets in the country," and a Customer Service Representative in most of those Computer Centers, in the hope that users will be encouraged to contact their local service reps who can, if necessary, get help from Fort Worth at no extra cost to the user. If the system works as planned, you should be able to get help for the cost of a local call, with a minimum of delay. That is, if we all limit our calls to questions about using Radio Shack hardware and software.

Another reason for the change is that many people, and especially businessmen who own a Model 11, for instance, would prefer to pay for a call to find out quickly what they want to know, rather than wait 15 or 20 minutes, or longer, on a free 800-number line for the answer.

About These 817 Numbers

Just in case you didn't see the May 1982 issue of the *TRS-80 Microcomputer News*, Radio Shack has assigned area 817 numbers to seven main groups of customer-support personnel:

- (817) 870-2041—Model I/III Business
- (817) 870-2042—Model II/16 Business
- (817) 870-2044—Languages and Compilers
- (817) 870-2150—Color Pocket Computer
- (817) 870-2571—Hardware and Communications
- (817) 390-3302—Educational Software
- (817) 870-2271—Games, Books and New Products

These numbers, which became effective on or before June 1, 1982, are to be called between 8:00 a.m. and 5:00 p.m. (Central Time) if, as the *Microcomputer News* puts it, "you elect to call us instead of your local Radio Shack Computer Center Customer Service Representative."

The Navy might abbreviate that to COMCENCUSSERREP, which makes more sense than COCESUSER.

Remember, if we use these seven numbers only when our problems can't be solved by our local Radio Shack store, Computer Department, or Computer Center, the waiting time for help on an 817 line will be kept to a minimum.

New Color Computer

By now you know that the rumors about Radio Shack dropping the Color Computer were only half true. When they recently cut the price of the 4K Color Computer to $299 from $399, it was a preliminary to offering the 16K version for $399.95. Selling a 16K Color Computer for only 95 cents more than the 4K model will, of course, kill sales of the 4K version.

The switch is to bring the Color Computer in line with the competition, such as the $100 Timex/Sinclair 1000 (only 2K, but the price is right), and the 5K VIC-20 and 16K TI 99/4A (both selling for less than $300). □

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THE BIG WHOOPS!

A Cosmocomical Theory of Creation

Peter Payack

CFD

Since earliest human times, one of the great unsolved mysteries is the nature and origin of the universe. Now, scientists have put forward a bold new theory which elucidates not only the intricate web of the cosmic-evolutionary scenario but also gives meaning to the enigmatic happenings of everyday life. It links together through computer aided mathematical models, such seemingly unrelated phenomena as black holes and holes in swiss cheese, gravity, condominium and energy conversion, death, the theory of evolution and the birth of Richard Nixon, quasars, and why both half-baked cakes and fully-baked civilizations fail.

The "BIG WHOOPS!" theory, as this daring new cosmological conception is called, contends that every object in the universe has a built-in *whoops!* factor that leads to its eventual downfall in an incongruous, if not downright silly, way. According to the theory, this is an inherent component of reality's basic nature which can not be altered in any way. It explains why, when things seem to be going along smoothly, *whoops!*, something happens that messes everything up. Say an almost inconceivable giant red star, some 500 million kilometers in diameter, farcically collapses into a tiny white dwarf, not more than 20 kilometers across. Or, you are on your way to a close friend's funeral when you slip on a banana peel and rip your meticulously pressed pants. That's the *whoops!* factor at work.

Further, it is postulated that the more massive the material object, the larger and sillier is its potential *whoops!* Therefore, if we were to extrapolate back some 20 billion years to a time when all the matter of the universe was concentrated into a highly compressed primordial globule, you can readily see that it exploded and formed today's observable cosmos because of the *whoops!* factor at its absolute best!

This cosmocomical event can best be visualized by picturing in your mind this preposterous primeval atom as a cosmogonical whoopee cushion which is being blown-up for a party gag. After it has been properly inflated and placed on a chair (preferably under a pillow) one of the unsuspecting guests "sits on it," and in a manner of speaking, lets the air out of the archetypal bag! Only in this singular case the air happens to be loaded with galaxies, pulsars, planets, stars, nebulae, comets, black holes, meteors, quarks and quasars that go hurling into all directions of space, and the universe is brought into being. Who blew it up, and who or what "sat on it" has not been addressed by these scientists who feel that these questions should be left to the realm of philosophical and theological inquiry

The observations that led to the theoretical foundations of this theory were done at the Mt. Malderner Observatory, in California, with the aid of its newly constructed 2.50-inch kaleidoscope. □

Peter Payack, 64 Highland Avenue, Cambridge, MA 02139.

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Greg Yob

Volla! The "Star" System

I was looking over the stack of items for review in this column and noticed that some of them are getting a bit old—I haven't enough space to give each item the kind of review I would like to do and have any room for the other items and small programs that I know you appreciate.

The "star" system is rather popular for rating restaurants, movies and tourist attractions: zero stars means the show isn't worth considering, one or two stars indicate that the product is reasonable but nothing special, three stars means good, four, quite good and five stars is superb. So from now on I will take less space for description and use the stars to give you my overall impression of a reviewed item. You can check the advertisements or write the manufacturer if you want more details.

While we are at this, note that *Creative Computing* has a *Software Buyer's Guide* which covers quite a few products and is worth reading.

PetChess *****

If you have been reading this magazine during the past two years, you know that David Levy wrote a column on computer games and how to program them, particularly games requiring some skill and thought to play. Mr. Levy went further and helped produce *PetChess* which is by far the finest chess program for the PET I have seen. I expect it will stand up rather well in the microcomputer chess tournaments.

PetChess from ACT Ltd. comes as a set of two tapes which hold versions for Basic 1.0, Basic 2.0/Revision 3.0, Basic 4.0 and the 8032 models of the PET. You will need a full 32K machine to load *PetChess*. Once started, *PetChess* draws a chessboard and the men, and awaits your commands. The instruction book is clear and concise and includes the FIDE Laws of Chess followed by the program.

All of the features you would expect of a chess program are present. This includes the entry of moves, the placement of pieces for problem solving, backing up if you blunder, displaying the square numbers, and setting playing level. An especially nice feature is the *H which displays the list of available commands at any point in the game. The 8032 version also displays the previous 20 moves at the right of the board for your reference.

PetChess is excellent for the amateur player—so get it! I do have some "wish for" items for the chess buff. They include: storage of the game or board position to the disk for later recall, a chess clock for timed games, and a dump of the current game to the printer.

I am a moderately good chess player, but PetChess can beat me consistently at Level 4, and unlike many chess games, it does quite well in the endgame where some deeper looking ahead is needed. When you first start, use Level 0 or 1 which plays very aggressively but with no foresight. Then work up to the level that suits you. *PetChess* is a very fast player—Level 4 takes about 30 seconds per move. It sells for about $50.

If you write software, take a good long look at *PetChess*. Sometimes a program can be written for the user rather than the programmer; *PetChess* is a good example.

PET Nuke Fix

Donald Barker reports that the PET Nuke program has a WAIT statement which prevents PET Nuke from working on the Basic 2.0/Revision 3.0 and 8032 machines. The offending line is:

```
5311 WAIT 59410,4,4:POKE216,23:
PRINT:PRINT BL$;:GETZZ$:RETURN
```

Mr. Barker provides this fix:

```
Delete 5311
5320 GET ZZ$:
IF ZZ$="" THEN 5320
5325 POKE 216,23:PRINT:
PRINT BL$;
5330 RETURN
```

I do not use the WAIT statement, because the PET will not respond to the Stop key while doing the WAIT statement. If the desired event does not happen, the PET remains stuck in the WAIT state.

If you have Basic 2.0/Revision 3.0, try exploring the results of WAIT 6502,n where n is from 0 to 255. This is for Basic 2.0/Revision 3.0 owners only.

CP/M for the PET *****

The universe of Commodore computers is rather like a ghetto in that we tend not to notice what is going on with other personal computers. The Apple and

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NEW SUBSCRIBERS ONLY

Atari are rather like distant cousins, and who ever heard of the Z-80?

There is an enormous world of machines and software for the 8080 and Z-80 processors, and most of it uses the operating system known as CP/M. The only practical way to get a PET or other 6502 based machine to run 8080 code is to get an 8080 or Z-80 and attach it to the PET. The Softcard by Microsoft does the trick for Apples by hooking a Z-80 into the Apple bus. There is a catch with this for PET owners, however: most CP/M applications demand at least 48K of RAM.

Small Systems Engineering has built the Softbox which is a unit about the size of a large textbook (it fits nicely on top of your disk drives with room to spare for the ventilation holes in the top of the case) which contains a Z-80 processor running at 4MHz, 60K of RAM, 4K of ROM (which holds the CP/M BIOS), an IEEE 488 bus port, an RS-232 port and a Corvus hard disk port.

To use the Softbox, you simply plug it in to the IEEE 488 bus, insert the CP/M system disk and do the usual DLOAD "*", A program is loaded from the disk into the PET which then activates the Softbox. The usual CP/M prompts appear on the screen, and the CP/M world is open for your pleasure. The Softbox actually does all the CP/M computations while the PET serves as a terminal.

SSE has about 25 of the standard CP/M software packages, including Wordstar and DBase, available on PET disks at present. Since several CP/M bulletin boards are now offering CP/M software via the telephone lines, the use of a modem lets you obtain some 3000 public domain programs for your Softbox.

As with all CP/M systems, the main problem is to get a diskette in the format you can use. The Softbox uses the Commodore disks with a modified format. You can backup the diskettes, but otherwise you must run CP/M to change the contents of the disks. SSE of course provides the master diskette for the packages they sell in PET format, so you are limited to their selection and prices at present. I expect this situation will change rather rapidly.

SSE has written a rather concise and clear introductory manual to help you get started with CP/M. There are several books which go further into CP/M and an incredible amount on CP/M in publications such as *Microsystems* and *Datacast*. The Softbox, which costs $895, carries my highest approval.

VIC Bits

I have a few letters inquiring about VIC Basic. The best way to look at a VIC is to see it as a Basic 2.0/Revision 3.0 PET with a rather funny screen and memory map. I suggest that all VIC owners get some of the manuals for the PET such as the Osborne book, *PET/CBM Personal Computer Guide*. If you skip entirely the material on disks and Basic 4.0, what remains will help you quite a bit with your VIC.

The VIC disk drive arrived on my desk a while ago, and I am rapidly discovering that the VIC disk is identical in operation to a Basic 2.0/Revision 3.0 PET operating a 4040 disk drive sans a drive number. For example, if you want to get the disk catalog, you enter: LOAD "$0",8. The PET/4040 owner would have entered LOAD "$",8 where the 0 refers to the drive #0. If you have the VIC disk, locate a 4040 drive owner who has Basic 2.0/Revision 3.0 in his PET and ask questions.

In many ways the VIC situation today is identical to the PET situation about two or three years ago. I suggest that you look at back issues of PET newsletters and personal computing magazines circa 1979 to 1981. Much of the material you find will apply to the VIC. My June '82 column compares Basic 4.0 to IEEE 488 commands for PET disks. The IEEE 488 commands will work on your VIC, so take a look.

When the PET disks first arrived, the complaints about the oddness and tediousness of the disk commands were loud and frequent. As the VIC disk becomes popular, I expect the same hue and cry will arise. Eventually the "DOS Support" (or *Wedge*) came along to make life bearable, and *Disk-O-Pro* finally provided the Basic 4.0 commands for us hapless 2.0/Revision 3.0 owners. A cartridge with the *Wedge* of VIC-O-Pro is a very sensible idea. Will somebody please make it? Your product will get an immediate review.

The Single Disk Glitch

If you have the 2031 single disk drive and a Basic 2.0/Revision 3.0 machine, you may have found a bug in your Basic 2.0/Revision 3.0 ROMs. When you read a file from the disk, some of the characters will be missing. The exact reason for this is obscure and beyond the scope of this column. Willi Kusche has provided these patches:

```
4C ED FF EA
AD 40 E8 29 FB 8D 40 E8
A9 5F 4C 87 F1
```

The catch, of course, is that these patches are in your ROM, so you must make an EPROM to replace your $FOOO ROM. Willi will provide a ROM for $15. If you prefer, Skyles Electric Works will also provide this ROM for $50.

DiscSavers ***

Isn't it annoying when a friend hands you a diskette with good programs on it, but without that protective paper envelope? Or perhaps you bought a box of discount diskettes which came sans jackets?

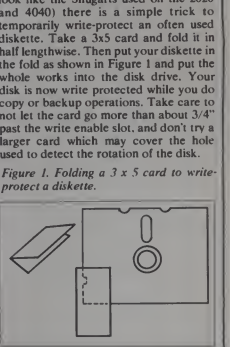
RockRoy offers colored vinyl disk sleeves to protect and help you keep your disk collection in order for about $.60 per sleeve. The colors are red, green, yellow, and blue.

Since RockRoy is the manufacturer, ask your dealer to place an order for you. You can buy boxes of 12 in each color or "assorted" which is three each of the four colors for $6.29. My ***** rating means that the DiscSaver is a good product, but not an exciting one.

A Write Protect Trick

If you have the 2020 or 4040 disks, or the 8050 with the Tandon drives (These look like the Shugarts used on the 2020 and 4040) there is a simple trick to temporarily write-protect an often used diskette. Take a 3x5 card and fold it in half lengthwise. Then put your diskette in the fold as shown in Figure 1 and put the whole works into the disk drive. Your disk is now write protected while you do copy or backup operations. Take care to not let the card go more than about 3/4" past the write enable slot, and don't try a larger card which may cover the hole used to detect the rotation of the disk.

Figure 1. Folding a 3 x 5 card to write-protect a diskette.



Fold the 3 x 5 card lengthwise as shown and put the diskette into the folded part of the card. Insert the works into the disk drive. Be sure the card does not cover the index hole.

Asteroidz and Munchman *

Guess which two popular arcade games these two from ComputerMat are modeled after. You get one guess. Both of these programs run on an 8K PET (both ROMs) and are simplified versions of the arcade games Asteroids and Pac-Man. In one sense it is quite a challenge to fit a good representation of an arcade game in an 8K PET, but to do a good job you

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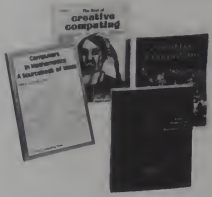

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must write the entire thing in machine language.

Asteroidz is better than *Munchman* both in speed and responsiveness. It also has several levels of play with the novice level quite easy to master. It took me some time to clear the screen at the expert level. The asteroids do not make smaller ones. Instead, they get smaller as your shots knock off chunks of them (breakout and asteroids?). One flaw is that your shots slow down the action, and if you have several shots on the screen, their range is quite short. Once the screen is cleared, the game is over.

Munchman is written entirely in Basic and is quite slow as a result. I never was able to clear the board, though I did get close. The drawback will be especially discouraging to novice players. The board does not have the "pass thru" found in Pac-Man and I noticed that the direction keys were ignored at times, so I got eaten even though my finger was on the correct key.

Winning these games is a challenge in its own right, but don't expect the kind of action you find at the arcades. I also wished for a joystick option on the user port, as many of my mistakes consisted of pressing the wrong key—my attention is on the screen, not the keyboard. Asteroidz and Munchman sell for $12.95 each.

Pakjana ***

I first noticed *Pakjana* in an article on "Object Languages" such as Smalltalk and Logo. A property of these languages is that you can easily define new procedures which immediately become part of the language. To solve a problem, you build a series of procedures which can be executed simply by typing their names. Then you combine these into other procedures and eventually you have constructed a special language of your own from these building blocks.

Pakjana draws a dancer which you can command to perform different actions, on the PET screen. For example, if you type UP, Pakjana (The dancer's name) will move up one step. UP 3 moves him up three lines. Nine kinds of faces can be selected by HEAD n, for example, HEAD 8 will make Pakjana smile. Similar commands exist for arm and leg movements.

The fun begins when you start joining commands together. REPEAT lets you repeat a sequence of actions such as REPEAT 3 (UP 2 LEFT 4) which makes the sequence in parentheses happen three times. A more powerful command is TO which lets you define a sequence as a new command in *Pakjana*. For example, you can set TO WAVE as LEFTARM 3 LEFTARM 4, and WAVE will then be a command like any of the others. WAVE 3 will wave the arm three times.

Some simple utility functions such as LIST and EDIT provide a minimal means for looking at and modifying commands. You can TAPESAVE your work for later TAPELOAD. HELP summarizes the commands available other than the ones you have defined.

I like *Pakjana* very much. It is a good way to introduce newcomers and children to computer language. Alas, a few bugs prevent me from assigning four or five stars. One of the faces, HEAD 3, leaves the nose at the edge of Pakjana's face; when another face is selected, Pakjana has two noses.

The face and arm commands do not provide symmetrical sets of right and left positions. For example, HEAD 3 looks to the dancer's right but there isn't a similar look to the dancer's left. RIGHTARM 7 is not the mirror of LEFTARM 7.

The most annoying bug is that *Pakjana* requires at least two dances to be performed before you can TAPESAVE your work. If these problems were fixed, I would give *Pakjana* a four-star rating.

Since I usually use the disk, I made the modifications in Figure 2 to use DISKSAVE and DISKLOAD instead of TAPESAVE and TAPELOAD. If you get *Pakjana* and make some improvements, I would like to see them. If you aren't afraid of a few bugs, get this program.

Pakjana, which costs $2.50, comes with a program listing, an introductory manual that kids can use and several pages which describe the operation of the program. Bill Finzer would like to see this program on other small computers, and so would I.

Filemaster ***

If you have owned a disk drive for more than six months, you know what happens to disks: they collect programs. Whatever method you use to keep the programs in order will soon cease to apply when you are in a hurry and save a program on the first disk that comes to hand. Inevitably the day comes when a cleanup job must be done.

The PET COPY command is then your workhorse, but it is clumsy to use and requires much typing. This is where *Filemaster* from Software by Sasso shines. When you load *Filemaster*, it starts up automatically. (This neat trick involves saving the program via the monitor with some values on the stack which when loaded fool the PET into thinking it is running the program.) You then insert your source disk in drive #0 and the recipient disk into drive #1. The directory is read and several options are presented. You may select the files to be copied from the directory on the screen.

The complete directory is shown, including scratched and botched files. *Filemaster* will attempt to restore damaged files and will let you unscratch a file if it is still intact on the disk. A bad file will be read until it can't be read further, and then placed in a sequential file for your further manipulations.

I have found *Filemaster* rather handy when I have to reorganize my disk collection, and I expect that you will too. *Filemaster* is a good utility and a bargain at $30.

A Yeech Program

If you have the Fat-40 or 8032 Pet, and want to bug somebody, try this little gem:

```
10 REM IRRITATION
20 FOR J=1 TO 255
30 POKE 231,J
40 PRINT CHR$(7);
50 NEXT
```

The function of location 231 will become painfully apparent in a few seconds. Variations on this theme are:

```
30 POKE 231, 255*RND(J)
30 POKE 231, J*RND(1)
```

```
12824 DATA DISKSAVE,/,DISKLOAD,/,TO,/,END,/,EDIT,/

7085 DK$="@:"+TK$+",W"
7090 OPEN 1,8,3,DK$
7091 CR$=CHR$(13)
7095 PRINT#1,RR;CR$;
7110 PRINT#1,R$(R);CR$;
7115 PRINT#1,CC$(R);CR$;
7130 PRINT#1,CH$(CP,R);CR$;

7190 CLOSE1:P$="FINISHED DISK SAVE":GOSUB2200:TM=1:GOSUB9600:RETURN

7217 DK$="@:"+TK$+",R"
7220 OPEN 1,8,3,DK$:GOSUB4400

10115 PRINT"rvs DISKSAVE.
10120 PRINT"rvs DISKLOAD
```

Figure 2. Modifications to Pakjana for disk.

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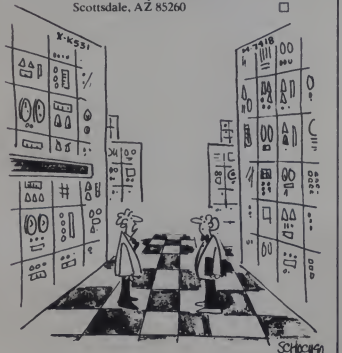

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Steve Gray, et al.

Practical Guide to Computers in Education, by Coburn, Kelman, Roberts, Snyder, Watt and Weiner. Addison-Wesley Publishing Co., 266 pages. 1982.

This book, written by a group of computer educators, is aimed at school administrators, teachers and parents with an interest in the potential and the limitations of working with computers and children.

Practical Guide to Computers in Education is a clearly written work and an excellent resource for people just starting out on the quest for straight information about educational computing. From the onset, the style of the book encourages the reader to relax because, even though computers can be overwhelming, the authors are knowledgeable, experienced and committed to making the journey pleasant.

The book provides a concise and well-organized forum which covers practical as well as philosophical questions relating to computers in schools. It discusses broad ranging questions such as: Is computer education a fad? How will computers transform schools and the way students learn? Will computers widen the schism between the haves and the have nots? Also included are more pragmatic questions such as: What do you want to do with the computer? Which computer should you buy? And how will you know a good educational software package from a poor one? These points and others are all crucial in the overall decision to include computers in a school.

The authors, all affiliated with a non-profit educational organization called Intentional Educations, Inc. are not a bunch of banner waving computer fanatics who, in their haste to proselytize, gloss over important issues and philosophical considerations. Neither does the reader get the impression that they are convinced that computers are the panacea for the American educational system. Instead, *Practical Guide to Computers in Education* offers a balanced view of educational computing.

The presentation of an objective viewpoint is critical during a time when schools are under pressure to continue high standards of education in spite of drastically shrinking budgets. Through the effective use of true life vignettes, the reader is permitted to peek into several schools where community pressure forced administrators to jump blindly on the computer bandwagon only to find that in some cases not only weren't all their problems solved when the computer arrived, but many new ones were created.

One thing that would improve an otherwise fine book has to do with its extremely undramatic visual presentation. At first glance it really doesn't appear to be a very exciting book and because of this, some of the people who could most benefit from the contents might not bother to read it. Perhaps some monochromatic highlighting or some more original photographs and illustrations would give the potential reader a better idea of the high level at which this book is written.

views...books

Dramatic pizazz not withstanding, *Practical Guide to Computers in Education* is a realistic look at what can and cannot be done with computers in schools. It should be required reading for anyone who finds himself as part of the decision making process to purchase computers. The authors have been through it all themselves and leave the reader with this pearl of wisdom: "Listen very carefully and don't believe everything you hear."—*Annie Fox*

Basic Basic—English Dictionary for the Apple, PET, and TRS-80, by Larry Noonan. Dilithium Press, Beaverton, OR. 153 pages, paperback $10.95. 1982.

This is a great idea, a book to help people translate Basic programs written for a computer other than their own. The idea is quite simple (although writing the book involved an incredible amount of attention to detail): an alphabetic listing of all the commonly used Basic commands, showing how to implement each command for the three computers involved.

The author wrote the book because all three computers are used in his school in Canada, and after a while, "It became obvious that there was a need for something that would help students, teachers and other computer users recognize the similarities and differences among the three Basic languages used by these computers," the introduction says.

Part I is a dictionary of commands, functions, statements and operators used in the three Basic dialects. For example, under CHR$, we're told that this function is used only in Applesoft (not Integer Basic) but that it can be simulated by creating a string with all the ASCII characters, and an example is given. CHR$ is used in PET Basic, and reference is made to "Appendix A for special ASCII characters to be used with CHR$ on the PET." As for the TRS-80, CHR$ "is used only in Level II Basic," and details on this usage are given.

Some statements can't be translated, of course; this includes Apple's FLASH command, which to put on the TRS-80 requires adding program lines to make the display switch back and forth from white-on-black to black-on-white.

Part II is a ten-page summary of terms, in table form, "for quick reference when more detailed information is not needed." Five appendixes supply ASCII codes, abbreviations of Basic words, details on the three graphics systems, reserved words, and Boolean operators.

If you're interested in translating programs from one of these three computers to one of the others, get this book.

Understanding Your VIC, Volume I: Basic Programming, by David Schultz. Total Information Services, Inc., Box 921, Los Alamos, NM 87544. 146 pages, paperback $11.95 (plus $2 for first-class shipping and handling). 1981.

More accurately, this is a book about programming the Commodore VIC-20. The preface says it "is intended to supplement the reference manuals provided by Commodore" and "is not a Basic programming guide, but rather a tutorial presentation of how Basic works on the VIC." Hmmm; a fine distinction.

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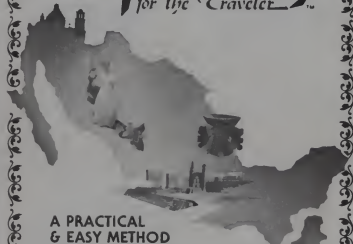

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Nevertheless, the author starts out with calculator mode, then moves on to input/output, getting information into the program, data, cassette usage, branching, IF, subroutines, strings, subscripted variables, program design, color, and sound. Appendix A gives listings of six programs (mailing list, number conversions, logical functions, color demo, and sound demo). The color and sound demo programs, on cassette, are $7.95 (plus $1 postage). Appendix B gives a simple 20-page backgrounder on data processing, from bytes to logical operators.

Many examples are given; because the text is typed, the author distinguishes between what is typed on the keyboard, and what is read on the TV display, by using a T or R before every line in every example. Monotonous, but it's the easiest way. Exercises are scattered throughout the book.

This is a good guide to VIC-20 programming in Basic, with plenty of helpful examples, and much attention to detail. However, some beginners may get bogged down in the chapter on program design, in which the author felt constrained to get into pseudo-code, which may confuse more than simplify things for some.

Number Treasury: A Source Book of Problems for Calculators and Computers, by Stanley J. Bezuszka and Margaret Kenney. Dale Seymour Publications, 198 pages, 1982.

Number Treasury is a math teacher's dream book as well as a young mathematician's math book. (All math novices and math phobics should exit here.) It is designed as a resource for high school math teachers and gifted junior high students and contains a wealth of mathematical knowledge. Within its covers, *Number Treasury* provides a quick overview of number theory with concise definitions of everything from prime, perfect and Fibonacci numbers to the lesser known but equally intriguing lucky and happy numbers.

The layout of the book, though not exciting, is consistent throughout. Each section includes an explanation of the laws governing each kind of number, followed by examples and problems to be solved. The predicatability and conciseness are appropriate for the subject matter, and the format makes it very easy for a teacher to skim through the pages and choose problems for students to solve.

One criticism of *Number Treasury* lies in the insinuation of the subtitle that somehow the book relates to computers and calculators. It doesn't. Although it is true that a teacher *with programming knowledge* could direct students in the creation of computer generated solutions to the problems, the book itself makes no mention of how this might be done. A teacher who doesn't know programming would find it impossible to learn or teach anything about computers from the information presented here. It simply was not designed to be used with computers or calculators at all and it is misleading to imply that this is another of the new "computer math" books. *Number Treasury* is, however, a good book. In conjunction with the input of a creative instructor it could be used (with or without computers) very effectively.—*Annie Fox*

views...book

Compu-Guide: A Consumer's Guide to Small Business Computers, by Martha Eischen. Dilithium Press, Beaverton, OR. 164 pages, paperback $14.95, 1982.

Based on the author's one-day seminar titled "Do You Need a Computer?," this slim volume is packed with advice to the person seeking a small computer for business applications.

The author starts out by discussing what a computer can do (save labor, reduce costs, improve work quality, etc.) and can't do (eliminate jobs, reduce personnel, eliminate paperwork, correct current procedures, etc.), asks the reader if he really needs a computer, then gets down to defining objectives, assessing requirements, performing a study, and keeping the staff happy. She pauses to give a chapter on DP terminology, then gets into Choosing the Right System (a look at the various parts of a system), Hardware and Software Contracts, Your System Today and Tomorrow (expandability, transportability, etc.), Installation and Implementation, The Personal Computer, and ends with an appendix consisting of questions to answer, and blanks to fill in with data, as part of a feasibility study.

The book is crammed with common-sense advice and basic information, written very clearly and concisely. Its major drawback is the drawings, which are cartoons in the style of Helen Hoskinson's somewhat confused ladies that once appeared in *The New Yorker*. Many are amusing, but all are poorly drawn, and instead of offsetting what the author (or publisher?) may have felt was rather technical material with a little humor, the cartoons add more of a frivolous touch than anything else. Forget the cartoons—read the book.

An Introduction to Microprocessors: Experiments in Digital Technology, by Noel T. Smith. Hayden Book Co., Rochelle Park, NJ. 182 pages, paperback $10.95, 1981.

The back cover says this is a "learn-by-doing" guide to the use of ICs that "provides a foundation for understanding the underlying hardware actions of programming statements."

The first chapter, an Introduction to Digital Technology, covers the theory and manufacture of integrated circuits, and also tells how to build the breadboard needed to perform the experiments in the subsequent chapters; or you can buy a commercial breadboard.

The first experiments are with logic gates (NOT, AND, OR, NAND, NOR), then you move on to synchronizing circuits (flip-flops, multivibrators, timers, clocks, triggers), clocked logic, data manipulation and display, data processing (with a Motorola MC14500B), and multibit microprocessors (using a Motorola MC6802). Appendixes describe an alternate breadboard design, and provide IC pin-out diagrams that identify which pin connects to what IC input or output line. No indication is given of the cost of the breadboard or ICs required for the 35 experiments.

Smith writes simply and clearly, and goes into great detail. The experiments range from determining the output of an OR gate, to designing a program for BCD subtraction. This looks like an excellent way to get hands-on experience with computer hardware, down at the gate level. □

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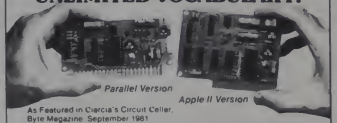

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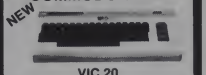

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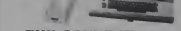

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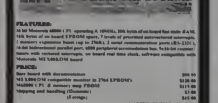

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index to advertisers

Reader Service No.	Advertiser	Page
101	Aardvark Technical Services	169
102	Advanced Logic Systems	136
103	Adventure International	60
"	ALF Products	22
104	The Aiken Group	265
105	Alpha Byte Computer Products	194-195
106	Amdek Corporation	32
107	Amedex Corporation	116
108	American Small Business Computers	236
109	Apparel	197
311	Apparel	273
110	Apple Computer Corporation	138
111	Applied Software Technology	98
112	Archive	199
113	Armco Insurance Group	211
114	ARCsoft Publishers	231
"	Artwork	225
"	Aspen Software	154
115	Astrocade Corporation	268
116	Automated Simulations	77
117	Automated Simulations	135
118	Bill Mail Order	268
119	Beagle Brothers Micro Software	295
120	Big Five Software	2
121	Bit 3 Computer Corporation	285
122	Broderbund	52-53
123	Business Computer Products	288
124	C&C Software	175
125	C&S Electronics, Ltd	227
126	California Accessory	157
127	Calsoft	189
128	Central Point Software	294
129	Chrisin Data	271
130	Coast Magazine	227
131	Coast Magazine	227
132	Comm Data Systems	261
133	Commodore Business Machines	46-47
134	Commodore Business Machines	Cover 3
135	Compuserve	125
136	Computronics	251
137	Computer Bus	143
138	Computer Discount of America	286
139	Computer Exchange	82-83
140	Computer Mail Order	184-85
141	Computer Plus	297
142	Computer Specialties	183
143	Computer Time Inc	279
144	Computer's Voice	261
145	Connecticut Information Systems	217
146	Consumer Computers Mail Order	247
147	Corona Data	15
148	Cosmic Corp Unlimited	165
149	Cottega Software	109
150	Covercraft	269
151	CPU Shop	275
"	Creative Software	240
152	Cybertronics	245
153	Cybertronics	247
154	Datasmith	261
155	Datasoft	23
156	Discount Data Products	191
157	Discount Software Group	187
158	D/Punch Company	232
159	Dresselhaus Computer Products	215
160	Dynacomp	159-161
161	800 Software	99
162	E&L Instruments	209
163	Educational Activities	292
"	Electric Games	239
164	Electronic Specialists	307
165	ETS Centre	303
166	Federal Energy Systems	291
"	Financial Software	175

Reader Service No.	Advertiser	Page
167	First Star Software	293
168	Flipitrack Training Tapes	291
169	Franklin Computer Corp	76, 79
170	Frederick Computer Products	265
171	Gladstone	241
172	Gnosis	273
173	Gold Disk Software	16
174	Happy Hands	183
175	Heyden Book Company	114
176	Health Company	85, 86a, 86b, 87
304	Human Engineered Software	148
177	Huntington Computing	179
178	IBM	94, 95
179	I/O Inc	117
179	In-Home	231
180	Intec Peripherals Corp	241
181	Integral Data Systems	91
199	Interpretive Education	115
182	The Intelligent Investor	234
184	Jade Computer Products	219-221
185	Jmacsoft Inc	281
186	Kaigio Electronics Co Inc	183
187	Kelly's Computing	208
305	Kensington	237
306	Kerri	245
189	Leaf Electronc	292
190	Leading Edge	9
191	Leading Edge	Cover 4
192	Lifeboat Associates	72
193	Lifeboat Associates	281
194	LNW Research	35
195	LNW Research	253
196	Lyco Computer	297
"	Macmillan Book Club	103-105
197	Mark Four Imports	269
198	Maxell	5
200	Memdech	43
201	Merry Bee Communications	80
202	Meta Engineering	303
203	Meta Engineering	305
204	Micro Business World	151
205	Micro Computer Service Center	304
206	Micro D	19
207	Micro House	24-25
208	Micro Lab	108
209	Micro Learningware	236
210	Micro Management	287
211	Micromint, Inc	307
212	Micro Mountain	229
213	Microsand	279
214	Microstatics	273
215	Microsystems	285
216	Microwere Distributing	279
217	Microworks	215
218	Milton Bradley	45
219	Mind Systems	10
220	Monument Computer Service	215
221	M-R Information System	80
222	Muse Software	57
223	Muse Software	85
224	National Software	243
225	Nebs Computer Forms	281
226	NEC Information Systems, Inc	113
227	NEECO	171
"	Newport Machine Design	90
228	NRI Schools/Electronics Division	121-123
229	Omega Microware	255
230	Omega Microware	295
231	Omega Sales	213
232	On-Line Systems	56
233	Optimal Technology Inc	300
234	Orange Micro	173
235	Pacific Exchanges	232

Reader Service No.	Advertiser	Page
233	Pacific Exchanges	241
235	Pacific Exchanges	268
234	P.C. Magazine	147
235	Peek & Poke Software	305
236	Penguin Software	145
236	Perry Oil & Gas	297
237	Peripheral Unlimited	263
238	Personal Computer Age	183
240	Personal Systems Tech	223
241	Piccadilly Software Inc	88
242	Prectical Peripherals Inc	Cover 2-1
243	Professional Software	203
244	Professional Software	205
245	Programmers Institute	257
246	Programmers Institute	259
247	Protecto Enterprizes	98
248	Quadram Corporation	235
249	Quality Software	17
250	Quark Engineering	51
252	Qume	101
253	Radio Shack	49-54
254	Radio Shack	141
256	Red Baron	176-177
257	R.H. Electronics	133
259	Rock Roy Inc	71
259	Royal Software	201
260	Savey	107
261	Sentient	128
262	Silicon Valley Systems	11
"	Sinclair Research Ltd	39-41
263	Snug Software	67
264	Sir-Tech	27
265	Sir-Tech	29
265	Softech Microsystems	127-131
266	Software City	249
268	Software City	90
269	Software Dimension	152
270	Software Street	257
271	Southwestern Data	277
271	Southwestern Data	289
272	Southwestern Data	306
273	Spinnaker Software	12-13
274	SPA	237
275	SPA	240
276	SPA	273
277	Star Micronics	74, 75
278	Stoneware Micro Computer	161
279	Stoneware Micro Computer	259
280	Strategic Simulations	38
281	Strategic Simulations	96
282	Street Electronics Corp	255
283	Strictly Software	167
284	Sublogic	93
285	Sublogic	126
309	Success Sellers	253
286	Systems Design Lab	281
287	Tecmar Inc	7
288	Telesoft	65
289	Telesterminal	163
290	Terrapin	110
291	Texas Instruments	64
293	Transnet	304
293	TSK Electronics Corp	88
292	TYC Software	236
294	Uncom	290
295	United Home Computer	296
296	Vabar	21
297	Video	142
298	Voyager Software	297
299	Weaper Micro	30
300	Weaper Micro	31
301	Wiley Publishing	290
302	XPS Inc	90

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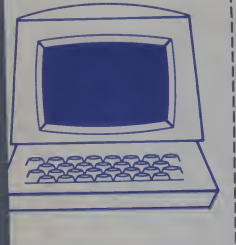

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137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	
155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	
173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	
191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	
209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	
227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	
245	248	247	248	249	250	251	252	253	254	255	256	257	258	259	260	281	262	
263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	
299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	
317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	
335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	
353	354	355	356	357	358	359	360	361	362	363	364	385	366	387	368	369	370	
371	372	373	374	375	378	377	378	379	380	381	382	383	384	385	386	387	388	
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119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	
137	138	139	140	141	142	143	144	145	148	147	148	149	150	151	152	153	154	
155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	
173	174	175	178	177	178	179	180	181	182	183	184	185	186	187	188	189	190	
191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	
209	210	211	212	213	214	215	218	217	218	219	220	221	222	223	224	225	226	
227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	
245	248	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	
263	264	265	266	267	268	269	270	271	272	273	274	275	278	277	278	279	280	
281	282	283	284	285	288	287	288	289	290	291	292	293	294	295	296	297	298	
299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	318	
317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	
335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	
353	354	355	358	357	358	359	360	361	362	363	364	385	366	387	368	369	370	
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119	120	121	122	123	124	125	128	127	126	129	130	131	132	133	134	135	138	
137	138	139	140	141	142	143	144	145	148	147	148	149	150	151	152	153	154	
155	156	157	158	159	180	161	162	163	184	185	186	187	188	189	170	171	172	
173	174	175	178	177	178	179	180	181	182	183	184	185	186	187	188	189	190	
191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	208	207	208	
209	210	211	212	213	214	215	218	217	218	219	220	221	222	223	224	225	226	
227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	
245	248	247	248	249	250	251	252	253	254	255	258	257	258	259	280	281	282	
263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	
281	282	283	284	285	288	287	288	289	290	291	292	293	294	295	296	297	298	
299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	318	
317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	
335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	
353	354	355	356	357	358	359	360	381	362	363	364	365	366	367	368	389	370	
371	372	373	374	375	378	377	378	379	380	381	382	383	364	385	388	387	388	
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