

COMPUTE!

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The Journal For Progressive Computing™

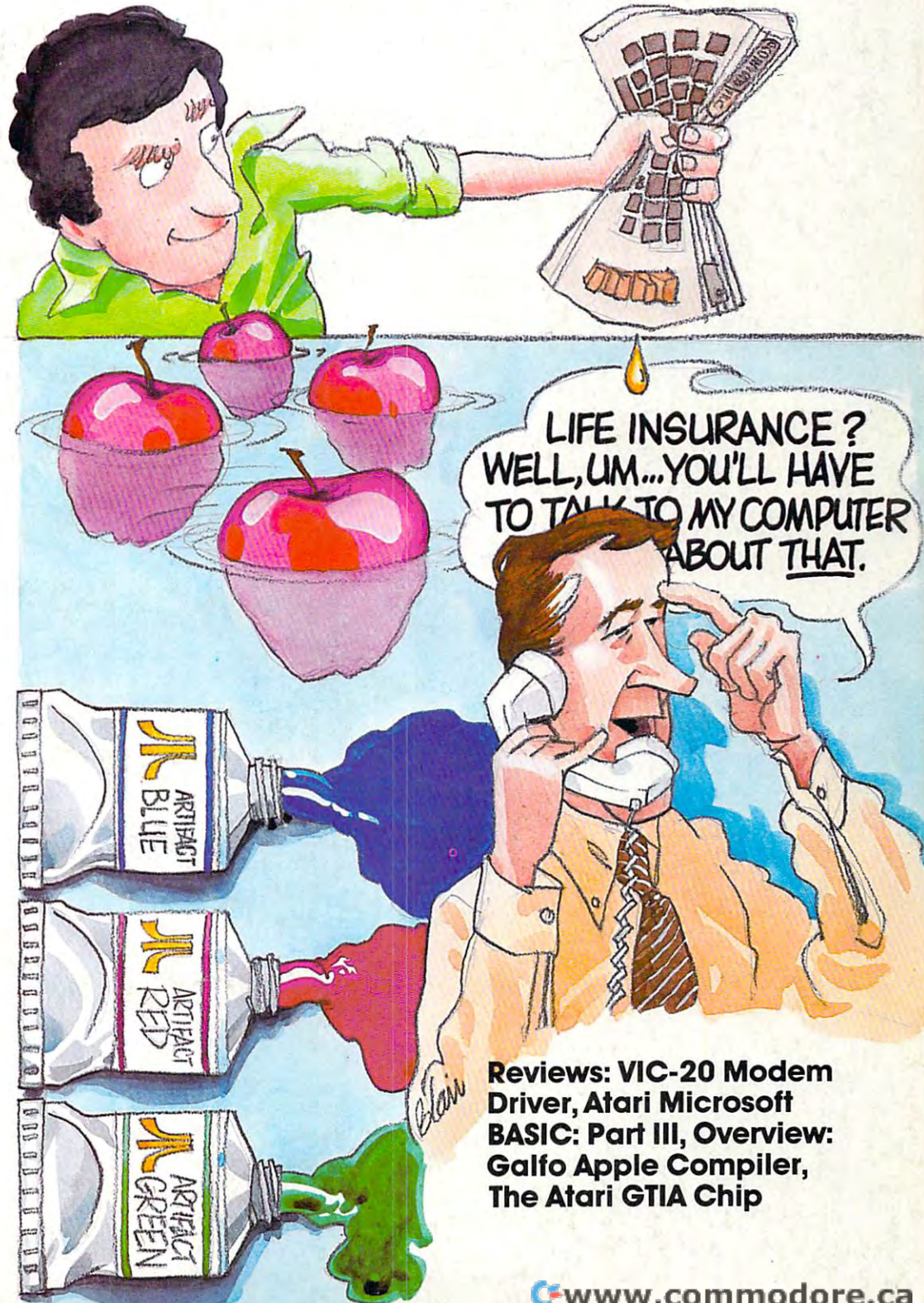
**Putting The
Squeeze On Your
VIC-20:**
Getting The Most Out
Of 5000 Bytes...

**Modifying Apple's
Floating Point
BASIC**

**Life Insurance
Estimator:**
An Applications
Program

**Extra Colors For
Atari Through
Artifacting**

**Screen Input
For Commodore
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**Reviews: VIC-20 Modem
Driver, Atari Microsoft
BASIC: Part III, Overview:
Galfo Apple Compiler,
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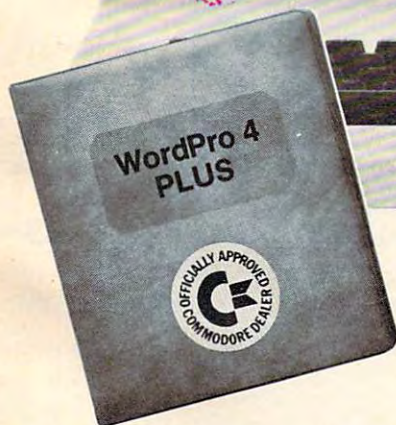
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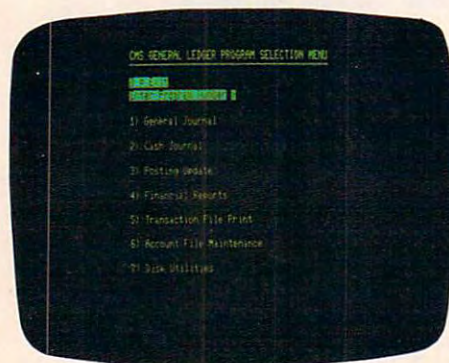
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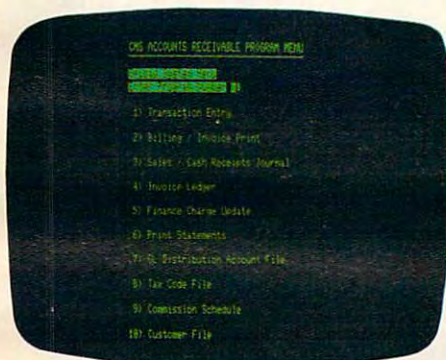
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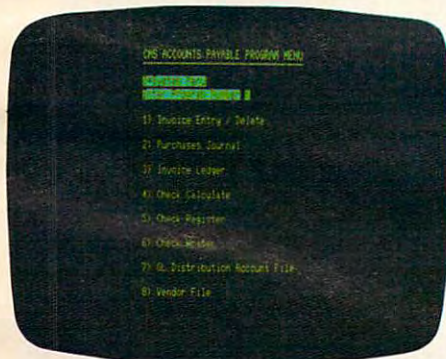
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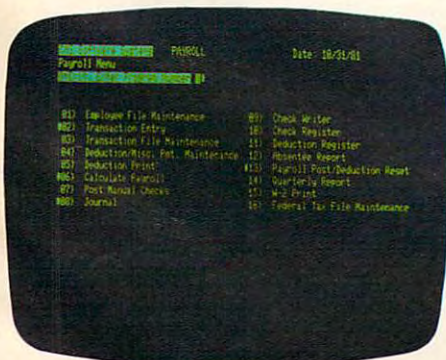
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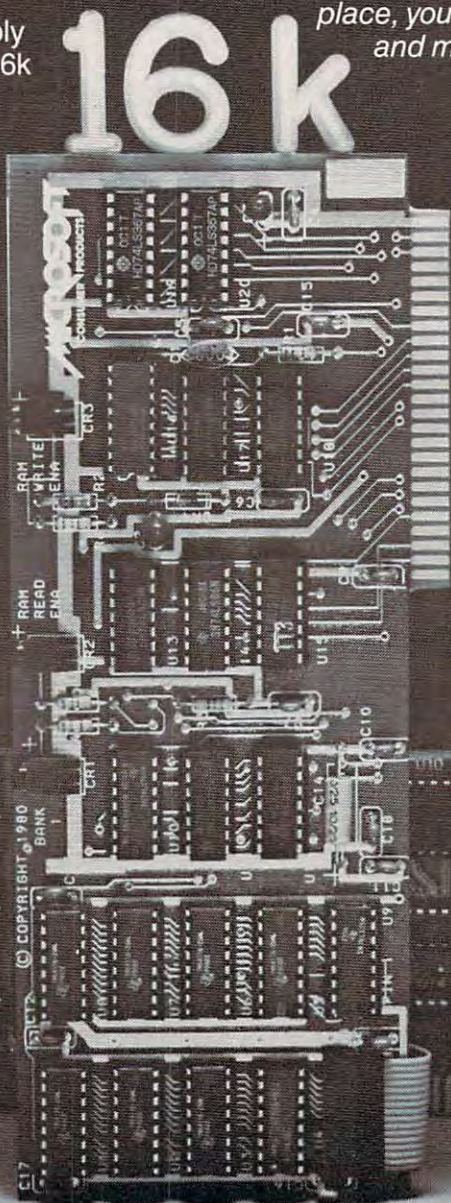
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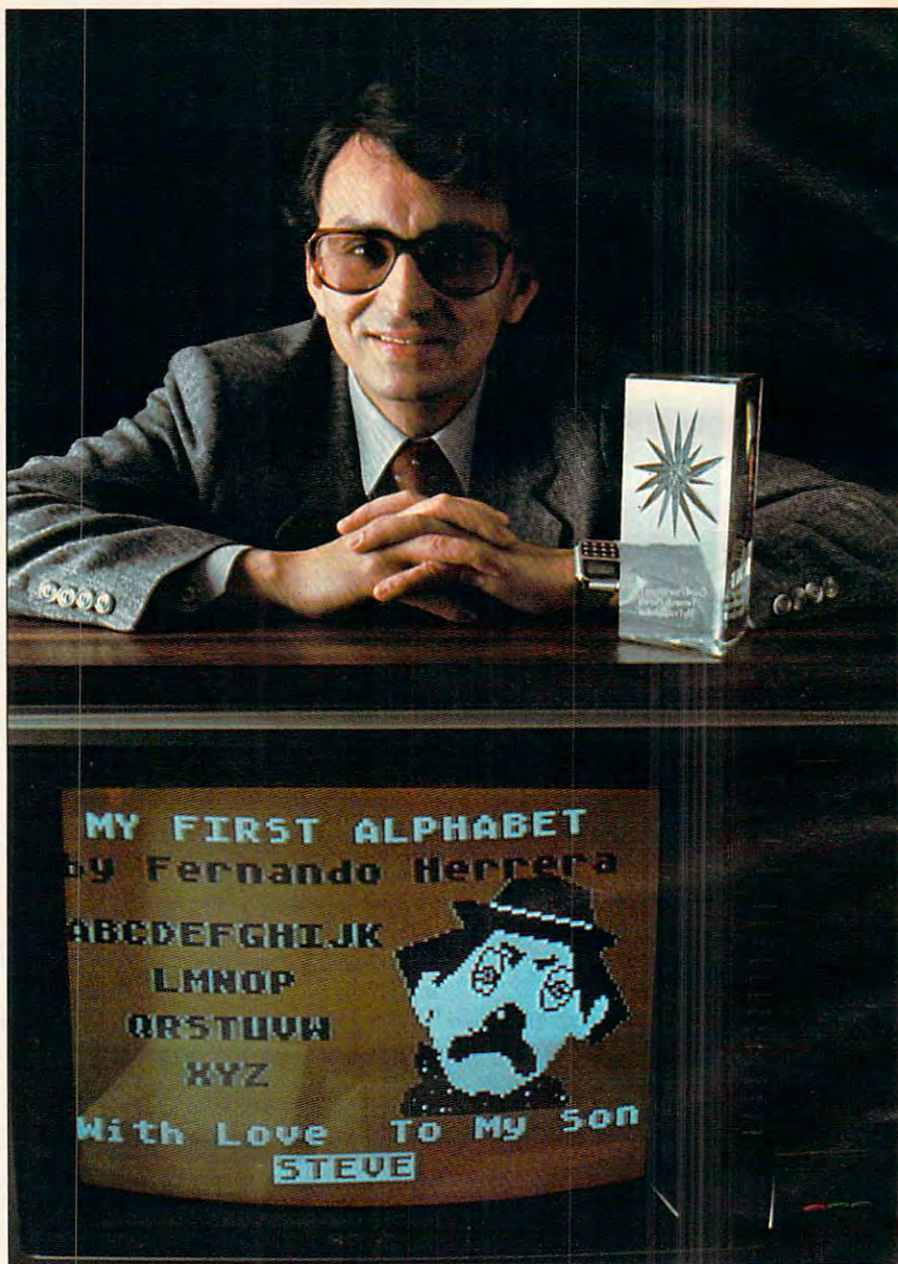
Fernando Herrera became the first grand prize winner of the ATARI Software Acquisition Program (ASAP) competition because he believed in computers, his son and himself.

The story of Herrera's success began with his son's sight problems. Young Steve Herrera had been born with severe cataracts in both eyes and, naturally, his father was concerned. Herrera reasoned that the boy's learning abilities could be seriously affected by growing up in a world he could not see.

Having just purchased an ATARI 800 Home Computer, it occurred to Herrera that this could be the perfect tool for testing Steve's vision. So he wrote a program simply displaying the letter "E" in various sizes.

Success! It turned out that 2-year-old Steve could see even the smaller "E's" without special lenses. Herrera was first relieved, and then intrigued when he discovered that not only could his son see the "E's," but he would happily play with the computer-generated letters for hours. So Herrera added a picture of an elephant to go with the "E," and then more letters and pictures. Thus, "My First Alphabet" was born, a unique teaching program for children two-years and older consisting of 36 high resolution pictures of letters and numbers.

Herrera submitted the program to the ATARI Program Exchange, where it became an instant best-seller. ATARI was so impressed with the outstanding design, suitability and graphic appeal of "My First Alphabet," that the program is being incorporated into the ATARI line of software.



In addition to his grand prize winnings of \$25,000 in cash and an ATARI STAR trophy, Herrera also automatically receives royalties from sales of his program through the ATARI Program Exchange.

But Fernando Herrera wasn't the only software "star" that ATARI discovered. Three other ATARI STARS were awarded at the ASAP awards ceremony for software submitted to the ATARI Program Exchange and

judged by ATARI to be particularly unique and outstanding.

Ron and Lynn Marcuse of Freehold, New Jersey, teamed up to write three winning entries in the Business and Professional category for home computers: "Data Management System," "The Diskette Librarian" and "The Weekly Planner."

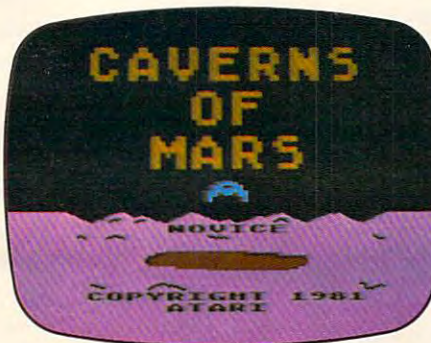
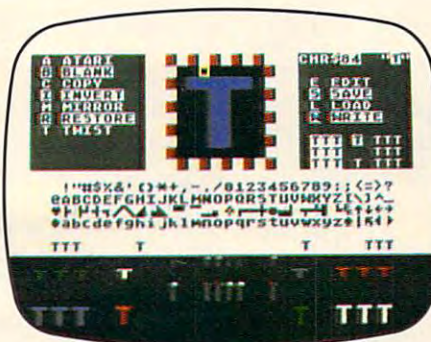
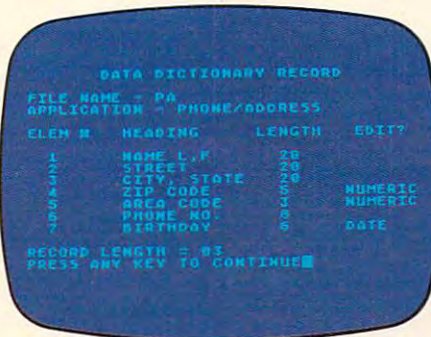
Sheldon Leeman of Oak Park, Michigan, captured an ATARI STAR for his exceptionally well-engineered "INSTEDIT" character set editor.

Greg Christensen of Anaheim, California, became our youngest ATARI STAR winner at the age of 17. Christensen designed the clever "Caverns of Mars" game program, which also will be incorporated into the ATARI product line. Greg designed the program in 1½ months after owning his ATARI Home Computer for less than a year.

Every three months, ATARI awards ATARI STARS to the writers of software programs submitted to the ATARI Software Acquisition Program and judged first, second and third place in the following categories: Consumer (including entertainment, personal interest and development); Education; Business and Professional programs for the home (personal finance and record keeping); and System Software.

Quarterly prizes consist of selected ATARI products worth up to \$3,000, as well as an ATARI STAR, plus royalties from program sales through the ATARI Program Exchange. The annual grand prize is the coveted ATARI STAR trophy and \$25,000 in cash.

To be eligible, your software idea must be accepted by the ATARI Software Acquisition Program. Your program can have a broad application or serve a very specific purpose.



After submittal, consultation from ATARI is available if you need personal assistance with sound, graphics, or other technical aspects of your program.

To make your job easier, ATARI provides some 20 software development tools through the ATARI Program Exchange. A list and description of the various system software is published quarterly in the ATARI Program Exchange Catalog. These tools enable you to utilize all the ATARI resources and software, including the six ATARI programming languages.

Fernando Herrera had a great idea that made him a star. ATARI would like to give you the same opportunity.



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The Editor's notes...

Robert C. Lock
Publisher/Editor

The Apple Plan

Many of you may not be aware that Apple, Inc., is currently pushing for a revision of the tax law that will allow them to give an Apple II system (with appropriately revised tax deductions) to every elementary and secondary school in the country. *The Wall Street Journal* estimates this number to be in excess of 80,000 schools, and that's a great many Apple II's. We applaud this move, but feel some additional perspective might be in order. Apple, Inc., is quoted as wishing to make this massive donation because they're concerned with the future ... exposing kids to computers, etc. We certainly share this concern and wouldn't want to be accused of looking a gift computer in the keyboard, as it were.

A Historical Perspective

Apple has been an industry leader in the placement of computer systems in school systems. They and many Apple dealers have been at the forefront with aggressive bidding and state contract winning ways for several years. Their principal competition during the last year or so has been Radio Shack, Commodore, and Atari, with Atari coming on quite strong. A case in point? The Minnesota Educational Consortium has been a quantity purchaser (and not so coincidentally, a significant developer of educational software) from and for Apple for the last three years. We reported in this column last November that Atari, Inc. had been added to that contract with fully configured Atari 400 systems (including black and white monitor, BASIC, joystick and disk drive) for less than \$600. MEEC had already ordered 1000 +, and the Dade County School System in Florida was right behind with a similar contract.

In the last ten months we've seen increasingly powerful and user friendly computer systems (the Atari 400, the VIC-20, the Radio Shack Color Computer) become available, fully configured, in

the \$500-\$800 price range. We suspect that Apple is running into a rapidly diminishing market share at the elementary and secondary level.

The Future

We see nothing but good news on the horizon for the cost-conscious educators. With the coming Super VIC (the VIC-64 from Commodore, due to be introduced this summer at less than \$600) and Atari's rumored low-mid-end entry sometime this summer, the value of the computing power dollar for educators will only increase. Apple has apparently chosen to ignore the low-end market in their product line. With this statement we're certainly not implying that they don't want the business of consumers or educators. We simply mean they've chosen for the moment not to enter the \$500-\$800 consumer computer market. On the high end they're battling with such industry names as Xerox, IBM, and Hewlett-Packard. And, quite frankly, they have no product on the low end. We suspect the secondary education market, long a potentially substantial market for Apple and others, is taking a hard look at the \$2000 or more Apple system. After all, when your goal is allowing computer access to your sixth graders, how many VIC-20, or Atari-400, or Radio Shack Color Computer systems can you buy for the cost of a similarly configured Apple II system?

Of Tax Breaks and Competition

Press reports indicate no special treatment for Apple, Inc., in the proposed revisions to the corporate tax law. At that point, every other vendor has the same options open to them. In that light, we support Apple's aggressive offer, and the revision of the tax law, as suggested. After all, manufacturers can already donate hardware to universities, why not to secondary schools? We do feel, however, that while Apple's move deserves plaudits, the spectre of competition should be maintained to help balance our mutual perspective.

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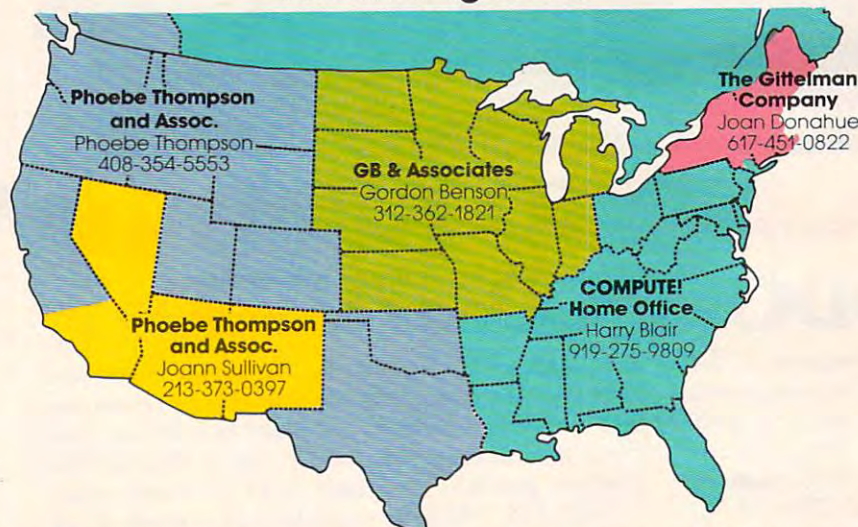
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Ask The Readers

Robert Lock, Richard Mansfield
And Readers

Please address any questions or answers to: Ask The Readers, **COMPUTE!** Magazine, P.O. Box 5406, Greensboro, NC 27403.

Answers

Mr. Rovero, whose article, "A User-defined Character Editor," appeared in **COMPUTE!**, February, 1982, #21, has updated the program to run on all PET/CBM machines. He offers to make copies for interested readers:

"I have since modified the program to work with all ROMs 1.0 through 4.0, 16K-32K (8K with REMARKS deleted), 40 or 80 column screens and with either tape or disk (Update and 4.0 ROMs). Readers may obtain a copy of the original program or the 'All ROM' version on tape or 4040 format disk by providing the magnetic media, self addressed mailer, and \$3.00"

P. J. Rovero
Navy Oceanography Command Center
Comnavmarianas Box 2
FPO San Francisco 96630

"I am writing about the Commodore disk drive, upgraded 2040 or the 4040. It seems like when I had a program running relative files, the disk would write to two or more files at the same time. I would write information to file 'A' and then later pull up file 'L' and it would contain the same information as does file 'A.' I went over and over my programs, and could not find anything that looked out of order.

Last week, a customer of mine who uses a custom program I wrote for him called and said his accounts were all messed up. He had the same problem of writing to two different accounts at the same time.

I took his disks and ran a printout of the directory, Track 18, Sectors 0-19 and I found the problem. It seems that the directory has been messed up and is pointing to the same data for both accounts.

If you look at bits 4 and 5 of each directory entry they will tell you the track and sector that each entry's data is stored at. Bit 4 points to the Track, and bit 5 points to the Sector. If for example, the bits 4 and 5 look like this 0E 01 then you should look at Track 14 Sector 1 for your

data. If bit 4 and 5 of the directory entries are the same, then, when you write to any one of these files, they will all look as if they have been written to. The problem is that the directory tells them all to look at the same data.

I just got a call from my dealer, who I convinced to call Commodore. That he did, and the answer he got was that they had a list of bugs on the 2040 and 4040 operating system and it seems this is one of them. He said if you have too many files on a disk that it may start to overwrite the directory. He didn't give any idea of what was too many....

I am going to rewrite my customer's program and all his data disks for 101 files maximum (down from 141) and see if this won't help. In the meantime maybe this information will help someone else who is having similar problems.

Ronald L. Straley

*"In **COMPUTE!**, February, 1982, #21, Michael A. Ivins wanted a program for the Atari that would dump text screens to a printer or file. He hoped for DATA statement creation for use in POSITION and PRINT statements in an adventure game.*

Computer's Voice is currently marketing a program called Menumaker that will complete this application. This program currently allows the user to type any screen in GRAPHICS 0 with full key editing. The program then dumps the screen to a tape or disk file making POSITION and PRINT statements. By including a different character set with the program, screen creation with that new set is very easy. Cost is \$14.95 for the 8K tape version and \$19.95 for the 16K disk version. We are currently working on a GRAPHICS 1 and 2 version as well.

Dave Pettit, President
Computer's Voice
2370 Ella Dr.
Flint, MI 48504

We received several replies to Don Dudley's question about problems with his VIC-20 tape drive. Here are two, but they both wisely suggest that you might want to leave adjustments to the experts.

"In reply to Don Dudley's question regarding his cassette player. The most likely cause of his problem is that the read/write head is out of alignment. I suggest using a plastic screwdriver, to keep from magnetizing the head, this can be purchased from any electronics supply store for less than a buck. With the player running, and the computer trying to read it, you will see a small screw on either the right or left side of the head. It is necessary to turn this screw, clockwise or counter-clockwise, until the computer begins to read the tape. Be careful not to remove the screw during the process, it's a real pain to get it back in again!"

If you feel at all uncomfortable with the idea, any electronics repair store can align it in just a few moments, and usually for under \$25." Mike Lipay

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"In response to Don Dudley's letter (March '82) about his VIC recorder that only loads when upside down, I had a similar problem with mine. A week after I bought it, I tried loading tapes made by some friends, with little success. The dealer exchanged it, since it wouldn't load one of his demo tapes.

The replacement still wouldn't load one friend's tape until by chance I pushed down a bit on the recorder's door, effectively changing the azimuth relationship of the tape and the playback head. Another friend had a similar problem until he bent the tension spring in the back of the cassette compartment forward far enough to increase the tape to head pressure. If neither of these methods appeal to you, a trip to the dealer for a head alignment may be required. Good luck!" John Williamson

The example program which illustrated the technique described in this letter was left out when it was first published in this department in **COMPUTE!**, March, 1982, #22. We reprint it here in its entirety.

"For several years I have been dealing with the crash of the INPUT statement in our 2001 and 4016 Commodore Computers when the RETURN key is depressed with no input! I have read of several fairly short routines that overcome this problem and have developed my own favorite, as have most users. (Our students develop software for the Elementary School - kids, and their teachers, will crash programs.)

Anyway - this evening, quite by accident, I stumbled upon a quick way to protect the RETURN key on INPUT! At least I have never heard of it. [Lines 70, 80, 160, 170, and 180 will do.] If you type in the enclosed program and RUN same, you will notice that the INPUT at line 70 (numeric) and line 160 (string) are protected under input/return (and, of course RUN/STOP)!!

When you look at the listing, I'm sure your reaction will be the same as mine was when I looked at the listing and said to myself and all within earshot, "What's going on here? I tried this years ago! It didn't work then, so why is it working now?"

The key lies in the length of the input prompt - exactly 38 characters. This configuration puts the INPUT question mark at the end of the input line and the cursor all by itself on the left of the next line. Bingo - RETURN = null. The conditional picks up the pieces and we're in business." John Taylor

```
10 REM >> DIE THROW <<
20 :
30 PRINT [CLEAR]
40 :
50 REM >> HOW MANY THROWS ? <<
60 :
70 INPUT "HOW MANY TIMES SHALL THE DIE
   BE THROWN";N
80 IF N<1 OR N>50 THENPRINT "CAN'T DO
   THAT":FOR X=1 TO 2000:NEXT:GOTO 30
90 PRINT
```

```
100 :
110 :
120 REM > BODY OF PROGRAM OMITTED <
130 :
140 :
150 REM >> AGAIN ? <<
160 INPUT "ANOTHER ROUND? JUST GIVE A YES
   OR NO";Q$
170 IF LEFT$(Q$,1)="Y" THEN 30
180 IF Q$=" " OR LEFT$(Q$,1)<"N" THENPRINT
   "[3 UP]":GOTO160
READY.
```

Mr. Ferguson is the author of "Large Alphabet For The VIC," **COMPUTE!**, March, 1982, #22, pg. 104.

"Today I have discovered why I never could understand how to create more than 64 characters: your article in the October '81 [**COMPUTE!** #17] issue was in error.

Not your fault, however. [Your information, on] page 32 of the October **COMPUTE!** is obviously from Commodore's ... new VIC manual. The VIC people are wrong.

On pages 83-84 of their manual it gives the values to be POKED into 36869. But the formula given on page 215 of the manual (which you printed in October) does not yield these values. It should be POKE 36869,PEEK (36869) AND 240 OR X.

I had had trouble last fall getting the erroneous Boolean formula to work, but I assumed I was doing something wrong. But with the correct values printed on pgs. 83-84, I realized the formula was wrong."

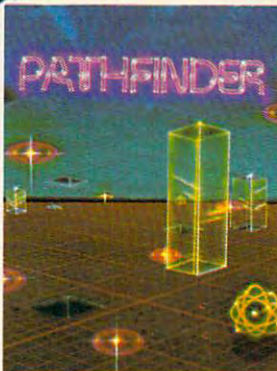
Doug Ferguson

Questions

"I would appreciate it if your readers could give me the publisher or bookstore where I could obtain the book Computers In Medicine by Derek Enlander. It was recommended reading in a recent course I took, but I do not have the publisher's name." L. Thomas

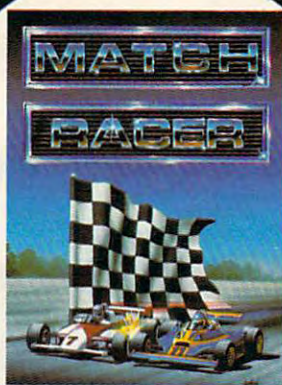
"I have a few questions regarding that pernicious malady known as "Atari lock-up." First of all, does this happen with other brands of micros? Secondly, though it is generally attributed to "over-editing," why does it occur at all? And finally, has anyone else suffered a similar occurrence which I shall dub "two-line lock-up"? In this frustrating instance (which always seems to occur when typing "L." for a listing when the cursor is on the bottom row of the display area in text mode), the cursor advances one row after return, then does nothing! The screen may be cleared or reset, but any command issued will have the same two-line response followed by zilch, cipher, naught, nothing. Of course the program so intensely struggled with is in another dimension at this point and cannot be retrieved (as far as I know); the unit must be powered down to recover. Unfortunately, the programmer has a more difficult time. Comments, suggestions and, of course, remedies appreciated." Greg Kopp

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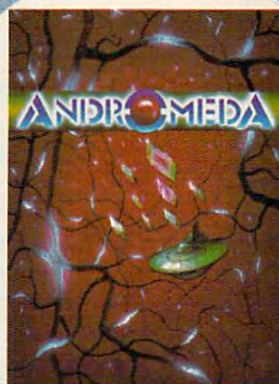
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I am an Apple II owner. I have had my system for three years. I am very interested in the Apple's high-res graphics capabilities. I have been unable to locate the machine code addresses of the Apple's high-res subroutines. Any suggestions on where to find this information would be greatly appreciated. I am looking for highly detailed technical information on the Apple II high resolution graphic mode." Scott Ayers

"I hope that either you or your readers can help me. I have an original 8K Commodore PET, which I recently converted to 32K, along with the upgraded (rev. 3.0) ROMs. I've converted all my programs to work on the new system except for two, Swordquest and Escape From the Death Planet, with sound (both written by P. O'Donovan for Fantasy Games Software; originally in Madison, Wisconsin). The problem with trying to convert them is that both have lines at the beginning which don't list, that contain both BASIC commands and ML subroutines. I would appreciate it if anyone can send me fixes. I hate to lose these two excellent programs." Rudolph F. Lauer

"One time, I used Atari's DOS, and I had two copies of Lotto, a game I have made, with the same filename. I

could only get the first one. Furthermore, I don't know what to change in my program. How do I get rid of the first LOTTO without killing the second one?"

Brent Edwards

RENAME does not check to see if the new name you give is the name of an existing file on the disk, so you can end up with two files with the same name. This can be very hard to deal with – any access to the first file also references the duplicate. If you try to delete or rename one of the files, you delete or rename the other as well. To fix such problems, you need to disable the feature of the DOS which causes it to access both names (which is useful for allowing multiple RENAMES). After booting DOS with the BASIC cartridge, enter:

POKE 3118,0

You can type DOS to go to the disk menu and any RENAMES or DELETES will only affect the first file of the duplicate pair.

Note that you should not re-save this modified DOS to disk, since it will not be able to perform multiple RENAMES. You can also restore the DOS with POKE 3118,184. (This information was found in the *OS/A + Users Manual*, published by Optimized Systems Software, Inc.) ©

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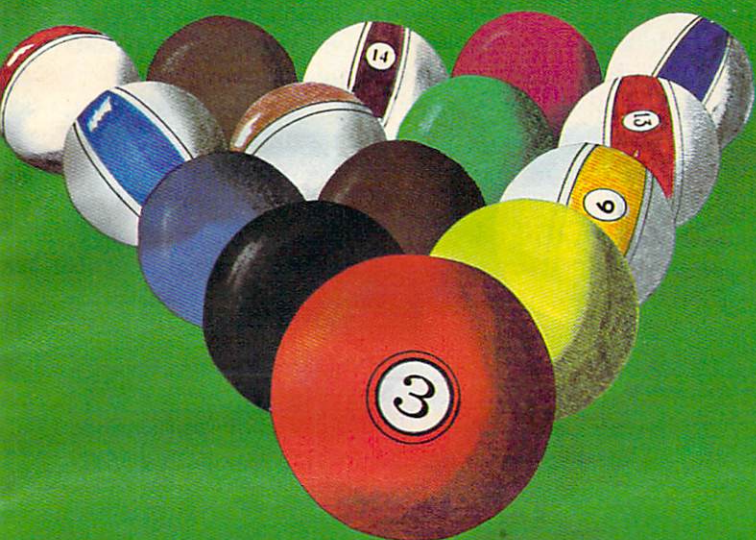
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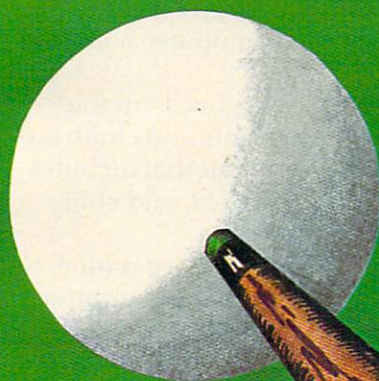
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Computers And Society

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And Now Let's Hear It For The Cookie Monster...

Omens are funny things. I was sitting on a flight to New York next to a person who was telling me of her concern with the Game Arcades. It seems that a midwestern community close to her home had recently banned these places in response to parent's beliefs that such activities were contributing to their children's truancy rate. Her belief was that, if anything, school use of computer games should increase, not decrease. From her perspective, the computer would free the teacher to give more individual attention to the students. I told her that I found her ideas to be similar to my own, and was amused that this conversation took place on a trip during which I would be seeing more than 50 games written or acquired by Children's Television Workshop (CTW) for use in their computer building at the Sesame Place park.

I haven't been to Sesame Place, but I am told that it is a wonderful place for parents and children to enjoy themselves in an environment that includes elements of a museum, recreation area, and computer game arcade.

Since I had provided CTW with some minor assistance on the technical aspects of the computer activity at Sesame Place, I was most pleased to be given an opportunity to see the programs which were captivating the many thousands of children who visited there. Two events suggested that my experience would be worth sharing with you. First, at least two more Sesame Place parks are planned, greatly increasing the number of families who can visit this facility. Second, I had read that certain of the CTW programs were going to be released for the Apple computer, and that versions for other computers might follow in the not too distant future.

Before describing the CTW effort, it might be beneficial to explain that major efforts in the generation of educational software for personal computers have been tried before. Among the more successful activities, one must list the Minnesota

Educational Computer Consortium (MECC). This branch of Minnesota's state government provides teachers all over the state with access to centralized computers, as well as providing special purchase contracts for Apple and Atari computers for classroom use.

Many of the MECC programs (such as the simulation, Lemonade) have become quite popular. Through a variety of marketing arrangements, MECC software is now becoming available for the Apple and Atari computers on a nationwide basis. MECC is one of the pioneers in the educational use of computers, and has done a fine job overall. The concentration of talent and effort required for the success of a venture the size of MECC is sufficiently rare that they have appeared to be a beacon in a vast sea of mediocre educational software.

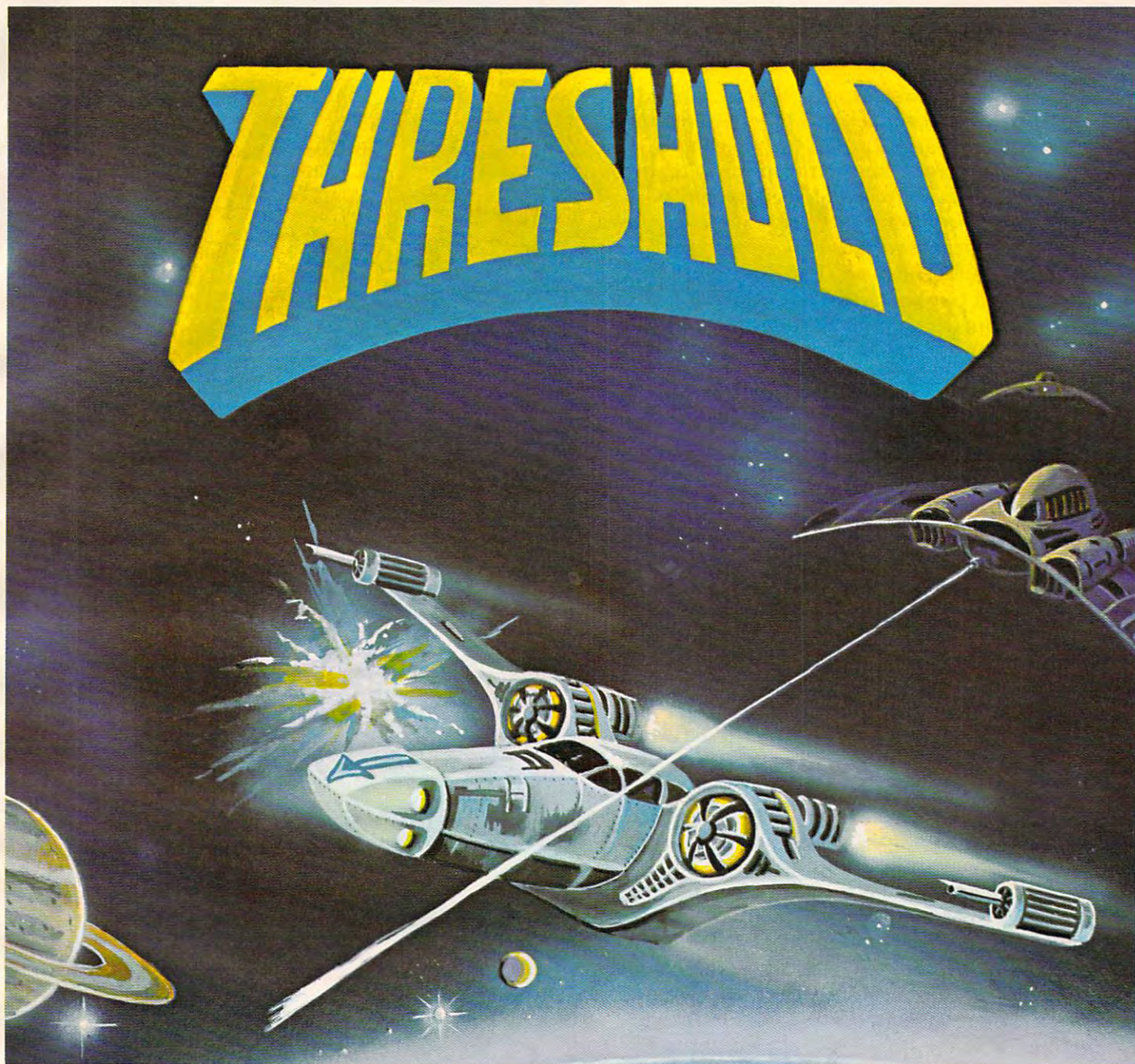
What excites me is the fact that by introducing educational software products of their own, CTW will further legitimize the business of high quality educational software packages and thus, encourage the development of more packages of this type by the many hundreds of excellent programmers located in their homes all over the world.

In order to be useful, multi-program educational software offerings should include a distribution of educational goals and skill level requirements. In addition, these programs should be interconnected with a well defined common theme.

The common theme for the CTW software is very simple. The activities must be both educational and entertaining.

As at other high quality software houses, the software teams at CTW include designers, artists, teachers, code writers, etc. Once a program is designed in storyboard form it is then implemented for classroom testing. Based on the results of this testing, the program is then modified and tested again. By the time the program is approved for use, it has undergone a massive amount of testing, evaluation, and modification. The effect of this effort is obvious when these programs are run. There is a level of quality and polish which sets these programs apart from most of the other educational software I have seen.

While MECC software is available for a wide range of grade levels, the present CTW programs are geared primarily for the youngsters who would watch Sesame Street on television. There are games for pattern matching, pattern recognition, eye-hand coordination, counting, etc. One of my favorite programs requires that you identify a picture by looking through a keyhole that can be moved around the surface of the object you are trying to identify. The keyhole only shows a part of the underlying picture, so the user has to reconstruct



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the overall image from memory. When I played this game, the object was a pig. I typed *ANIMAL* as my response and was rewarded for my correct answer. This illustrates another important feature of the CTW software. Acceptable answers are carefully chosen to allow some variation in response. Correct (but generalized) answers are accepted as are some misspelled answers. For example, I consistently spelled Grover as *GROWVER* with no complaints from the system (although the computer did show me the proper spelling of Grover's name each time as a reminder).

CTW and MECC are not the only organizations devoted to the creation and distribution of high quality educational software. I know of several teams of brilliant people who are devoting their efforts to this area.

One excellent team is located at Automated Simulations – a software house known primarily for its adventure games. While these games (created by the EPYX division) are their mainstay, releases from the Mind Toys division suggest that Automated Simulations has a promising future in educational game software.

Two recent releases of theirs, *Jabbertalky* and *Ricochet*, deserve comment. Both of these games are very high in educational value. While *Jabbertalky* is a word and sentence game and *Ricochet* is a game of logical thinking, they each share a quality that I have not seen before in personal computer games – dynamic handicapping. When two players are competing with each other, the computer is paying close attention to the skill levels displayed by each player. As each new round is started, the challenge level for each player is adjusted accordingly. The result of this is that a novice can compete against an expert without being devastated and losing interest in the game. The expert doesn't have to "play down" to the newcomer – the game will take care of the discrepancy itself. Now parents and their children can play the same logic game and find themselves equally challenged. Even if this was the only thing worth mentioning about these games (and there is much more to recommend them), I would still suggest that you see them.

The design team at Automated Simulations includes Bernie de Koven – the author of "The Well Played Game" – a book I reviewed last year.

As I look toward the future, I see a new class of educational software being developed which bridges the gap between the traditional CAI and drill and practice programs and the arcade games. The creation and distribution of this new software should do much to secure an appropriate place for the personal computer in education. ©

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Introducing computers into the office can create problems of employee adjustment to the new technology. A word processor, for example, can seem uncomfortably fast, complex, and altogether too sensitive to employees who are used to typewriters. Here, Craig Brod, President of Technostress International, explains some techniques which can speed the acceptance, the diffusion, of computers into the office environment.

Guest Commentary:

Managing Technostress: Accelerating Diffusion Of New Technology

Craig Brod
Berkeley, CA

The process by which innovation spreads is a diffuse one, and the rate at which the new replaces the old within companies exercises a major influence on costs. The introduction of a computer into an office environment will produce disruption. Delayed schedules, decreased performance and productivity will add to the cost of implementing the computer.

Additionally, there will be a delay between when the computer accounts for ten percent of the office productivity and the date when the proportion reaches 90 percent. The faster the computer is adopted, the more quickly the average costs of a company will approximate those of the new technology. Also, the smaller the gap will be between best and only average productivity. The rate of diffusion of the computer depends on personnel who must feel comfortable using it.

Accelerated diffusion of new technology necessitates a high level match between operator and machine. This match is an arrival point: altered tasks, roles, and machine packing must be learned. A secretary who trades her typewriter for a computer word processor has to learn to increase her concentration on work (due to the sensitivity of the machine), her hand-eye coordination (due to the speed of information flow), and her ability to respond to signs instead of symbols (due to the shorthand language of the computer). All of this learning, in turn, depends on flexible mental

functions.

Even under optimal working conditions – that is, conditions that lack union-management conflicts, major compensation issues, and layoffs – it is difficult for employees to learn so many new skills well. In fact, employees often lack the necessary skills to make a rapid and performance-oriented adjustment to new technology; neither their capabilities nor those of the computer are tapped. Here we often find *technostress*.

Limited Diffusion

Technostress is the condition resulting from the inability of an individual or organization to adapt to the introduction and operation of new technology. It has a negative impact on human performance by: (a) shifting attention from work-congruent stress to internal states of distress, (b) reducing the ability to process information accurately, (c) slowing the response time to computer generated demands, and (d) breaking up natural work-rest pauses that characterize normal work patterns.

Technostress, which begins as reduced performance, results in behavior that slows the rate of diffusion. Let's highlight three of the most pertinent manifestations of technostress.

First, patterns of use. Shortly after the introduction of a computer, for example, a few employees, for reasons we don't yet understand, will excel at using it. This manifests itself as repeated use and little unnecessary movement around the office. Many employees, however, show initial excitement, genuine experimentation with new skills, and then, due to technostress, are unable to make a proper adjustment. What follows is withdrawal from using the computer: increased time on non-machine tasks, hand calculated data, and social activities away from the machine. The result is a centralized pattern of use of the computer.

Second, high error rates. Indicators of high error rates begin to surface early. Employees often forget or violate new procedures. This ostensibly occurs because new procedures require new learning. However, closer scrutiny reveals a more precise explanation. Employees who learn quickly, and are intellectually astute, for example, have higher order needs to emit novel responses in relation to work rules and procedures they perceive to be simple and repetitive.

Therefore, these employees, in order not to be bored, attempt to invent new rules and shortcut new procedures. It is not uncommon to see an adept secretary, who has only recently begun to operate a computer, skip over sections of the training manual and try to learn procedures on her own. Also, in a short time, she will type in information that is extraneous to the program.



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Overload

On the other hand, a large number of employees experience overload when learning to operate a computer. This results from a combination of factors: the high workloads which continue while learning of new procedures is taking place, poor problem-solving skills, self-doubt concerning one's ability to master new tasks, and, often, jealousy of those in the surrounding environment who are learning quickly.

Overload takes the form of forgetting new procedures and applying old solutions to new problems. It is common to see an overloaded secretary, turned computer operator, revert to past conditioning by typing on the computer as though it were a standard typewriter. When the computer will not accept what is being typed, the operator continues to replicate these trials, while insisting that he or she is doing everything according to code. This usually ends with the secretary blaming the machine or the computer manufacturer for personal failures.

One measure of inappropriate learning is inaccurate input of data. Once inaccurate data is entered into a computer system, for example, it sets up a technostress-error cycle (see Figure 1 below).

Figure 1 indicates that errors occur in a closed

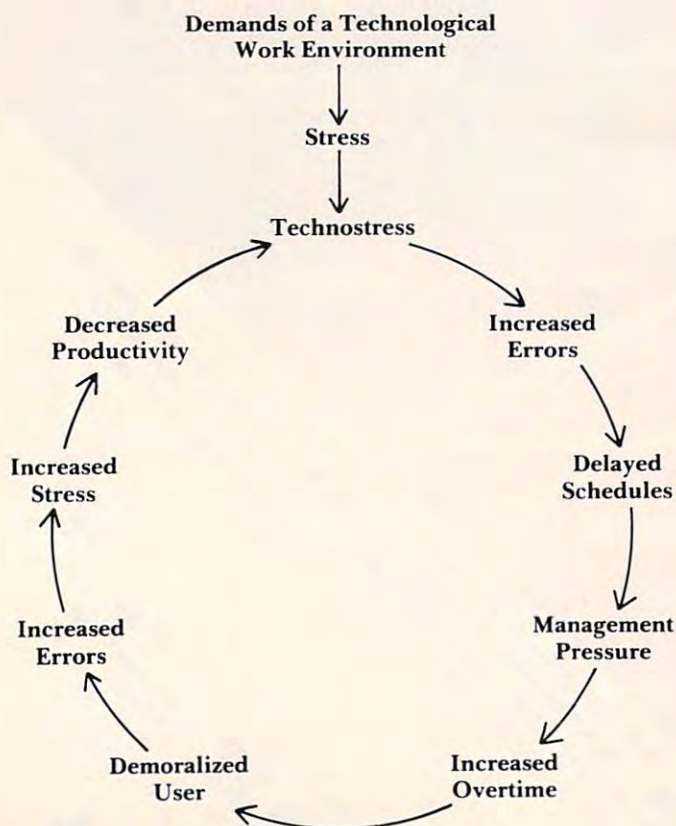


Figure 1: Technostress Error Cycle

system. Unlike a typist, whose spelling mistakes on an interoffice transmittal may go to one or two other people, and elicit a comment of sloppiness, an operator who enters inaccurate data into a computer system has a direct impact on many people who depend on accurate information. In addition, errors are visible to anyone within the information network, and the operator is held accountable for errors that may have dramatic consequences. A common result is that operators of computer systems often suffer from what I call the "tyranny of errors": the feeling that they lack the skills to control errors frustrates them, and this frustration, in turn, is converted into the feeling that the machine is too sensitive to use for anything except simple problems and assignments.

Third, sabotage. This occurs in a variety of ways. A computer operator who continually bangs a knee against the computer, causing it to lose its memory, complains that the computer was designed poorly. A programmer, impatient with the response time of a computer terminal, will sometimes hit the terminal or bang down on the keys. Recently, I was called in on a consulting assignment by an operations officer who wanted to prevent the firing of a programmer who had a history of hitting visual display terminals. The man, who suffered from technostress, needed to be trained to work more effectively with new technology.

Three Phases Which Improve Diffusion

Diffusion of new technology can be accelerated by shaping human performance. Technostress training is designed to reduce technostress and build a better match between employees and new technology. There are three phases to the training.

Phase I – Education. The educational phase is designed to provide the employee with an explanatory scheme for understanding the nature of technostress and his or her responses to it. The most important aspect of this phase is the conceptual framework: technostress is made plausible to the employee and its acceptance naturally leads to the practice of specific coping techniques.

For example, a trainer working with a group of employees identifies the demands of the new technology: specific communication patterns, short-cycle repetitive work, machine dependent time, altered task-related thinking functions, increased hand-eye coordination, and altered kinesthetic responses to the environment. The responses to these demands are individually elicited from members of the group. The point here is to begin to build a prospective set of skills which can be used to reduce the technostress.

Not only do employees appreciate learning about the changes taking place, but they also im-

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mediately begin to sense increased control over task-specific behaviors. In addition, appreciation of the complexity of the changes reinforces the learning of new skills.

After identifying the demands and individual responses, the trainer points out the elements of a technostress response: heightened arousal – increased heart rate, sweaty palms, rapid breathing, bodily tension or a speedy, buzzed feeling; blocked learning – past conditioning, avoidance thoughts, images, and self-statements (e.g., old solutions to new problems, rejection of new procedures, a sense of helplessness, failure thoughts; distorted information processing function (IPF) of which four modes are identified – inventive or novel behavior, mediated or rule behavior, attentive or emergency behavior, conditioned or stimulus-response behavior.

Under technostress, the modes are used inappropriately to perform a variety of tasks. The trainer then indicates that training will be directed toward: (a) controlling physiological arousal, (b) substituting coping statements for negative learning statements, (c) using imaging to accomplish work tasks more effectively, and (d) employing accurate information processing.

The educational phase concludes with a discussion centering on employees viewing technostress as a series of phases, rather than as one massive reaction. To master technostress, four phases are suggested: preparing for new demands, confronting or handling new demands, possibly being overwhelmed by new demands, and finally, reinforcing oneself for having coped.

The initial educational phase provides employees with a cognitive framework to better grasp work demands and the appropriate responses to them. It secures the transition into the second, the rehearsal phase of the training.

Rehearsal

Phase II – Rehearsal. The second phase of technostress training is designed to provide employees with a variety of coping techniques to use at each of the various phases of the coping process. The coping techniques include both direct action and cognitive coping modes. Direct action modes include: identifying task-related stressors, arranging an action plan, regulating work pauses, and physical relaxation.

The cognitive coping modes, which are most important because they are especially adversely affected under conditions of high stress, are treated in three ways. First, viewing cognitive processes as a series of self-statements that the employee said to himself. Thus, appraisal of learning blocks and self-perception are translated into specific self-

statements. The modification of the employee's internal dialogue – "I can't learn these procedures" – is accomplished by having him become aware of and monitor the negative self-defeating self-statements he emits under conditions of high work-congruent stress.

In collaboration with the trainer, the employees are able to generate sets of coping self-statements that encourage them to: (1) assess their technostress level; (2) control negative thoughts and self-statements; (3) acknowledge and use positively the arousal they are experiencing; (4) cope with the overwhelmed feeling they might experience; (5) reinforce themselves for having coped.

Second there is technostress reduction emphasizing high-intensity imaging. Employees are instructed to take the task-related stressors they have identified and visualize how they would alter them under conditions of technostress. For example, a programmer, who identified irregular computer response times as a source of technostress, was asked to visualize an increase in his workload, and a decrease in supervisory support, then to visualize alternatives to his technostress. The alternatives, arrangement of contingency work, pacing, of morning activities, and paused relaxation, are rewarded by the trainer.

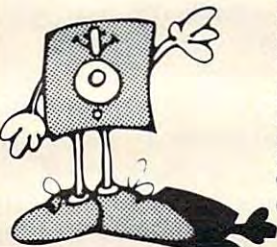
A third aspect of rehearsal is practice and familiarity with identified information processing functions. This requires two steps. Employee cognitive styles can be assessed on a test. This test briefly identifies the way employees organize information. Then, employees are instructed in how to use their cognitive style to make the accomplishment of tasks easier and more efficient. Next, employees are instructed in how to identify and use IPF's to solve task-related problems. IPF's can be learned and practiced in structured role-play and workbook assignments. Special attention is given to repetitive association between past conditioning and methods of returning to the proper mode of information processing.

The Final Phase: Monitored Work

Phase III – Network Training. Once the employees become proficient in employing behavioral and cognitive coping skills, the trainer suggests that the employees should test out and practice their coping skills by actually employing them under day-to-day stressful conditions. At this point, a number of employees are selected as network mentors. They are given additional training in problem-solving methods, technostress, and leadership skills. These mentors are able to monitor the environment for signs of technostress and to act as a valuable resource to other employees. After some months, the mentors can fill out a brief questionnaire to assess

the degree to which the knowledge and skills learned in the education and rehearsal phase have been generalized to the high technology environment.

Technostress training involves discussing the nature of technostress, and individual responses, rehearsing coping skills, and testing these skills under actual work conditions. Network mentors should be educated to monitor the impact of the training. Preliminary results suggest that such a skills-oriented, technostress training procedure is successful in accelerating the diffusion of new technology into a working environment. ©



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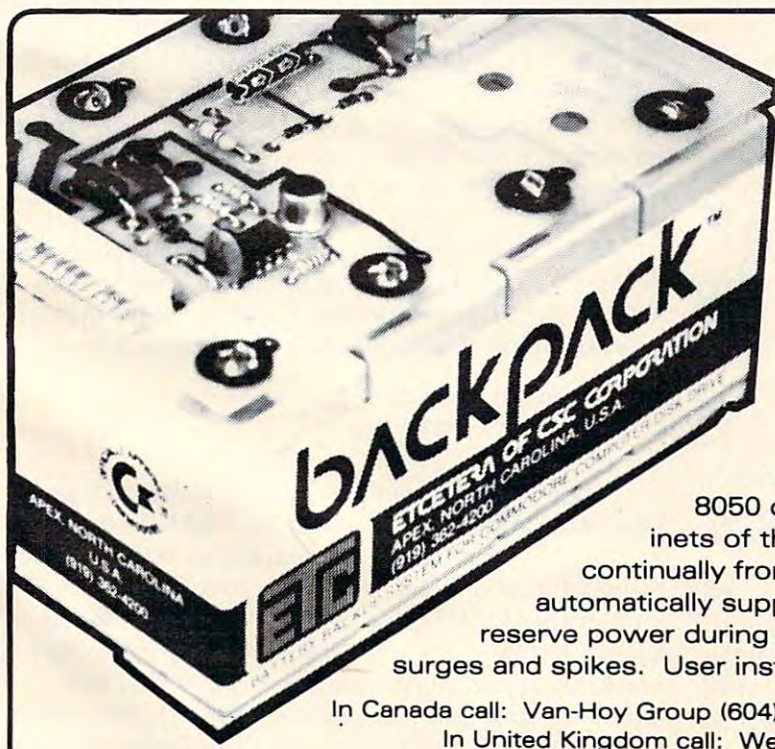
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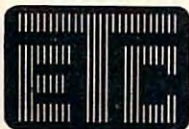
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The Beginner's Page

The ASCII Code

Richard Mansfield
Assistant Editor

It's easy to see how a typewriter puts a letter of the alphabet onto a piece of paper. You press the "F" key and the paper is struck by an inked ribbon, pushed against the paper by a small metal image of F. But what happens when you hit the F on a computer? It puts the number 70 into one of its memory cells.

What does 70 have to do with F? To answer that, we'll need to know what the ASCII Code is and learn the meanings of two BASIC commands: CHR\$ and ASC.

Type in this short program:

```
5 DIM A$(1) : REM THIS LINE IS ONLY
  NECESSARY ON ATARI
10 INPUT A$
20 PRINT ASC(A$)
30 GOTO 10
```

When you RUN this, you can type letters on your keyboard and see them translated into numbers. (Hit the RETURN key after each one.) Try "F" and you'll get 70. What you are seeing is called the ASCII Code. Computers only store *numbers* in their memory cells. In fact, they can only store the number one and the number zero. (For a more detailed explanation of how computers remember things, see "The Beginner's Page," **COMPUTE!** March, 1982, #22.) The computer can store words and symbols or pictures or anything else in patterns of these ones and zeros.

To store the letters of the alphabet, symbols like the percent sign, punctuation marks – all the keys on your keyboard – the computer uses a special code, the American Standard Code for Information Interchange, ASCII.

When Seven Is Not Seven

If you are RUNning the program above, type the number seven on your keyboard. It's not seven! In the ASCII code, it's 55. The number six, though, is 54, so the scheme is not entirely random. Why didn't they just use the number seven to stand for number seven in this code?

There are reasons for everything. If you learn to program in *machine language*, as opposed to BASIC, you'll work with hexadecimal numbers. In

hex, the ASCII code for zero is 30 and seven is 37. In hex, it makes a bit more sense.

But back to ASCII. ASC, of course, is short for ASCII and you can find out what the ASCII equivalent of a single character is by typing PRINT ASC("F") or by asking for the ASC of a string variable (as we do with A\$ in the program above).

You can go the other way with CHR\$. This is BASIC's "character string" command. Where ASC translates a character into ASCII, CHR\$ translates ASCII back into a character. So, you give CHR\$ a number between 0 and 255 and it will give you a character. Here's a short program to see how CHR\$ works:

```
10 INPUT X
20 PRINT CHR$(X)
30 GOTO 10
```

Each manufacturer has deviated somewhat from standard ASCII. For example, the Atari uses a code called ATASCII which is very similar to ASCII, but there are some differences. The creators of the ASCII standard had decided that the number seven should not print any character. Instead, seven is supposed to ring a bell, or a buzzer, or whatever sound your computer can make that can be used like a bell on standard typewriters. But on the Atari, if you type PRINT CHR\$(7), the computer puts a graphics symbol, a large backslash, on screen. To sound the buzzer, use PRINT CHR\$(253). By the way, CHR\$(7) *does* ring a bell on Commodore computers with built in sound.

These variations on ASCII between computer models are one of the reasons that you cannot take a game on tape for the Apple and LOAD it into your PET.

The total of all 255 possible characters, graphics symbols, and buzzers that your computer can use is called its *character set*. To see your computer's character set, type in the following program:

```
10 FOR I=0 TO 255
20 PRINT CHR$(I);
30 NEXT I
```

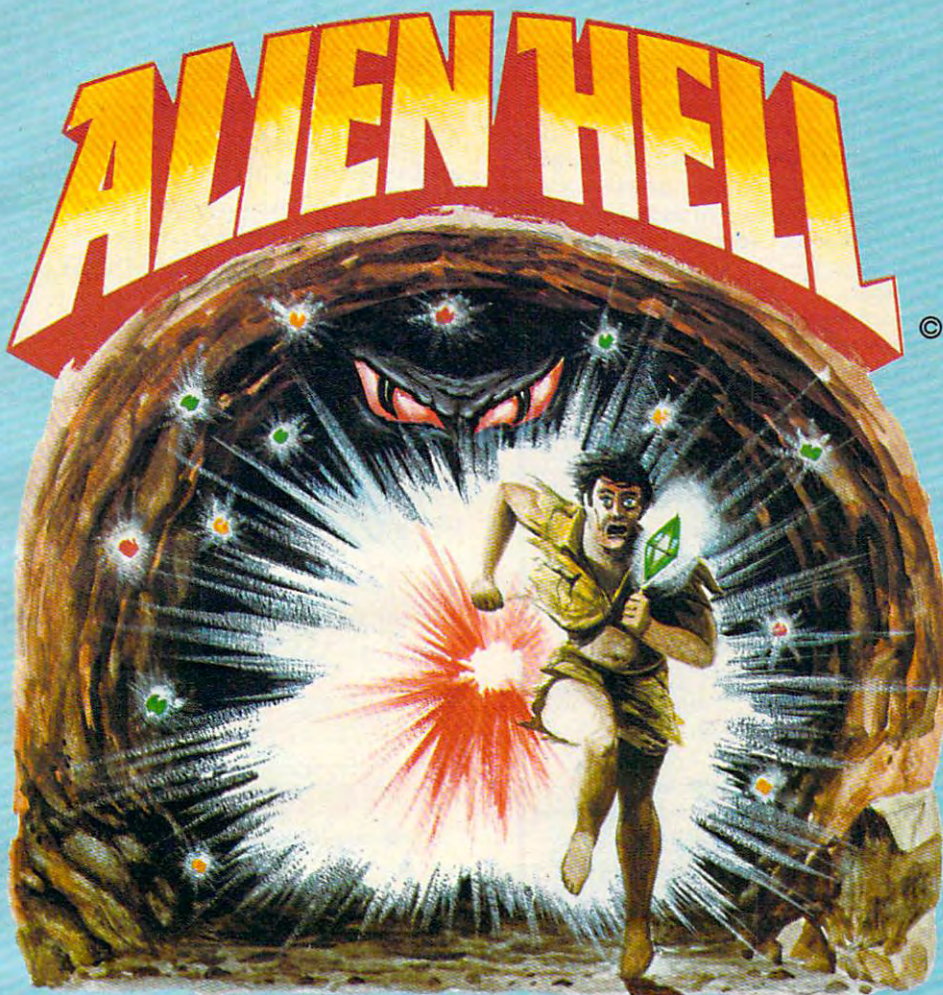
The semicolon makes sure that they are put one after another on the screen (PRINT causes a carriage return unless the semicolon is there). But wait, what about the carriage return itself? Isn't it one of the ASCII code numbers? You bet. So are cursor-moving keys, reverse field, and other special tricks your computer can perform. When you RUN this program, get set for some strange effects. As the program runs through the numbers from zero to 255, it will encounter the clear-the-screen character too.

There are a number of uses for ASC and CHR\$. With CHR\$, you can send characters to your computer that cannot be typed in from the

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keyboard. There might be no key on your keyboard which rings the bell. Use CHR\$. This can be done directly from the keyboard or as part of a BASIC program.

Another common problem is trying to print quotes. You can't just type PRINT "THE "BEST" COMPUTER" because the set of inside quotes around the word *best* will confuse the computer. Try it. It will think you are printing the words *the* and *computer* with a numeric variable (*best*) between them. It will print a zero since the variable *best* has no value. To achieve the result you want, type PRINT "THE " CHR\$(34) "BEST" CHR\$(34) "COMPUTER".

If there is a printer attached and "listening" (responding) to your computer, you can make it do a carriage return by typing PRINT CHR\$(13). Or, if the printer has a bell, try PRINT CHR\$(7). Most printers accept the standard ASCII code and their instruction booklets will usually explain what numbers to send to perform backspace, underlining, etc. Remember, in this case it doesn't matter what codes your *computer* is using. When you send a letter to the printer, the *printer's* code (probably standard ASCII) will determine what gets put on paper. ©

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x					@D	Duplicate diskette
x			x	4	@C	Copy or concatenate disk file(s)*
x					@R	Rename file
x			x	3	@S	Scratch file(s)*
x	x				@\$	List directory**
x					@U:	Reset disk drive
x	x	x	x	6	@L	List disk file or BASIC program**

Note: Some of the disk utility command set may also be used, if an appropriate direct access channel has been opened.

* Standard command with added options.

** Added disk command.

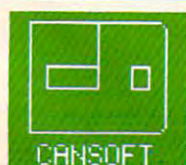
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SYSRES™ EXTENDED EDITOR COMMANDS

Disk	Printer	Tape	Directory	Modes	Command	Function
x			x	4	/	Quick load from disk
x			x	4	↑	Quick load from disk with auto run
x			x	2	APPEND	Append from disk to end of current program
				4	AUTO	Auto line number (allows header)
x			x	3	BLOAD	Load machine language (binary) file
x			x	3	BRUN	Load and execute machine language program
	x			776	CHANGE	Change pattern to another pattern
				2	CLOSE	Close one or all files
				1	CMD	Set output to file (does not send "READY.")
				4	DELETE	Delete a range of lines from program
	x			1	DUMP	Dump all scalar variables to screen or file
x	x		x	2	EXEC	Execute a file as keyboard commands
	x			240	FIND	Find occurrences of a pattern
x		x	x	3	GET	Read a sequential file into editor
				7	KEY	Define a key as a special function
				1	KEYS	Turn key functions on
				1	KILL	Disable SYSRES™
	x			1	KILL*	Disable SYSRES™ and unreserve memory
				10	LIST	Improved BASIC LIST command
x		x	x	3	LOAD	Defaults to disk drive
x			x	2	MERGE	Merge from disk into current program
	x			1	MON	Break to current machine language monitor
				1	OLD	Restore program after "NEW"
x	x	x	x	24	PUT	Send program to disk-as text file
				6	RENUMBER	Renumber all or part of program
				2	RUN	Run current program, ignores screen garbage
x		x	x	3	SAVE	Defaults to disk drive, allows replace
x		x		1	SETD	Set disk device #, allows multiple drives
	x			4	SETP	Set printer channel, format mode, paging
	x			4	TRACE	Select 1 of 3 trace/step modes and speed
x		x	x	3	VERIFY	Compare current program against disk/tape
				1	WHY	Print position of last error
				1	WHY?	List line of break or error
x	x			*		Send output to printer
	x			#		Display current version of SYSRES™



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This program will analyze your life insurance needs and give you a guide to the coverage necessary to adequately provide for your family. The program will run on VIC-20, Apple, Atari, PET, and OSI computers.

Life Insurance Estimator

David E. Pitts
Houston, TX

Calculating the life insurance needs of a family can be a time consuming procedure since the entire financial picture, the age of all family members, and future plans must be considered. Because of this, most families probably don't have a clear understanding of their life insurance needs. The program which is described here will help make this planning a little easier since it removes the burden of using discount tables, annuity tables, and year-by-year survivor benefit tables.

The program calculates a balance sheet for the family which gives the family assets and the family liabilities (see the example run). The user inputs the assets: life insurance, real estate, securities, cash on hand and also inputs a liability: current uninsured debts. All other liabilities are calculated by the program based upon the monthly goals for the insurance plan, the social security benefits (or other benefit plan), the age of and number of children, the age of the spouse, the current tax bracket and the interest rate expected on annuities and funds set up from the insurance proceeds. The default tax bracket used is 27.3% and the default savings rate is 5.5%, yielding a 4% annual return.

The monthly income goals are by phase: 1) spouse with children at home, 2) education fund, 3) spouse between child rearing and retirement, and 4) spouse's retirement. Inflation is not directly accounted for in the calculations. However, in order to offset inflation, the fund for the spouse's retirement is not discounted for the number of years in the future when retirement will occur. The user may want to adjust the other income goals upward as a function of expected inflation and the number of years in the future when the fund will be required.

The use of this program should not be considered the only approach to understanding a family's life insurance needs; advice from life insurance

agents, accountants, lawyers, etc. may be more appropriate for a particular situation. Careful evaluation of the program outputs is advised based upon all family needs, both those entered into the program and those which the program may not allow.

The program is based upon the Consumer's Union's book 1972 *Revised Edition of the Consumers Union Report on Life Insurance, A Guide to Planning and Buying the Protection You Need* (Grossman Publishers, New York, 1973).

Social security benefits for children are in force until they are 18 at which time they stop drawing benefits unless they are full time students. A full time student can often receive higher benefits, thereby causing the family's maximum allowable benefits to be exceeded. The effect of this is to reduce the amount available to the family. If the family has another benefit plan which provides for the spouse (independent of the children being in college after 18) then the maximum permitted monthly benefit should be set to a large number in order to adjust for this limiting factor. Social Security doesn't allow for benefits between child rearing and retirement so, if your benefit plan allows such benefits, or if your spouse plans to work during this period, then you should reduce the monthly goal for that period appropriately.

The year by year monthly income from the retirement plan (e.g. Social Security) for the years minor children are in the home can be verified by printing the variable C(I) for I = 1 to 18.

Organization Of The Program

Statement Description

30	Rounds to next highest 1000 dollars.
40	Function for positioning data in balance table.
60-190	Inputs income goals and benefits.
210-240	Calculates income table components for widow and children C(I) and students S(I).
250-290	Sums the benefits and checks for total not to exceed maximum allowable benefits.
300-340	Inputs Tax bracket and Interest rate to be applied immediate annuities for funds needed for future income. Interest income is reduced by Tax Bracket percentage.
360-390	Reduces 18 year income table to several periods, each of which has constant monthly income benefits.
400-420	Calculates family income fund.
440-450	Calculates education fund assuming 40 month eligibility.
470	Retirement fund calculation.
490-500	Widow's income calculation between child rearing and retirement.
520-730	Balance sheet calculations and printout.
780	Print routine for proper spacing of variables in balance sheet table.

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Program Run

LIFE INSURANCE PLAN

```

-----
ENTER # OF CHILDREN UNDER 18? 3
MONTHLY INCOME GOAL FOR SPOUSE & CHILDREN?
750
MONTHLY INCOME GOAL FOR SPOUSE'S RETIREMENT?
500
MONTHLY INCOME GOAL FOR SPOUSE BETWEEN CHILD
REARING AND RETIREMENT, IF NO CHILDREN <18,
THIS APPLIES NOW TO RETIREMENT? 250
LUMP SUM EDUCATION FUND FOR EACH CHILD? 12000
-----
START WITH OLDEST CHILD

AGE OF CHILD # 1 ? 12
AGE OF CHILD # 2 ? 10
AGE OF CHILD # 3 ? 3
-----
ENTER SOCIAL SECURITY (OR OTHER PROGRAM)
MONTHLY SURVIVOR BENEFITS:

FOR A SPOUSE & 2 OR MORE CHILDREN? 402
FOR A SPOUSE & 1 CHILD? 326
FOR A STUDENT 18-21? 163
FOR A FAMILY'S MAXIMUM PERMISSABLE BENEFIT?
402
FOR SPOUSE STARTING RETIREMENT AT AGE 62? 179
-----
IF INTEREST RATE REQUESTED ISN'T KNOWN ENTER
'0'

CURRENT TAX BRACKET IN %? 30

SAVINGS ACCOUNT INTEREST RATE FOR SURVIVORS
ANNUITY? 10

```

Using This Program On PET, Apple VIC-20 And Atari

● Program 1 is a completely general Microsoft BASIC program and will run without modification on any PET/CBM, Apple, OSI, etc. However, it is written for a 64-character display. The only problem is with the "balance sheet"; it will not look as neat and formatted as the author intended. Two solutions are easy to implement. 1) Have the balance sheet printed out on an 80-column printer, 2) make minor changes to the program. Solution 2) requires you to divide the number in TAB statements by two (e.g. PRINT TAB(35) becomes PRINT TAB(17)) and change line 780 to read:

780 V = FNP1 (V):PRINTTAB(V/2);:RETURN

● VIC owners should substitute the lines in Program 2 for those in Program 1. Although the printout will not look as the author intended, due to the 22 character display, you can easily read the information. You will also probably want to delete line 580 (by entering the number 580 and pressing RETURN, or just not typing it in.)

● Atari owners should type the lines given in Program 3 in place of the corresponding lines in Program 1 to convert the program to Atari BASIC and correct for a 40-column display. You may wish to make other cosmetic changes, such as using lowercase for prompts, or using a formatting routine for the balance sheet.

```

CURRENT AGE OF SPOUSE? 33
-----
ENTER FAMILY ASSETS
LIFE INSURANCE? 25000
CASH ON HAND? 10000
REAL ESTATE EQUITY? 7000
SECURITIES? 0
OTHER ASSETS? 0
-----
UNINSURED DEBTS, OTHER THAN
HOME MORTGAGE? 0
-----

```

BALANCE SHEET

FAMILY ASSETS		FAMILY LIABILITIES	
LIFE INSURANCE	25000	FAMILY INCOME FUND	50000
REAL ESTATE	7000	EDUCATION FUND	9000
SECURITIES	0	RETIREMENT FUND	41000
CASH ON HAND	10000	UNINSURED DEBTS	0
OTHER ASSETS	0	SPOUSE INCOME FUND	10000
TOTAL			110000

LIFE INSURANCE NEEDED = \$ 68000

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- BACCARAT (Atari only)** Price: \$18.95 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 007 to your left and Goldfinger to your right. Learn and play BACCARAT at your leisure on the Atari. Contains full high resolution color graphics and matching sound. Runs in 16K. Requires one joystick.
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- GO FISH (Available for all computers)** Price: \$14.95 Cassette/\$18.95 Diskette
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- BLACKJACK COACH (2K TRS-80 only)** Price: \$29.95 Cassette/\$33.95 Diskette
BLACKJACK COACH is both a game and an educational tool. With this program you may quantitatively test standard and special playing and betting methods, including the several card count schemes. You can simply play, play with the computer as a coach, or statistically test your method under long run automatic play. All the standard player choices are included: insurance, splitting pairs, doubling down and surrender (optional). The computer analyzes the technique and provides detailed summary reports which statistically pinpoint the strengths and weaknesses of your play. Don't risk your money at the tables until you have practiced with BLACKJACK COACH!

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- VALDEZ (Available for all computers)** Price: \$15.95 Cassette/\$19.95 Diskette
VALDEZ is a computer simulation of super tanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 x 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modeled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software reviews in 80 Software Critique and Personal Computing.
- BACKGAMMON 2.0 (Atari, North Star, OSBORNE and CP/M only)** Price: \$14.95 Cassette/\$18.95 Diskette
This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.
- CHESS MASTER (North Star and TRS-80 only)** Price: \$19.95 Cassette/\$23.95 Diskette
This complete and very powerful program provides five levels of play. It includes castling, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the SOFTWARE SPECIALISTS of California, Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users. See review in OnComputing.
- FOREST FIRE! (Atari only)** Price: \$14.95 Cassette/\$18.95 Diskette
Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalties. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.
- BLACK HOLE (Apple only)** Price: \$14.95 Cassette/\$18.95 Diskette
This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using side jets for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.
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- CHOMPELO (Atari only)** Price: \$11.95 Cassette/\$15.95 Diskette
CHOMPELO is really two challenging games in one. One is similar to NIM; you must bite off part of a cookie, but avoid taking the poisoned portion. The other game is the popular board game REVERSI. It fully uses the Atari's graphics capability, and is hard to beat. This package will run on a 16K system.

AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard IBM 3740 single density/double density compatible format 8" CP/M floppy disks for systems running under MBASIC or CBASIC (for example, Altos, Xerox 820 and many others). 5 1/4" CP/M diskettes are available for the North Star and Osborne computer systems.

- *ATARI, PET, CBM, NORTH STAR, CP/M, IBM, OSBORNE, SUPERBRAIN and XEROX are registered trademarks and/or trade marks.
- **Except where noted, all TRS-80 Model I software is available on cassette (only) for the TRS-80 Model III. Exceptions: VALDEZ, CRIBBAGE, GRAFIX, CHESSMASTER. TRS-80 diskettes are not supplied with either DOS or BASIC.
- ***For most North Star disk-based systems, DYNACOMP presently does not support the new North Star Advantage.
- ****For Altos systems having Microsoft BASIC.
- *****For SUPERBRAIN systems running under MBASIC or CBASIC (state which).

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- 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 hilarious high resolution animated graphics (arcade) game which exercises much of the Atari's power. Requires one joystick.
- SPACE TILT (Apple and Atari only)** Price: \$15.95 Cassette/\$19.95 Diskette
Use the game paddles to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Sound simple? Not when the hole gets smaller and smaller! A built-in timer allows you to measure your skill against others in this habit-forming action game.
- ESCAPE FROM VOLANTUM (Atari only)** Price: \$15.95 Cassette/\$19.95 Diskette
Bring the action and excitement of an arcade into your home with ESCAPE FROM VOLANTUM! To escape you must maneuver your space ship around obstacles and laser blast the dragon (without being eaten). If he is killed with a direct shot (not just a leg lopped off), a door opens to the outside. However, the door does not stay open indefinitely. If you fail to escape in time, the door closes and a new dragon appears. Sometimes you can smash through the door by repeatedly chipping away at it. Other times it is impervious. At the higher levels of play more obstacles and dragons appear, adding to the excitement. Uses high resolution graphics and sound. Runs in 16K.
- ALPHA FIGHTER (Atari only)** Price: \$12.95 Cassette/\$16.95 Diskette
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion! Jet five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.
- 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. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.
- INTRUDER ALERT (Atari only)** Price: \$14.95 Cassette/\$18.95 Diskette
This is a fast paced graphics game which places you in the middle of the "Dreadnaught" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.
- MIDWAY (Atari 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 are both included. Runs in 16K.
- TRIPLE BLOCKADE (Atari only)** Price: \$14.95 Cassette/\$18.95 Diskette
TRIPLE BLOCKADE is a two-to-three player graphics and sound action game. It is based on the classic video arcade game which millions have enjoyed. Using the Atari joystick, the object is to direct your blockading line around the screen without running into your opponent(s). Although the concept is simple, the combined graphics and sound effect lead to "high anxiety".
- GAMES PACK I (Available for all computers)** Price: \$10.95 Cassette/\$14.95 Diskette
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSESHOE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.
- GAMES PACK II (Available for all computers)** Price: \$10.95 Cassette/\$14.95 Diskette
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY DUCEY, LIFE, WUMPUSS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.
- Why pay \$7.95 or more per program when you can buy a DYNACOMP collection for just \$10.95?
- MOON PROBE (Atari and North Star only)** Price: \$11.95 Cassette/\$15.95 Diskette
This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at 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/\$18.95 Diskette
This galactic "shoot 'em up" game places you near a black hole. You control your spacecraft's joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.
- CHIRP INVADERS (PET/CBM only)** Price: \$14.95 Cassette/\$18.95 Diskette
CHIRP INVADERS is an addictive game using action graphics. A Federation space station must be reached before the Chirps conquer the Earth. Stationary obstacles, moving meteors, and the attacking Chirps must all be avoided for a successful journey. Good luck.
- SUPER SUB CHASE (Atari only)** Price: \$19.95 Cassette/\$23.95 Diskette
SUPER SUB CHASE simulates a search and destroy mission. Set your course and keep an eye on the sonar readings as you hunt for the hidden submarine. Set the depth charge explosion depth and watch them sink towards the sub. This is an addictive game which takes advantage of the Atari's graphics and sound capabilities. One or two players. Joystick(s) required.

ADVENTURE

- CRANSTON MANOR ADVENTURE (North Star and CP/M only)** Price: \$19.95 Diskette
At last! A comprehensive adventure game for North Star and CP/M systems. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are werewolves and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play can be stopped at any time and the status stored on diskette. Not available in 5 1/4" CP/M format.
- GUMBALL RALLY ADVENTURE (North Star only, 48K)** Price: \$21.95 Diskette
Take part in this outlaw race from the east coast to the west coast. The goal is to find your way to the finish line while maintaining the highest possible speed. You may choose one of five cars available at the garage. The choice will affect your speed and range. Remember to take spare parts and don't get caught speeding!
- UNCLE HARRY'S WILL (North Star only, 40K)** Price: \$24.95 Diskette
Uncle Harry has died and has left you everything. However, he has neglected to mention where everything is! Instead, his will consists of a poem which contains clues. You will have to travel all over the United States both by car and on foot to solve the puzzle, and there are over 300 locations to probe. Be careful and watch out for red herrings!

SPEECH SYNTHESIS

- DYNACOMP is now distributing the new and revolutionary TYPE-N-TALK™ (TNT) speech synthesizer from Voxco. Simply connect TNT to your computer's serial interface, enter text from the keyboard and hear the words spoken. TNT is the easiest-to-program speech synthesizer on the market. It uses the least amount of memory and provides the most flexible vocabulary available anywhere!
- TYPE-N-TALK List price \$375. DYNACOMP's price \$319.95 plus \$5.00 for shipping and handling.
- TALK TO ME (TNT Atari only, 24K)** Price: \$14.95 Cassette/\$18.95 Diskette
This program presents a superb tutorial on speech synthesis using the Atari 800 and TYPE-N-TALK™. TALK TO ME will illustrate natural word generation as well as phoneme generation. The documentation includes many helpful programming tips. TALK TO ME has been demonstrated on network (CBS) TV!

MISCELLANEOUS

- CRYSTALS (Atari only)** Price: \$ 9.95 Cassette/\$13.95 Diskette
A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari. Runs in 16K Atari.
- NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY**
DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.
- Price: \$9.95 each/\$7.95 each (4 or more)
The complete collection may be purchased for \$149.95
- 5 1/4" DISKETTES (soft sector/ten sector)** Price: \$39.95-26 Diskettes
As you might imagine, DYNACOMP purchases diskettes in large quantities and at wholesale prices. We want to pass the savings along to you!

Program 1: Microsoft Version

```

10 REM LIFE INSURANCE PLAN BY DAVID E. PITTS
20 REM 16011 STONEHAVEN DR. HOUSTON TX 77059
30 DEFFNRD(A)=INT((A+999)/1000)*1000
40 DEFFNP1(A)=L-LEN(STR$(A))+1
50 DIMS(18),MI(18),Y(18),C(19):E=0:Y=0
60 PRINTTAB(20);"LIFE INSURANCE PLAN":PRINT:PRINT:GOSUB740
70 PRINT:INPUT"ENTER # OF CHILDREN UNDER 18";N:IFN=0THEN90
80 PRINT:INPUT"MONTHLY INCOME GOAL FOR SPOUSE & CHILDREN";SC
90 PRINT:INPUT"MONTHLY INCOME GOAL FOR SPOUSE'S RETIREMENT";WR
100 PRINT:PRINT"MONTHLY INCOME GOAL FOR SPOUSE BETWEEN CHILD REARING"
110 PRINT"AND RETIREMENT,IF NO CHILDREN <18,THIS APPLIES NOW TO
    RETIREMENT";
120 INPUTMB:IFN=0THENGOSUB760:GOTO190
130 PRINT:INPUT"LUMP SUM EDUCATION FUND FOR EACH CHILD";E
140 PRINT:PRINT:GOSUB740:PRINT"START WITH OLDEST CHILD":PRINT:PRINT
150 FORI=1TON:PRINT"AGE OF CHILD # ";I;:INPUTY(I):Y(I)=18-Y(I):NEXT
160 GOSUB760:INPUT"FOR A SPOUSE & 2 OR MORE CHILDREN";B2
170 INPUT"FOR A SPOUSE & 1 CHILD";B1:INPUT"FOR A STUDENT 18-21";BS
180 INPUT"FOR A FAMILY'S MAXIMUM PERMISSABLE BENEFIT";BF
190 INPUT"FOR SPOUSE STARTING RETIREMENT AT AGE 62";B6:IFN=0THEN300
200 REM CALC OF YEAR BY YEAR MONTHLY BENEFITS WHILE CHILDREN <18
210 FORI=1TOY(N):IFI<=Y(N-1)THENC(I)=C(I)+B2
220 IFI>Y(N-1)ANDI<=Y(N)THENC(I)=C(I)+B1
230 FORJ=1TON:IFI>Y(J)ANDI<=Y(J)+4THENS(I)=S(I)+BS
240 NEXT:J=J+1:NEXT
250 FORI=1TO18:IFS(I)>BFTHENS(I)=BF
260 IFS(I)>0THENS(I)=BF-S(I)
270 IFS(I)=0THENS(I)=C(I)
280 IFS(I)<C(I)THENC(I)=S(I)
290 NEXT
300 GOSUB740:PRINT"IF INTEREST RATE REQUESTED ISN'T KNOWN ENTER '0'"
310 PRINT:INPUT"CURRENT TAX BRACKET IN %";T:T=T/100:PRINT
320 IFT=0THENT=.273
330 INPUT"SAVINGS ACCOUNT INTEREST RATE FOR SURVIVORS ANNUITY";R:R=R/100
340 IFR=0THENR=.055
350 REM BEGINNING OF INCOME FUND COMPUTATIONS
360 R=R*(1-T):MI(1)=C(1):K=1:S(0)=0:X=1:IFN=0THENE=0:GOTO450
370 FORI=1TO19:IFC(I)=MI(K)THEN390
380 S(K)=I-X:X=I:K=K+1:MI(K)=C(I)
390 NEXT:X=0:Y=0
400 FORI=1TOK-1:A=12*(1-(1+R)^-S(I))/R:D=1/(1+R)^X:X=X+S(I)
410 Z=SC-MI(I):IFZ<0THENZ=0
420 MI(I)=Z*A:MI(I)=FNRD(MI(I))*D:Y=Y+MI(I):NEXT:Y=FNRD(Y)
430 REM BEGINNING OF EDUCATION FUND CALCULATIONS
440 ED=E-B2*40:E=0:FORI=1TON:E=E+ED/(1+R)^Y(I):NEXT:E=FNRD(E)
450 INPUT"CURRENT AGE OF SPOUSE";AG:RE=WR-B6:AG=62-AG:IFAG<0THENAG=0
460 REM BEGINNING OF RETIREMENT CALCULATIONS
470 RE=RE*12*(1-(1+R)^-20)/R:RE=FNRD(RE)
480 REM INCOME BETWEEN CHILD-REARING AND RETIREMENT
490 AG=AG-Y(N):IFAG<0THENAG=0
500 WI=MB*12*(1-(1+R)^-AG)/(R*(1+R)^Y(N)):WI=FNRD(WI):GOSUB740
510 REM BEGIN BALANCE SHEET CALCULATIONS
520 PRINT"ENTER FAMILY ASSETS":PRINT:INPUT"LIFE INSURANCE";S:PRINT
530 INPUT"CASH ON HAND";X:Z=X+S:PRINT:INPUT"REAL ESTATE EQUITY";J:Z=J+Z
540 PRINT

```


COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of **COMPUTE!**. Each issue contains much, much more than there's space here to list, but here are some highlights:

January, 1981: Load PET Programs Into The Apple II, Player-Missile Graphics for Atari, The Atari DOS, The Kernel of the OSI Operating System, Fixing LOADING Problems on the PET, Spooling with the PET Disk, Expanding KIM.

February, 1981: Simulating PRINT USING, Using the Atari as a Terminal for Telecommunications, Attach a Printer to the Atari, Double Density Graphing on C1P, Commodore Disk Systems, PET Crash Prevention, A 25¢ Apple II Clock.

March, 1981: Machine Language Programming for Beginners, Getting the Most from your PET Cassette Deck, Apple and PASCAL, Flipping your Apple Disk, Designing your own Atari Character Sets, Renumber for Atari, An Atari Disassembler, Six-gun Shootout Game for OSI C1P, PET Machine Language Graphics.

April, 1981: How to be a VIC Expert, Resolving the Applesoft and Hires Graphics Memory Conflicts, Atari SuperCube, String Arrays in Atari, Memory Partition in PET, Pet Relative Files, Working with BASIC 4.0, Commodore File I/O, ROM Expansion for Commodore PET.

May, 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032.

June, 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever-expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, QuadraPET: Multitasking?

July, 1981: Home Heating and Cooling, Animating Integer BASIC Loes Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine

Language Programs on PET Tape Headers, Commodore ROM Systems, The Voracious Butterfly on OSI.

August, 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying.

September, 1981: The Column Calculator, What is a Modem and Why Do I Need One?, PET, Apple, Atari: On Speaking Terms, A Tape "EXEC" for Applesoft, A Self-altering Program for Apple II, Positioning P/M Graphics and Regular Graphics in Memory, An Atari BASIC Sort, Shoot, an Arcade Game for Atari, Exploring OSI's Video Routine, PET Tape Append and Renumber, All About LOADING PET Cassettes.

October, 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, VIC, Budgeting on the Apple, Switching Cleanly from Text to Graphics on Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

November, 1981: SuperPet: A Preview, Japanese Micros: A First Look, Introduction to Binary Numbers, An Apple Primer, Page Flipper for Apple, An Atari Database System, A Program for Writing Programs on the Atari, Atari Textplot, OSI Relocation, The PET Speaks, Inversion Partitioning, A Personal News Service on PET, Bits, Bytes, and Basic Boole.

December, 1981: Saving Fuel \$\$ (Multiple Computers: versions for Apple, PET, and Atari), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Printer Interface for the Apple II, A Simple Atari Wordprocessor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game.

January, 1982: Invest (multiple computers), Developing a Business Algorithm (multiple

computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tiny-mon: a VIC Monitor, Vic Color Tips, VIC Memory Map, ZAP: A VIC Game.

February, 1982: Insurance Inventory (multiple computers), Musical Transposition (multiple computers), Multitasking Emulator (multiple computers), Disassemble Apple Programs from BASIC, Plotting Polar Graphs on Apple, Atari P/M Graphics Made Easy, Atari PILOT, Put A Rainbow in your Atari, Marquee for PET, PET Disk Disassembler, VIC Paddles and Keyboard, VIC Timekeeping.

March, 1982: Word Hunt Game (multiple computers), Infinite Precision Multiply (multiple computers), Atari Concentration Game, VIC Starfight Game, CBM BASIC 4.0 To Upgrade Conversion Kit, Apple Addresses, VIC Maps, EPROM Reliability, Atari Ghost Programming, Atari Machine Language Sort, Random Music Composition on PET, Comment Your Apple II Catalog.

April, 1982: Track Down Those Memory Bugs (multiple computers), Shooting Stars Game (multiple computers), Intelligent Input Subroutines (multiple computers), Ultracube for Atari, Customizing Apple's Copy Program, Using PET/CBM In The High School Physics Lab, Grading Exams on a Microcomputer (multiple computers), Atari Mailing List, Renumber VIC Programs The Easy Way, Browsing the VIC Chip, Disk Checkout for PET/CBM.

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```

550 INPUT"SECURITIES";H;Z=H+Z:PRINT:INPUT"OTHER ASSETS";O;Z=O+Z:GOSUB740
560 INPUT"UNINSURED DEBTS, OTHER THAN HOME MORTGAGE";Q:PRINT:GOSUB740
570 PRINT:PRINTTAB(22);"BALANCE SHEET":PRINT
580 PRINTTAB(5);"FAMILY ASSETS";TAB(35);"FAMILY LIABILITIES"
590 PRINT:PRINTTAB(5);"LIFE INSURANCE";:L=26;V=S:GOSUB780:PRINTS;
600 PRINTTAB(35);"FAMILY INCOME FUND";:L=59;V=Y:GOSUB780:PRINTY
610 PRINT:PRINTTAB(5);"REAL ESTATE";:L=26;V=J:GOSUB780:PRINTJ;
620 PRINTTAB(35);"EDUCATION FUND";:L=59;V=E:GOSUB780:PRINTE
630 PRINT:PRINTTAB(5);"SECURITIES";:L=26;V=H:GOSUB780:PRINTH;
640 PRINTTAB(35);"RETIREMENT FUND";:L=59;V=RE:GOSUB780:PRINTRE
650 PRINT:PRINTTAB(5);"CASH ON HAND";:L=26;V=X:GOSUB780:PRINTX;
660 PRINTTAB(35);"UNINSURED DEBTS";:L=59;V=Q:GOSUB780:PRINTQ
670 PRINT:PRINTTAB(5);"OTHER ASSETS";:L=26;V=O:GOSUB780:PRINTO;
680 PRINTTAB(35);"SPOUSE INCOME FUND";:L=59;V=WI:GOSUB780:PRINTWI
690 X=Y+E+RE+WI+Q
700 PRINT:GOSUB740:PRINT"TOTAL";:L=26;V=Z:GOSUB780:PRINTZ;
710 L=59;V=X:GOSUB780:PRINTX
720 GOSUB740:PRINT:PRINTTAB(15);"LIFE INSURANCE NEEDED = $";X-Z
730 END
740 PRINT"-----"
750 RETURN
760 GOSUB740:PRINT"ENTER SOCIAL SECURITY (OR OTHER PROGRAM) MONTHLY"
770 PRINT"SURVIVOR BENEFITS:";PRINT:RETURN
780 V=FNP1(V):PRINTTAB(V);:RETURN
790 REM S( )=INCOME WHILE STUDENT 18-21
800 REM C(I)=MONTHLY INCOME FROM RETIREMENT PLAN FOR YEAR I
810 REM      FOR WIDOW AND CHILDREN UNDER 18.
820 REM Y(I)=YEARS UNTIL CHILD I IS 18
830 REM N=NUMBER OF CHILDREN UNDER 18
840 REM B2=SURVIVOR BENEFITS FOR SPOUSE AND 2 OR MORE CHILDREN
850 REM B1= SURVIVOR BENEFITS FOR SPOUSE AND 1 CHILD
860 REM B5= SURVIVOR BENEFITS FOR STUDENT 18-21
870 REM BF=FAMILY'S MAX BENEFIT
880 REM B6=SPOUSE'S RETIREMENT BENEFIT AT AGE 62
890 REM SC=MONTHLY GOAL FOR SPOUSE & CHILDREN
900 REM WR=MONTHLY GOAL FOR SPOUSE (E.G. WIDOW) RETIREMENT
910 REM MB=MONTHLY GOAL FOR SPOUSE BETWEEN CHILDREN AND RETIREMENT
920 REM E=LUMP SUM EDUCATION FUND FOR EACH CHILD
930 REM MI( )=WORKING VARIABLE FOR INCOME CALCULATIONS
940 REM A=MULTIPLIER FOR ANNUITY FOR MONTHLY INCOME FOR SURVIVORS
950 REM D=DISCOUNT MULTIPLIER FOR MONEY NEEDED IN FUTURE
960 REM Y=FAMILY INCOME FUND
970 REM ED=TOTAL BENEFITS PAID TO EACH STUDENT
980 REM E=LUMP SUM EDUCATION FUND
990 REM RE=SPOUSE'S RETIREMENT FUND
1000 REM AG=# YEARS TO 62 FOR SPOUSE
1010 REM WI= WIDOW'S (SPOUSE'S) INCOME BETWEEN CHILDREN AND RETIREMENT
1020 REM Z=TOTAL OF FAMILY ASSETS
1030 REM K=#OF HOMOGENOUS PERIODS IN YEAR BY YEAR TABLE OF INCOME

```

Program 2: VIC-20 Version

```

570 PRINT:PRINT"      BALANCE SHEET":
    PRINT
600 PRINT"FAMILY INCOME":PRINT"FUND
    ";TAB(17);Y
610 PRINT"REAL ESTATE";TAB(17);J
620 PRINT"EDUCATION FUND";TAB(17);E
630 PRINT"SECURITIES";TAB(17);H
640 PRINT"RETIREMENT FUND";TAB(17);
    RE
650 PRINT"CASH ON HAND";TAB(17);X

```



```

660 PRINT"UNINSURED DEBTS";TAB(17);
    Q
670 PRINT"OTHER ASSETS";TAB(17);O
680 PRINT"SPOUSE INCOME":PRINT"FUND
    ";TAB(17);WI
700 PRINT"TOTAL";Z
710 PRINT"    ";X
720 GOSUB740:PRINT:PRINT"LIFE INSUR
    ANCE":PRINT"NEEDED =$";X-Z

740 PRINT"-----"

```

Program 3: Atari Version

```

30 FNRD=2000
60 POKE 85,10:?"LIFE INSURANCE PLAN":?
:?"GOSUB 740
70 ? :?"ENTER # OF CHILDREN UNDER 18":
INPUT N:IF N=0 THEN 90
80 ? :?"MONTHLY INCOME GOAL FOR SPOUSE
AND CHILDREN":INPUT SC
90 ? :?"MONTHLY INCOME GOAL FOR SPOUSE'
S":?"RETIREMENT":INPUT WR
100 ? :?"MONTHLY INCOME GOAL FOR SPOUSE
":?"BETWEEN CHILD REARING"
110 ? "AND RETIREMENTM IF NO CHILDREN <1
8":?"THIS APPLIES NOW TO RETIREMENT";
130 ? :?"LUMP SUM EDUCATION FUND FOR EA
CH CHILD":INPUT E
150 FOR I=1 TO N:?"AGE OF CHILD # ";I:
INPUT TEMP:Y(I)=18-TEMP:NEXT I
160 GOSUB 760:?"FOR A SPOUSE & 2 OR MOR
E CHILDREN":INPUT B2
170 ? "FOR A SPOUSE & 1 CHILD":INPUT B1
:?"FOR A STUDENT 18-21":INPUT B3
180 ? "FOR A FAMILY'S MAXIMUM PERMISSABL
E BENEFIT":INPUT BF
190 ? "FOR SPOUSE STARTING RETIREMENT AT
AGE 62":INPUT B6:IF N=0 THEN 300
240 NEXT J:NEXT I
290 NEXT I
310 ? :?"CURRENT TAX BRACKET IN %":IN
PUT T:T=T/100:PRINT
330 ? "SAVINGS ACCOUNT INTEREST RATE FOR
":?"SURVIVORS ANNUITY":INPUT R:R=R/100

390 NEXT I:X=0:Y=0
420 MI(I)=Z%A:TEMP=MI(I):GOSUB FNRD:MI(I
)=TEMP%D:Y=Y+MI(I):NEXT I:TEMP=Y:GOSUB F
NRD:Y=TEMP
440 ED=E-B5*40:E=0:FOR I=1 TO N:E=E+ED/(
1+R)^Y(I):NEXT I:TEMP=E:GOSUB FNRD:E=TEM
P
450 ? "CURRENT AGE OF SPOUSE":INPUT AG:
RE=WR-B6:AG=62-AG:IF AG<0 THEN AG=0
470 RE=RE*12*(1-(1+R)^-20)/R:TEMP=RE:GOS
UB FNRD:RE=TEMP
500 WI=MB*12*(1-(1+R)^-AG)/(R*(1+R)^Y(N)

```

```

):TEMP=WI:GOSUB FNRD:WI=TEMP:GOSUB 740
520 ? "ENTER FAMILY ASSETS":? :?"LIFE I
NSURANCE":INPUT S:?"
530 ? "CASH ON HAND":X:Z=X+S:?"REAL
ESTATE EQUITY":INPUT J:Z=J+Z
550 ? "SECURITIES":INPUT H:Z=H+Z:?"
OTHER ASSETS":INPUT O:Z=O+Z:GOSUB 740
560 ? "UNINSURED DEBTS, OTHER THAN":?"H
OME MORTGAGE":INPUT Q:?"GOSUB 740
570 ? :POKE 85,11:?"BALANCE SHEET":?
580 ? "FAMILY ASSETS":POKE 85,17:?"FAM
ILY LIABILITIES"
590 ? :?"LIFE INSURANCE ";S
600 POKE 85,17:?"FAMILY INCOME FUND ";Y

```

```

610 ? :?"REAL ESTATE ";J;
620 POKE 85,17:?"EDUCATION FUND ";E
630 ? :?"SECURITIES ";H;
640 POKE 85,17:?"RETIREMENT FUND ";RE
650 ? :?"CASH ON HAND ";X;
660 POKE 85,17:?"UNINSURED DEBTS ";Q
670 ? :?"OTHER ASSETS ";O;
680 POKE 85,17:?"SPOUSE INCOME FUND":? WI
700 ? :GOSUB 740:?"TOTAL ";Z
710 ? X
720 GOSUB 740:?"POKE 85,7:?"LIFE INSUR
ANCE NEEDED =$";X-Z
740 ? "-----"
----"
760 GOSUB 740:?"ENTER SOCIAL SECURITY":
?"(OR OTHER PROGRAM) MONTHLY"
770 ? "SURVIVOR BENEFITS":? :RETURN
2000 TEMP=INT((TEMP+999)/1000)*1000:RETU
RN

```

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Myron Miller
Indianola, PA

I would like to expand on David D. Thornburg's excellent commentary "Computers And Society: Some Speculations On The Well-Played Game..." (**COMPUTE!**, July, 1981, #14, pp. 12-16). Mr. Thornburg dealt with the educational value of playing games. I would like to consider the educational value of programming games. A computer is a versatile educational device.

Computer literacy is an awareness of the use of computers, though not necessarily a formal education in computer science. It will become an extremely desirable secondary skill as inexpensive microcomputer technology continues to invade non-computer related career fields. Programming is the essence of computer literacy.

Why Games?

A program is the application of machine logic, usually through a high level language (BASIC, PASCAL, etc.), to solve a problem or perform a certain task. Games, while perhaps not the most important task, are a very effective and versatile medium for learning programming. Games offer some advantages that may be lacking in the more serious forms of programming. Games can be simple, or they can be rather complex. You can always think up a game that can match your level of programming ability. However, an effective checkbook balance program may be beyond your capabilities as a beginner and yet, later, prove too simple. Games can be complex enough to use all of the power in your computer. The average home user may have very little use for trigonometric and other higher math functions in normal home applications, but these functions can often be utilized in screen plots for games. The same is true for

machine language and graphics.

Games do not require expensive peripherals such as disk drives or printers. Games have a clear goal, they exercise your creativity, and they can be very motivating especially for children. A seventh grader may not be enthusiastic about writing a financial program, but blasting Klingons might prove interesting. The quality of the game itself is secondary, but it must be well-programmed. If the game is a real bore, who cares? What did you *learn* from the program?

Let's take a look at one way to program and, at the same time, develop a simple game program. A good program is nurtured – it is thought out and planned well in advance of actually typing the program into the machine's memory. Good programming procedure might be divided into five distinct steps. You do not need your computer until step five.

Step 1. Creation

The first step is creating an application or game. This can be difficult because it requires creativity and vision. You might think of this step in terms of "I would like the computer to do the following: _____." (You fill in the blank.) This is the brainstorming step. Let your imagination run free. Program creation should not be dominated with questions such as: "Will this work?", or "How can I do this?" Rather, think in terms of unrestricted possibilities. Don't allow concern for the implementation of the program to stifle a valuable creative effort. If something is a bit farfetched, it can be pared down later. But if it is cut at its inception, a valuable idea may be lost forever.

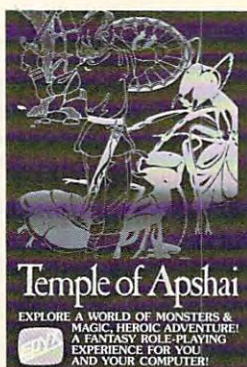
Example 1 shows the creation of the "High/Low Computer Game." This is a simple game, but it will demonstrate the principles that we are discussing. Note that the objectives of the program are very general. This step is a creative effort. Thus, at this point, we do not want specific details. We have room to expand the program or limit it. Note that there is not a hint as to *how* the computer will accomplish the task – the end result of program creation is a rough draft of *what* the program will do.

Example 1. Program Creation of the High/Low Computer Game.

I would like the computer to do the following: "Think" of a number, and ask the user to guess what the number is. If the user's guess is correct, the computer will indicate so, and "think" of another number. If the user's guess is too high or too low, the computer will indicate so, and the user will continue to guess until the correct number is obtained.

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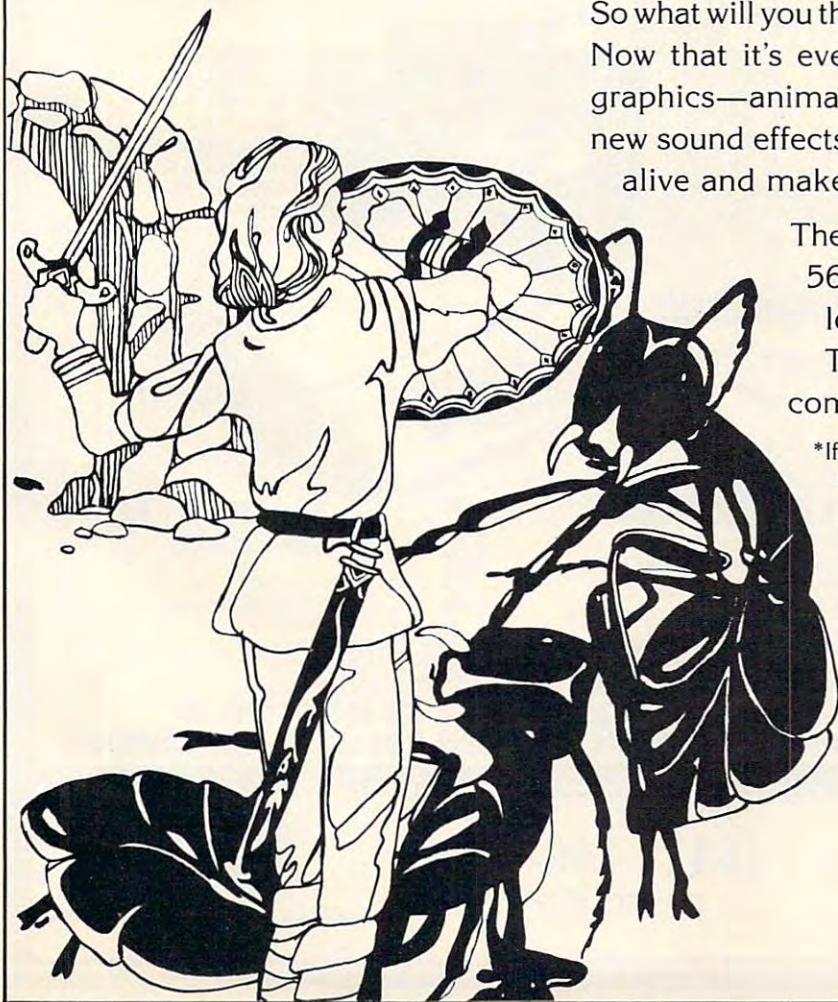
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Step II. Definition

Program creation (Step I) was an exercise for the imagination, but program definition (Step II) is concerned with reality. Program definition will define *exactly what* the program will do – again, not *how* but *what*. Step II considers that there are real limitations in the abilities of computers and human beings. Program definition will convert the desired effects of the program creation into real and possible objectives. Programming, like a trip in a car, requires that you know where you are going first, then you can figure out how to get there. Occasionally, an improvement will arise during the later stages of the programming effort, and such changes should be incorporated into the program. This should, however, be an exception rather than a rule.

Example 2 shows the program definition of the High/Low Computer Game. Note that the number that the computer “thinks” has been limited to an integer (whole number) between 1 and 100. Also note that specific responses by the computer have replaced the general statements found in the program creation.

Example 2. Program Definition of the High/Low Computer Game

Objectives:

1. The program will ‘think’ of an integer between 1 and 100.
2. The program will display: “I am thinking of a number between 1 and 100.” “Can you guess the number?” “Please enter your guess.”
3. The user enters his guess on the keyboard.
4. If the guess is:
 - a. Correct – the program will display: “Correct!” The program will return to the beginning, and will “think” of another integer....
 - b. Too Low – the program will display: “Too Low!” “Please try again.” The program will return to “Please enter your guess.”...
 - c. Too High – the program will display: “Too High!” Please try again.” The program will return to “Please enter your guess”...
5. b and c will continue, guiding the user to the correct value, until the correct value is entered. Then a will display “Correct!,” and repeat the program.

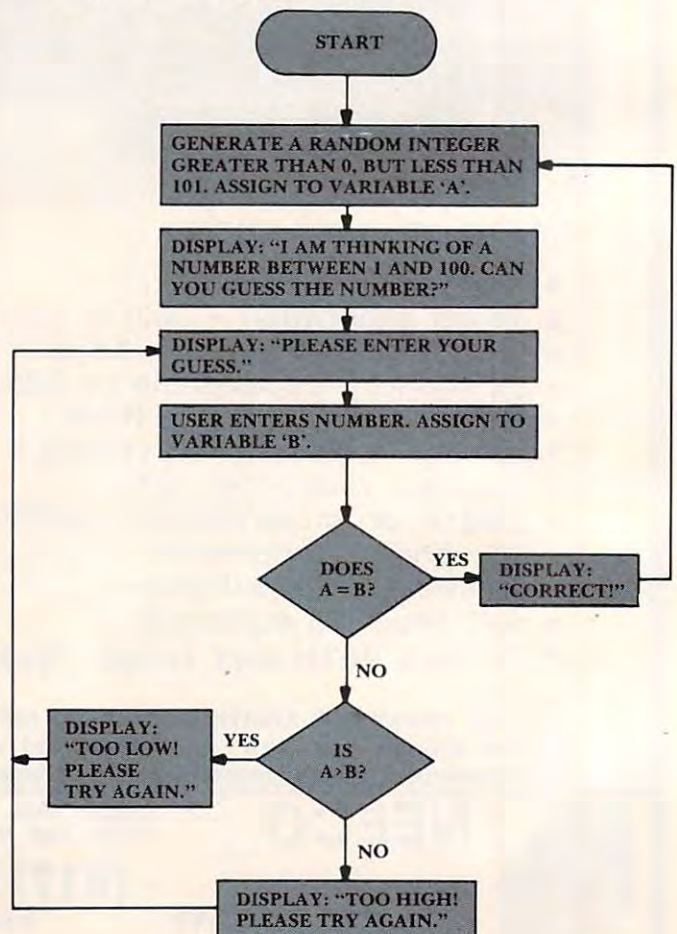
Step III. Solution

Thus far we have determined the “whats” of the program. Now we can develop the “hows.” The objectives of the program definition (Step II) are actually a series of problems, and we must develop a series of solutions – a set of algorithms (a method, or sequence of operations) that will satisfy the objectives in Step II. We must also develop a “struc-

ture” for the program. We must look at the objectives in Step II and ask ourselves: “What needs to be done first?” “How do we solve this?” “What needs to be done second?” etc.... Then we must ask ourselves: “How do we flow from the first item to the second and to the third?”, etc....

I prefer the use of a flowchart for this step (see Example 3). Each box contains an operation or a group of related operations; the arrows indicate the flow from one operation to the next. The diamond shaped boxes are “decision making” or “test” operations. Don’t go overboard when flowcharting – you may end up with a beautiful but useless piece of computer dogma. A flowchart is for human beings, not machines. Thus, it should be written in drab old English, not a computer language, for two reasons 1) a flowchart should be adaptable to any machine, and to almost any language; 2) it is very easy to get lost in a computer language. A good flowchart written in English can help you out of the woods, when you are debugging a program. If the flowchart is written in a computer language, you have two collections of gibberish.

Example 3. Program Solution in flowchart format for the High/Low Computer Game.



When you have completed your flowchart, you should pretend that you are a computer and "run" through your chart. Just follow the arrows! At decision-making operations (diamond shaped boxes), be sure to execute all of the possible conditions. Your flowchart "run" should satisfy the objectives determined in Step II. Look for illogical flow, or behavior that was not intended. Look for

Don't be afraid to make mistakes. If you are lucky you will make lots of them, and each one will burn a lesson into your memory.

redundant operations that can be eliminated or combined into a subroutine. A flowchart is really a logic map. If your logic is correct, your flowchart "run" will accomplish the objectives stated in the program definition (Step II). If you find any errors, they should be corrected before proceeding.

In Example 3, we have a flowchart for the High/Low Computer Game. Note the use of English, and the use of yes/no to mark the flow of the conditions at the decision-making boxes. Try a flowchart "run"; you will find that all of the program objectives have been satisfied, and the logic is in order.

One last comment: if you don't like them, don't use them. You can outline the operations or implement some kind of numerical scheme. What is needed is a guide showing the algorithms and the logic flow. Flowcharting is one method, but not the only method, or necessarily the best method. The best method is whatever you find most convenient.

Step IV. Translation

We are at the step in which most beginners want to start coding the program into the resident language of the machine. Don't fire up your computer just yet, we will still be working with a pencil and paper. There are a number of reasons to write your program on paper, then code it into the machine. Primarily, it is easier to work with paper than a 25 or 16 line "window" provided by the screen format. Also, you learn by your mistakes; a written listing will record the mistake, and you can enter the correction on the listing. This way you will always have the error and the correction for future reference. Don't be afraid to make mistakes. If you are lucky you will make lots of them, and each one will burn a lesson into your memory.

Program translation is simply the process of

converting the algorithms of the program solution (Step III) into the computer language used by your machine. If you did a good job in Step III, this step should be fairly straightforward. Naturally, you will have to be careful about the syntax (grammar of the language) and the rules for the machine to be used. Your flowchart or other solution medium should guide you from the beginning to the end of the program. When writing a listing, it is good practice to allow plenty of space in between each line for corrections or additional lines. Also, if you are not sure that a certain operation will work, test it on your computer. Whip up a "mini-program" that will use the operation in the same manner as desired in the listing. Test mini-programs can save you a lot of debugging (removal of errors) later on. When your listing is completed, again, pretend that you are a computer and execute a listing "run." Look for bad syntax, illogical operation, incorrect flow, and redundant steps. Your listing should comply with the objectives of Step II, and the flow in Step III.

Example 4 is the program translation of the High/Low Computer Game written in BASIC. The program is written for simplicity and clarity, rather than efficiency and design elegance. Note the frequent use of REM (remarks) statements. REM statements appear only in the listing, not during the execution of the program. They make a program easier to read and follow and, as such, should be used generously throughout the listing. REM statements do, however, consume memory space and increase program execution time. Thus, in

Example 4. Program Translation for the High/Low Computer Game.

Note: See if you can find the two bugs inserted into the program. (Program is written for a Commodore PET.)

```

10 PRINT "HIGH/LOW COMPUTER GAME."
20 LET A = INT(100*RND(1)+1)
30 REM 'A' IS THE NUMBER THAT THE
  COMPUTER IS THINKING.
40 PRINT "I AM THINKING OF A NUMBER
  BETWEEN 1 AND 100. CAN YOU GUESS THE
  NUMBER?"
50 PRINT "PLEASE ENTER YOUR GUESS."
60 INPUT B
70 REM 'B' IS THE USER'S GUESS.
80 IF A = B THEN GOTO 140
90 REM TEST FOR CORRECT GUESS
100 IF A > B THEN GOTO 160
110 REM TEST FOR LOW GUESS
120 PRINT "TOO HIGH! PLEASE TRY AGAIN."
130 GOTO 20
140 PRINT "CORRECT!"
150 GOTO 20
160 PRINT "TOO LOW! PLEASE TRY AGAIN."
170 GOTO 20

```

programs where memory space or execution speed is critical, they should be avoided. Another point: the line numbers increase in increments of 10 (10, 20, 30...). This allows additional lines to be added in between the existing lines without having to renumber the remainder of the program.

Two bugs have been intentionally inserted into the listing in Example 4. Perform a listing run, and see if you can find the bugs. Hint: use the flowchart in Example 3.

Step V. Entering and Debugging

Plug in your computer and fire it up. When you are satisfied with your listing, type it into your machine's memory. I like to debug as I go, so about every 20 lines or so, I run the program. This will point out any syntax errors, and may indicate a logic error. It can save you a lot of debugging later by pointing out a mistake before it becomes compounded by additional future operations. *Caution!* Before you run a partial program, be sure that you do not have any functions that will cause the computer to crash (loss of control of the computer usually caused by the processor getting caught in an endless loop). Machine language is very susceptible to crashing and must be properly terminated before executing. If you have to shut down and power up again to recover control, you will lose your program! Therefore, get the program into mass storage (tape or disk) often – about every 20 lines. If you then have a crash or a power failure, you will lose only a small portion of the program and not the entire effort. Remember, Random Access Memory is volatile – the contents (your program) vanish if the power is interrupted.

You have completed typing in your program, you are anxious to run it. You type in RUN and press return and then ... If you are lucky you will have a program rich in bugs. Lucky? Solving a tough bug is very educational, and the lessons taught by mistakes are longer lived than when everything goes smooth. Bugs are to programmers what storms are to sailors: you learn from them.

There are two general categories of bugs. The first is a syntax bug. You have violated a rule of the language or the specific machine. The program comes to a screeching halt and an error message is usually displayed. Quite simply, the machine does not understand what you have instructed it to do. Syntax bugs are usually easy to find and correct.

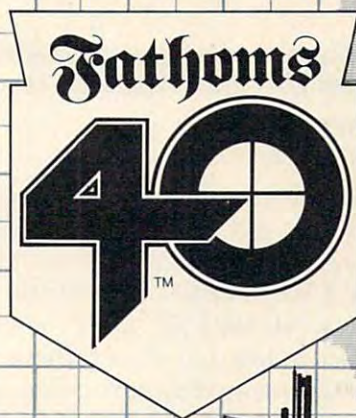
The second is a program logic bug. The program usually does not stop, nor are there any error messages. Rather, the program does unexpected things. The machine is content (that is, the syntax of the program is correct) with your instructions and merrily continues the execution no matter how weird things may get. But your instructions

are not telling the computer to do what you want it to do. The problem may only be in your listing, or it may be both in the listing and the flowchart. A review of both items may point to the bug. Program logic bugs can be difficult to find and correct.

Because syntax bugs vary and are usually easy to locate, we will concentrate on how to find program logic bugs. The first thing to do is determine *how* the actual operation differs from the desired operation. Observe the screen carefully and watch for peculiar behavior. Now you have to find the location of the bug. If needed, insert diagnostic stop commands into the program, so that you can check out how far the program proceeds before malfunctioning. Take a look at the variables by inserting print commands. When you have the general area of the bug's location, then look for simple but subtle errors in the listing: failure to RETURN from a subroutine, nested FOR/NEXT statements using the same variable name, confused variable names, GOTO's going to the wrong place, IF/THEN statements blocking steps that must be done regardless. Most program logic errors result from very simple one-step errors. At times, it is hard to believe that a simple error can have such drastic results. Watch out for nested subroutines (one subroutine calling a second subroutine which in turn calls up a third ..., etc). They can multiply a bug immensely. If you still can't find the bug, make sure that the functions employed do what you think they do. Look at calculations. Did you consider the proper order of evaluation (e.g., $6*2+3=15$, not 30)? Sometimes you may have to insert or delete steps just to see what happens. You may have to employ test mini-programs. Some bugs may show up only once in a while. You then have to isolate those conditions which cause it. One thing is certain, after you have solved a few tough bugs, you will know more about programming than the person, who by chance, gets things right the first time.

If you enter the program in Example 4 into your machine as it appears, you will find that you seldom will be able to guess the correct number. Your chances will always be 1 in 100. Also, the game will be very confusing: as you key in on what seems to be the correct guess, you will get conflicting results (e.g., 63 TOO LOW, 64 TOO HIGH). Comparison of the listing to the flowchart will identify the bugs. In the flowchart, the program returns to PLEASE ENTER YOUR GUESS after an incorrect guess has been processed. In the listing, the program returns to the beginning of the program and generates a new number. Thus, after each guess, the computer is thinking of a different number, but the user is trying to guess the original number. Thus, the user will very seldom guess

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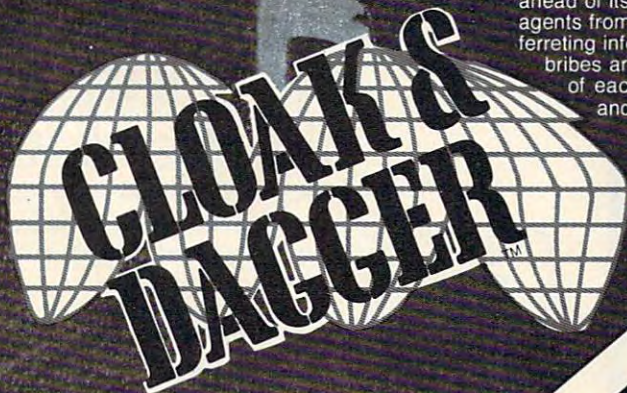
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correctly. The flowchart is correct, the listing is wrong. Lines 130 and 170 should read:

```
130 GOTO 50
170 GOTO 50
```

If you observed the program behavior during execution (bugs still present), you would note that the machine would display "I AM THINKING OF A NUMBER BETWEEN 1 AND 100. CAN YOU GUESS THE NUMBER?" after each incorrect guess. This is a clue that something is wrong. Inserting the following diagnostic step would clearly show that a new number was being generated after each guess.

```
75 PRINT "A="A, "B="B
```

This step would display the variables, and would be removed after the bugs were corrected. Finding the bugs would then, be a simple matter of determining which steps are returning too far back in the program. Diagnostic steps can be a very helpful debugging aid, so be sure to look for places in your listing in which they can be utilized.

You have debugged your program; it runs as expected. Are you done? From an educational standpoint, no! Look over your program, and try to find areas that need improvement. Do you understand your program, or did you modify certain steps until, by chance, they worked? Experiment with the program: try doing things another way, insert bugs and observe their effects. Also, you should write a review of the program in your notebook. (Do you keep a well organized notebook?) Enter specific problems and your solutions. Note your mistakes. Enter the bugs, how you found them, and why they caused problems. If there is something that you do not understand, enter that in your notebook as well. When you find an explanation, include it in your notebook. Enter all of the documentation that you generated during the program development (i.e., Examples 1 through 4). Enter possible improvements. Your notebook should be the best reference you own; keep it up to date.

The Ultimate Computer Game

Obviously, the High/Low Computer Game is no edge-of-your-seat thriller. In fact, it's pretty boring. But, our intention was to learn programming, not create an exciting game. As such, we should be concerned with how "well-programmed" is the game? As it appears in this article, not very; but I chose brevity and simplicity over efficiency and function. If you have been into computing for a week, you are not going to write Lunar Lander, but you may be able to handle the High/Low Computer Game.

The entire programming procedure may

seem like a lot of work, especially for a simple program. However, the most important point in this article is that programming does not start at the keyboard.

Programming is the ultimate computer game. Like any game, it has rules: proper program development, syntax, and program logic. Also like a game, you can win or lose: your program works, or it doesn't. But programming goes beyond conventional games; it exercises the imagination. Without imagination, there is nothing to program. With imagination, there is no limit. For me, there is a sense of achievement and fascination in converting an imagined idea into reality through programming.

REFERENCES

Thornburg, David D. "Computers And Society: Some Speculations On The Well-Played Game," **COMPUTE!**, Vol. 3, No. 7 (July, 1981), 12-16.

The idea of the High/Low Computer Game is not original, although the listing in Example 4 is my creation. I ran into this program while attending school, I don't know who came up with the idea originally, but I rather suspect it might be one of Ada's (the Countess of Lovelace) creations. ©

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T: A TEXT DISPLAY DEVICE: by Joseph Wrobel

(Atari 16K)
T: is an auto-loading, co-resident assembly language routine which greatly expands the display capabilities of the Atari. It allows you to freely intermix both text and graphics without the use of modified display lists, PEEKS or POKES. This is done by defining a new device ("T:"); printing to that device puts text onto the screen. The size of the text is determined by the graphics mode used.
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This technique for the Apple, VIC-20, Atari, and PET is a new approach to an old problem: where to put machine language routines into a BASIC program. Adding small machine language subroutines can greatly speed up a BASIC program, but there are some difficulties when trying to SAVE or LOAD them as one piece. These programs solve this problem.

A New Technique For Mixing BASIC And Machine Language

Louis Sander
Pittsburgh, PA

If you've ever added a machine language subroutine to BASIC, you know how useful this can be in speeding up the program. Several ways of SAVEing the ML and BASIC programs together on one tape have been described, and each has drawbacks. Some require space-consuming DATA statements for the BASIC program. Others do not allow SAVES from BASIC, or forbid you to ever change the BASIC program. Still others need direct mode POKES each time the conjoined programs are SAVED or RUN.

Some store the machine language in cassette buffers or at the top or bottom of memory, where you'd often prefer to keep other programs. None of this is very conducive to writing "fun" programs that you can easily RUN, improve, and modify, or give to friends.

Here is an easy and flexible technique for coupling BASIC programs and short machine language routines. This new technique eliminates all of the above-mentioned drawbacks. After a simple one-time setup, it allows routine SAVES from BASIC. It does not restrict later changes to your programs, and does not require you to convert your machine language into DATA statements. The new method provides space for 249 bytes of machine language *inside* the BASIC program, and allows you to increase this amount at will. It *does* put two restrictions on the contents of your ML

program, but these can be easily "programmed around."

By modifying links and line numbers, the technique establishes a very long dummy line as line 0 of your BASIC program. The line contains 249 dummy bytes which can be used to hold your ML program. You can set up the dummy line before your main program is in memory, or after, provided the main program contains no line numbers lower than 8. Here's how to do it:

1. Enter the following lines, exactly as shown:

Program 1. (PET/CBM)

```
0 REMXXX ... (45 X's total) ... XXX
1 REMXXX ... (45 X's total) ... XXX
2 REMXXX ... (45 X's total) ... XXX
3 REMXXX ... (45 X's total) ... XXX
4 REMXXX ... (45 X's total) ... XXX
5 IF PEEK (1279) THEN STOP
6 FOR I= 1030 TO 1278 : POKE I,88 : NEXT
7 POKE 1025,0 : POKE 1026,5 : LIST-7
```

The first five lines cannot contain embedded spaces, and each one must contain exactly 45 X's. Since all five are identical except for line numbers, you can type in the first one and use the screen editor to duplicate it.

2. RUN the program. This *must* be done for

Program 2. Apple Version

Since both the PET and the Apple store programs internally in the same way, Program 1 (for the PET) only has to be adjusted to account for memory differences. PET programs start at \$0400, Apple programs at \$0800, so an offset of 1024 must be added to memory references, and the "line link" bytes in line seven must be changed from \$0500 to \$0900. Free memory for your machine language program would begin at 2054 and end at 2302. This assumes, of course, Apple-soft in ROM. If your machine stores programs in a different area of memory, the program will have to be changed to reflect this. Remember that lines 0-4 must contain exactly 45 X's.

```
0 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  XXXXXXXXXXXXXXXX
1 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  XXXXXXXXXXXXXXXX
2 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  XXXXXXXXXXXXXXXX
3 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  XXXXXXXXXXXXXXXX
4 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  XXXXXXXXXXXXXXXX
5 IF PEEK(2303) THEN STOP
6 FOR I = 2054 TO 2302 : POKE I, 88 :
  NEXT
7 POKE 2049, 0 : POKE 2050, 9 : LIST
  - 7
```




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quires that no line in your main program be numbered lower than 23.

These programs are modifying BASIC line links, and taking advantage of the fact that, while

the computer's screen editor limits program lines to 80 characters, BASIC lets them be as long as 255.

Program 5:

Reserving Up To 2739 Bytes On PET/CBMs

```
0 REM *** ML SPACEMAKER ***
1 REM
2 REM      LOUIS F. SANDER
3 REM      153 MAYER DRIVE
4 REM      PITTSBURGH, PA 15237
5 REM
6 REM *** DELETE ALL BUT LINES 14
  -22          BEFORE US
  ING THE PROGRAM.
7 REM
14 PRINT249*LN"BYTES SET UP FOR ML
  . WANT MORE Y{03 LEFT}";
  :INPUTA$:IFA$<>"Y"THEN21
15 PRINT"{CLEAR}{02 DOWN}":FORI=0T
  04:PRINTLN+I"REM";:FORJ=1T
  045:PRINT":":NEXT:PRINT
16 NEXT:PRINT"LN="LN+1":GOTO17{HOM
  HOME}":POKE158,6:FORI=1TO6
  :POKE622+I,13:NEXT:END
17 A=255:NL=1280+A*(LN-1):IFPEEK(N
  L-1)THENPRINT"ERROR":STOP
18 FORI=NL-250TONL-2:POKEI,88:NEXT
```

```
:POKENL-254,NL/256
19 POKENL-A,NL-256*INT(NL/256):PRI
  NT"{CLEAR}LOCATIONS AVAILA
  BLE FOR M.L.:{02 DOWN}"
20 FORI=1TOLN:PRINT"{UP}LINE"i-1":
  "A*I+775"TO"A*I+1023" = 24
  9 BYTES{DOWN}":NEXT:GOTO14
21 PRINT"{02 DOWN}":FORI=14TO22:PR
  INTI:NEXT
22 FORI=1TO11:PRINT"{UP}":NEXT:PO
  KE158,9:FORI=1TO9:POKE622+
  I,13:NEXT:END
100 REM
101 REM * FOR ORIGINAL ROMS, SUBSTI
  TUTE          THESE FOR L
  INES 16 & 22:
102 REM
116 NEXT:PRINT"LN="LN+1":GOTO17{HOM
  HOME}":POKE525,6:FORI=1TO6
  :POKE526+I,13:NEXT:END
122 FORI=1TO11:PRINT"{UP}":NEXT:PO
  KE525,9:FORI=1TO9:POKE526+
  I,13:NEXT:END
```

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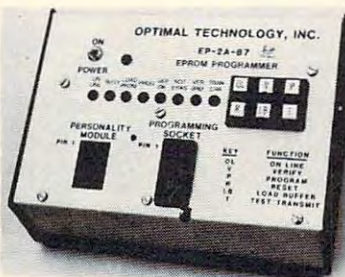
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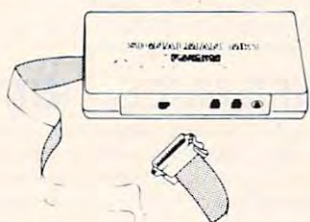
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4K or 8K bytes of soft ROM with optional battery backup.

RAM/ROM is compatible with any large keyboard machine. Plugs into one of the ROM sockets above screen memory to give you switch selected write protectable RAM.

Use RAM/ROM as a software development tool to store data or machine code beyond the normal BASIC range. Use RAM/ROM TO LOAD A ROM image where you have possible conflicts with more than one ROM requiring the same socket. Possible applications include machine language sort (such as SUPERSORT), universal wedge, Extramem, etc.

RAM/ROM - 4K \$85
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SUBSORT by James Strasma \$35

Subsort is an excellent general purpose machine language sort routine for PET/CBM computers. Sorts both one and two dimensioned arrays at lightning speed in either ascending or descending order. Other fields can be subsorted when a match is found, and fields need not be in any special order. Sort arrays may be specified by name, and fields are random length. Allows sorting by bit to provide 8 categories per byte. The routine works with all PET BASICs, adjusts to any memory size, and can co-exist with other programs in high memory.

SuperGraphics 2.0 NEW Version with TURTLE GRAPHICS

SuperGraphics, by John Fluharty, provides a 4k machine language extension which adds 35 full featured commands to Commodore BASIC to allow fast and easy plotting and manipulation of graphics on the PET/CBM video display, as well as SOUND Commands. Animations which previously were too slow or impossible without machine language subroutines now can be programmed directly in BASIC. Move blocks (or rocketships, etc.), or entire areas of the screen with a single, easy to use BASIC command. Scroll any portion of the screen up, down, left, or right. Turn on or off any of the 4000 (8000 on 8032) screen pixels with a single BASIC command. In high resolution mode, draw vertical, horizontal, and diagonal lines. Draw a box, fill a box, and move it around on the screen with easy to use BASIC commands. Plot curves using either rectangular or polar co-ordinates (great for Algebra, Geometry and Trig classes).

The SOUND commands allow you to initiate a note or series of notes (or even several songs) from BASIC, and then play them in the background mode without interfering with your BASIC program. This allows your program to run at full speed with simultaneous graphics and music.

Seven new TURTLE commands open up a whole new dimension in graphics. Place the TURTLE anywhere on the screen, set his DIRECTION, turn him LEFT or RIGHT, move him FORWARD, raise or lower his plotting pen, even flip the pen over to erase. Turtle commands use angles measured in degrees, not radians, so even elementary school children can create fantastic graphic displays.

Specify machine model (and size), ROM type (BASIC 3 or 4)
SuperGraphics (disk or tape) \$ 40
SuperGraphics in ROM 55
Volume discounts available on ROM version for schools.



for PET/CBM Computers

FLEX-FILE is a set of flexible, friendly programs to allow you to set up and maintain a data base. Print files with a versatile Report Writer or a Mail Label routine. Programmers will find it easy to add subroutines to their own programs to make use of Data Base files.

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Record size limit is 250 characters. The number of records per disk is limited only by the size of each record and the number of records per disk is limited only by the size of each record and the amount of free space on the disk. File maintenance lets you step forward or backward through a file, add, delete, or change a record, go to a numbered record, or find a record by specified field. The Find command locates any record when you enter all (or a portion of) the desired key. Field lengths may vary from record to record to allow maximum packing of information. Files may be sorted by any field, and any field may be specified as a key. Sequential files from other programs may be converted to Flex-File format, and Flex-File records may be converted to sequential (WordPro, PaperMate, other word processors may also use Flex-File data). Maximum record size, fields per record, and order of fields may be changed at any time.

MAILING LABELS

With typical record size of 127 characters, each disk can handle over 1000 records (about 2800 with 8050 drive). Labels may be printed any number wide, and may begin in any column position. There is no limit on the number or order of fields on a label, and two or three fields may be joined together on one line (like first name, last name, and title). A "type of customer" field allows selective printing.

REPORT WRITER

Print any field in any column. For numeric fields, use decimal point justification (and round to any accuracy). Define any column as a series of mathematical functions performed on other columns. These functions include arithmetic operations and various log and trig functions. Pass results of operations such as running total from row to row. At the end of the report, print total and/or average for any column. Complete record selection, including field within range, pattern match, and logical functions can be specified individually or in combination with other parameters.

FLEX-FILE by Michael Riley \$60
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BY L. C. Cargile and Michael Riley

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- full FIG FORTH model.
- all FORTH 79 STANDARD extensions.
- structured 6502 Assembler with nested decision making macros.
- full screen editing (same as when programming in BASIC).
- auto repeat key.
- sample programs.
- standard size screens (16 lines by 64 characters).
- 150 screens per diskette on 4040, 480 screens on 8050.
- ability to read and write BASIC sequential files.
- introductory manual.
- reference manual.

Runs on any 16K or 32K PET/CBM (including 8032) with ROM 3 or 4, and CBM disk drive. Please specify configuration when ordering.

Available soon:

Metacompiler for FORTH

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simple metacompiler for creating compacted object code which can be executed independently (without the FORTH system).

PaperMate 60 COMMAND WORD PROCESSOR

by Michael Riley



Paper-Mate is a full-featured word processor for CBM/PET. Paper-Mate incorporates 60 commands to give you full screen editing with graphics for all 16K or 32K machines (including 8032), all printers, and disk or tape drives.

For writing text, Paper-Mate has a definable keyboard so you can use either Business or Graphics machines. Shift lock on letters only, or use keyboard shift lock. All keys repeat.

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

All formatting commands are imbedded in text for complete control. Commands include margin control and release, column adjust, 9 tab settings, variable line spacing, justify text, center text, and auto print form letter (variable block). Files can be linked so that one command prints an entire manuscript. Auto page, page headers, page numbers, pause at end of page, and hyphenation pauses are included. Unlike most word processors, CBM graphics as well as text can be used. Paper-Mate can send any ASCII code over any secondary address to any printer.

Paper-Mate functions with 16/32K CBM/PET machines, with any printer, and with either cassette or disk.

To order Paper-Mate, please specify configuration.

Paper-Mate on disk or tape 40.00

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This is the concluding segment of a three-part review of Microsoft BASIC for Atari. Included is a demonstration program, illustrating some of the features of "AMSB."

Review:

Atari Microsoft BASIC (Part III)

Jerry White
Levittown, NY

This is the third and final part of our series on Atari Microsoft BASIC. A demonstration program called ALARM.MSB has been provided as an example. I used the file extension .MSB to indicate Microsoft BASIC. Since I have three different versions of BASIC, I had to have some way of knowing which version was used in a given program. If you have more than one version of BASIC, I suggest you use filename extensions .MSB to indicate Microsoft, and .BAP to indicate BASIC A+. Programs in Atari 8K BASIC may then be identified by having no extension, or by using .A8K, or .BAS.

Read the introduction display messages found in program lines 310 through 350. The user is prompted to enter the current hour, minute, and second, followed by an alarm hour and minute. For example, enter the current time as hour 9, minute 58, and second 30. Then enter the alarm hour as 10 and the alarm minute as 0. This will set the alarm for 1 minute and 30 seconds from our current time.

You may wonder why someone would want to use a computer as an alarm clock. In this case, we want to demonstrate commands unique to Atari Microsoft BASIC (AMSB). Since our computer has much greater display capability than any alarm clock, we can also tell someone why the alarm was set. The next and final prompt says, "ENTER ALARM MESSAGE BELOW:". This message will be displayed when the current time and the alarm time are equal.

As you begin to type this program into the computer, you will soon notice some strange looking statements. The SETCOLOR 6,9,0 is not an error. In GRAPHICS 0 of AMSB, this sets the background color to dark blue-grey. What ever happened to SETCOLOR 0, you ask? Color registers zero through three are used to set the colors of Player

Missiles.

At program line 190, notice the command LINE INPUT MESSAGE\$. LINE INPUT takes one screen line of keyboard input and places it into a string.

At program line 200 notice the command PRINT #6 AT (8,2). AT (8,2) replaces the Atari 8K BASIC POSITION statement.

You might also think there is an error in program line 240. Notice that the SOUND command contains five variables. That fifth variable is optional and specifies duration in 60ths of a second or jiffies. Each time the current minute changes, this sound will occur for 15/60ths or one quarter of a second. Up to twenty pending SOUND commands may be saved in what is called the *stack*. This permits your BASIC program to go on about other tasks while SOUND commands are executed automatically.

If you were to set an alarm for more than a few minutes into the future, you could shut off your TV or monitor and save a few watts. The alarm sound is the console bell. When the bell rings twice, you could turn your TV back on to read the message.

This concludes our series on Atari Microsoft BASIC. It was my intention to point out its strengths and weaknesses, make comparisons to Atari 8K BASIC and O.S.S. BASIC A+, and to demonstrate some of its unique commands. AMSB is not for everyone. I hope I've provided enough information so that you can decide if Atari Microsoft BASIC is for you.

```
10 REM ALARM.MSB by Jerry White
20 REM ATARI Microsoft BASIC
30 REM Alarm Clock Demonstration
40 GOSUB 300:GRAPHICS 0:SETCOLOR 6,9,0:P
OKE 82,10
50 PRINT:PRINT"% ATARI ALARM CLOCK *":PR
INT
60 PRINT:INPUT "ENTER CURRENT HOUR:";HR
70 HR=INT(HR):IF HR<0 OR HR>23 THEN 60
80 T=HR*60*60*60
90 PRINT:INPUT "ENTER CURRENT MINUTE:";M
IN
0100 MIN=INT(MIN):IF MIN<0 OR MIN>59 THE
N 90
0110 T=T+MIN*60*60
0120 PRINT:INPUT "ENTER CURRENT SECOND:
";SEC
0130 SEC=INT(SEC):IF SEC<0 OR SEC>59 THE
N 120
0140 T=T+SEC*60:TIME=T:REM TIME$ NOW HOL
DS THE CURRENT TIME
```


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\$6.95

TRICKY TUTORIALS(tm)

#1: DISPLAY LISTS — This program teaches you how to alter the program in the ATARI that controls the format of the screen. For example: when you say graphics 8 the machine responds with a large graphics 8 area at the top of the screen and a small text area at the bottom. Now, you will be able to mix the various modes on the screen at the same time. Just think how nice your programs could look with a mix of large and small text, and both high and low resolution graphics. this program has many examples plus does all of the difficult calculations!

#2: HORIZONTAL/VERTICAL SCROLLING — The information you put on the screen, either graphics or text, can be moved up, down or sideways. This can make some nice effects. You could move only the text on the bottom half of the screen or perhaps create a map and then move smoothly over it by using the joystick.

#3: PAGE FLIPPING — Normally you have to redraw the screen every time you change the picture or text. Now you can learn how to have the computer draw the next page you want to see while you are still looking at the previous page, then flip it instantly. You won't see it being drawn, so a complicated picture can seem to just appear. Depending on your memory size and how complicated the picture, you could flip between many pages, thus allowing animation or other special effects with your text.

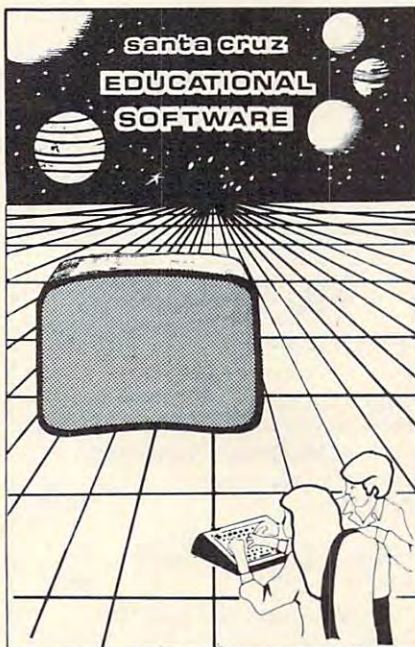
#4: BASICS OF ANIMATION — Shows you how to animate simple shapes using the PRINT and PLOT commands, and also has nice little PLAYER/MISSILE Graphics demo to learn. This would be an excellent way to start making your programs come alive on the screen. Recommended for new owners.

#5 PLAYER MISSILE GRAPHICS — This complex subject is demonstrated by starting with simple examples, and building up to a complete game and also an animated business chart on multiple pages! As always, the computer does most of the calculations. Requires 32K disk or tape and costs **\$29.95**

#6: SOUND — From explaining how to create single notes, to demonstrating complex four channel sound effects, this newest tutorial is great. Even those experienced with ATARI's sound capabilities will find the menu of sound effects a needed reference that can be used whenever you are in the need of a special sound for your programs. Everyone will learn something new! Written by Jerry White.

Tricky Tutorials (except #5) require 16K memory for cassette orders and 24K for disk. The price is \$19.95 each. You may order 1, 2, 3, & 4 for \$64.95. All six in a colorful binder cost \$99.95.

THE GRAPHICS MACHINE!! — Turn your computer into an incredible graphics tool with advanced commands like circle, box, fill, polygon, line, help, etc. 3 colors in graphics 8 with instant text!!!! Create colorful business charts or beautiful drawings and then save or retrieve them from disk in 5 SECONDS. YES, it's that fast. Needs all 48K, disk, and costs **\$19.95**



MINI-WORD PROCESSOR — This is for those of you who have a printer, but don't want to spend \$100 or more for a fancy word processor. It is suitable for simple editing of text, accepts most control characters for your printer, and text is stored on disk for easy retrieval. Holds 2½ typed pages at a time. Requires 32K, disk or tape. **\$19.95**

BOB'S BUSINESS — 14 small business type programs for home or office, all chosen from a nice menu. Supports printed output. 169 sectors of output require 16K tape, or 32K disk. **\$14.95**

KID'S #1 — Includes the following: 1) **TREASURE** — search for the lost treasure while trying to keep from falling into the sea. Nice graphics if you find it!; 2) **DIALOGUE** — talk back to the computer about four subjects; 3) **MATH QUIZ** — Nice musical and graphical rewards for good scores. Parents input the level of difficulty.

KID'S #2 — A spelling quiz, a "scrabble" type game, and a version of Touch with the computer giving all the directions! Both Kid's programs require 16K tape or 24K disk and cost **\$14.95** each.

MINI-DATABASE/DIALER — This unique new program stores and edits up to 8 lines of information such as name, address, and phone numbers, or messages, inventories or anything you want. It has the usual sort, search, and print options, but it also has an unusual feature. If your files include phone numbers and you have a touch-tone phone, the program will **DIAL THE PHONE NUMBERS FOR YOU!** This is perfect for those who make a lot of calls like salesmen, teens, or those trying to get through to busy numbers (acts as an auto-redialer). It is also a lot of fun to use. Requires 16K cassette or 24K disk and costs **\$24.95**

FONETONE — For those who only want to store name and phone numbers and have the dialer feature as above, we offer this reduced version. Same memory requirements, but only costs **\$14.95**. Don't forget you must have a touch-tone phone.

PLAYER PIANO — Turns your keyboard into a mini-piano and more. Multiple menu options provide the ability to create your own songs, save or load data files using cassette or diskette, fix or change any of up to 400 notes in memory, and play all or part of a song. The screen displays the keyboard and indicates each key as it is played from a data file or the notes you type. You don't have to be a musician to enjoy this educational and entertaining program. Requires 24K cassette or 32K disk. **\$14.95**

BOWLERS DATABASE — Provides the league bowler with the ability to record and retrieve bowling scores providing permanent records. The data may then be analyzed by the program and displayed or printed in summary or detail form. Data may be stored on cassette or diskette and updated quickly and efficiently. The program provides such information as highest and lowest scores by individual game, (first, second, and third games throughout the season), high and low series, current average, and more. The program listing and documentation provided are a tutorial on ATARI basic and record keeping. Requires 16K for cassette or 24K for disk. **\$14.95**

By the time you read this all computers (400/800) being produced should have the fabled GTIA chips included. Atari service may upgrade older computers. . . call and ask (it's easy to do yourself). We have one and the improvements that graphics modes 9,10, and 11 offer are great!! To help you figure out what to do with the new modes a new Tricky Tutorial will be offered in March on Modes 9 to 11. Either give us a call or write around that time.

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```

0150 PRINT:INPUT "ENTER ALARM HOUR:";AH
0160 AH=INT(AH):IF AH<0 OR AH>23 THEN 150
0170 PRINT:INPUT "ENTER ALARM MINUTE:";AM
0180 AM=INT(AM):IF AM<0 OR AM>59 THEN 170
0190 PRINT:PRINT "ENTER ALARM MESSAGE BELOW:"
LINE INPUT MESSAGE$:POKE 82,2:PRINT
0200 GRAPHICS 18:PRINT #6, AT (8,2);"time":AH$=""
0210 NEWMIN$=MID$(TIME$,4,2):MIN=VAL(NEWMIN$):HR=VAL(LEFT$(TIME$,2))
0230 IF NEWMIN$=OLDMIN$ THEN 250
0240 P=VAL(MID$(TIME$,4,2)):SOUND 0,P+10,10,15,15
0250 OLDMIN$=NEWMIN$:IF OLDTIME$<>TIME$ THEN OLDTIME$=TIME$:SETCOLOR 4,RND(0)*16,10:SETCOLOR 5,RND(0)*16,10
0260 PRINT#6, AT (6,4);TIME$
0270 IF HR=AH AND MIN=AM THEN 290
0280 G.210
0290 POKE 766,0:GRAPHICS 0:PRINT CHR$(25

```

```

3):PRINT:PRINT MESSAGE$:PRINT CHR$(253):END
0300 GRAPHICS 0:SETCOLOR 6,1,0:POKE 82,2:POKE 83,39:POKE 752,1:PRINT
0310 PRINT:PRINT "This Atari Microsoft Basic program":PRINT "demonstrates the use of some unique"
0320 PRINT "commands such as TIME, TIME$, and the":PRINT "SOUND command's fifth variable (duration)."
0330 PRINT "The SOUND will occur on each":PRINT "change of minute.":PRINT
0340 PRINT "The program may be used to set an":PRINT "alarm and have the Atari ring it's"
0350 PRINT "bell and display a reminder message.":PRINT:PRINT TAB(9)"PRESS 1 START TO BEGIN"
0360 FOR VOL=15 TO 0 STEP-.5:SOUND 0,0,2,VOL:NEXT VOL
0370 IF PEEK(53279)<>6 THEN POKE 755,3:POKE 755,2:G.370
0380 RETURN

```

©

* REMEMBER WHEN *

Grandma used envelopes for paying her bills, and it worked.

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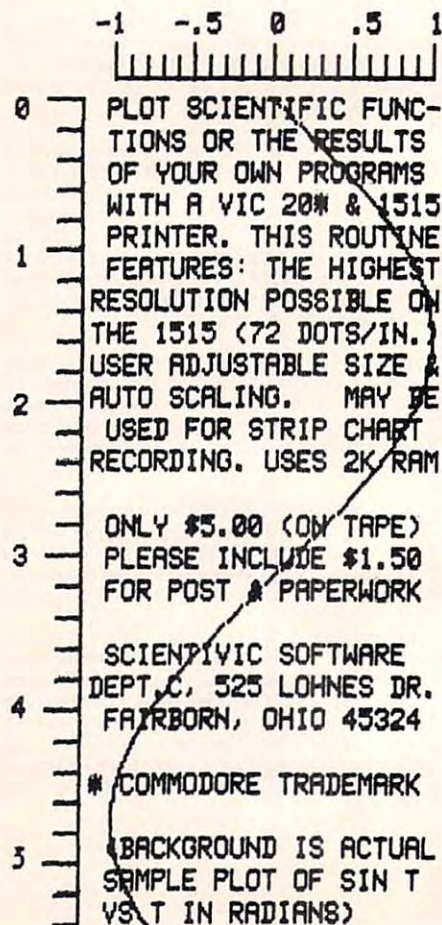
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To use your VIC to call other computers (or to use such telecommunications services as The Source or Micronet), you need special connecting equipment (an interface) to add a modem to the VIC. A modem is the device that lets your computer "talk" and "listen" to other computers, on the telephone.

Review:

Modem Driver Module (MDM-1)

Harvey B. Herman
Associate Editor

The MDM-1 module is an interface which allows the VIC to be connected to a modem. A simple program can then turn the VIC into a terminal which can access remote computers. In the process of evaluating it, I learned a few things about the VIC which were surprising (at least to me) and which I would like to share.

The full name for this equipment is "modem driver module." It plugs into the VIC user port and has connectors for a modem and a printer. You supply the cables. My experience with the PET, which also has a user port, led me to believe that somewhat complicated software would be necessary to drive the modem. Several machine language programs to do this are commercially available for the PET. Much to my surprise, I found the VIC supports the user port as a device for serial communications. That means that a relatively short BASIC program is all that is required to send data to a printer or to a remote computer using the VIC as a terminal. The designers of the VIC should be commended for including this feature in a low cost machine. [*"Terminal" means using the computer to communicate with other computers. In other words, it is not just working within itself as a self-contained device.*]

Connecting To The Modem

It is easy to set up the Modem Driver Module. Built in a sturdy box, it plugs in easily to the user port in the rear of the VIC. (Power off please!)

Any standard RS-232 cable (male at each end) can be used to attach a modem. The modem must be capable, however, of accepting TTL logic level signals as input. Ask a knowledgeable person if you are not sure. I had no trouble working with a Novation CAT modem or a ComData modem, at 300 baud (the number of characters sent per second). My guess is that most people will not have trouble with newer modems.

Hints On Software

When the hardware is in place, the VIC can be safely turned on and a terminal program loaded. A BASIC program is normally considered too slow for this application (i.e., using the VIC as a terminal). Two things mitigate against this. One, an area of memory is set aside as a buffer to store incoming characters temporarily if the computer is busy doing other things. Two, the remote computer can be directed to wait a short time after each line is sent, giving the VIC a chance to catch up.

The logic of a BASIC communications program should go something like this:

1. Open a file to the modem.
2. Get a character from the keyboard.
3. If a key is pressed, send that character to the modem.
4. Get a character from the modem.
5. If a character is received, print it on screen.
6. Repeat steps two and five.

Step one automatically allocates the buffer and allows the user to specify the characteristics of the serial transmission. The programmer has complete control of the baud rate, bits per character, and parity – much as he would if this were a "real" terminal with switch-selected options.

I wrote a short program, shown in the listing, to test the hardware for this review. It would take a much longer article to explain it thoroughly, so don't despair if it is obscure. It will make more sense when the Commodore VIC User's Guide becomes generally available. However, the program assumes a typical communications configuration (300 baud, 7 bit word, even parity, and full duplex) so that many people can use it with only minor changes.

The hardware and software worked fine when communicating with a DEC VAX-11/780. The combination of a VIC, modem, and Modem Driver Module makes an inexpensive terminal whose only limitation is the short, 20 character, line length. The VIC had no trouble keeping up with the computer, under worst case conditions, as long as I added fill characters after carriage return. This does slow the speed somewhat, and some users

might prefer a faster machine language program. However, I was content staying with BASIC.

There are other ways to use this module which shouldn't be slighted. A printer and a modem can be connected simultaneously to produce a "printing terminal." You can even use it without a modem to get VIC BASIC listings on a printer using a so-called *null modem cable*. The printer must have a proper buffer, however, for this application to work. [A *buffer is a temporary storage area for data.*] I did verify that I was able to make short listings on a Base 2 printer as long as the printer buffer was enabled, but I did not test it as a printing terminal.

This hardware is well constructed and worth the price. The only caveat is that you make sure your modem will accept TTL as input. [TTL is a *particular kind of electronic circuit; it means Transistor-Transistor-Logic.*]

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PARITY BIT

```
280 GOSUB 320
290 PRINT CHR$(C);:REM OUTPUT TO SC
    REEN
300 IF ST<>0 THEN CLOSE 2:STOP
310 GOTO 170
320 REM ASCII TO VIC
330 IF C>64 AND C<91 THEN C=C+128:R
    ETURN
340 IF C>96 AND C<123 THEN C=C-32
350 RETURN
360 REM VIC TO ASCII
370 IF B>64 AND B<91 THEN B=B+32:RE
    TURN
380 IF B>192 AND B<219 THEN B=B-128
390 RETURN
```

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```
100 REM VIC 300 BAUD TERMINAL
110 REM
120 REM HARVEY B. HERMAN
130 REM
140 OPEN 2,2,3,CHR$(6+32)+CHR$(32+6
    4):REM 300 BAUD, 1 STOP BI
    T, AND EVEN PARITY.
150 FL=0:REM CLEAR CONTROL CHARACTE
    R FLAG
160 PRINT CHR$(14);"{CLEAR}";:REM L
    OWER CASE CHARACTER SET AN
    D CLEAR SCREEN
170 GET B$:REM INPUT FROM KEYBOARD
180 IF B$="" THEN 250
190 IF B$="\ " THEN FL=1:GOTO 250:RE
    M SET CONTROL CHARACTER FL
    AG
200 IF ASC(B$)=136 THEN B$=CHR$(127
    ):REM F7 IS DEL
210 IF ASC(B$)=133 THEN B$=CHR$(27)
    :REM F1 IS ESC
220 IF FL=1 THEN B=ASC(B$)-64:B$=CH
    R$(B):FL=0:REM KEY PRESS I
    NTO CONTROL CHARACTER
230 B=ASC(B$):GOSUB 360:B$=CHR$(B)
240 PRINT#2,B$;:REM OUTPUT TO MODEM

250 GET#2,C$:REM INPUT FROM MODEM
260 IF C$="" THEN 300
270 C=ASC(C$) AND 127:REM MASK OUT ~
```

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Compilers take, for example, a BASIC program and translate it into a machine language-like form. It should then execute for faster than the original BASIC.

COMPUTE! Overview:

The Galfo Apple Compiler

The Integer BASIC Compiler from Galfo Systems contains two diskettes: one is a system diskette and the other is a compiler diskette.

Compilers are being marketed today primarily because BASIC is slow in execution speed – painfully slow for some applications. This is so because each BASIC command or instruction in a program must be converted by the interpreter before it can be understood and processed by the CPU (central processing unit). This conversion must be done each time the command or instruction is encountered in the program, thus contributing to the slow speed of a BASIC program. Compilers enjoy their speed advantage because these conversions are done only once – *before* the finished (or *compiled*) program is run. After the BASIC program is compiled, it will execute like a machine language program. The Galfo compiler creates code that is comparable to machine language in execution time. It will deliver truly fast programs.

There are several important and desirable features to look for when selecting a compiler. Can the compiled program be stored in any portion of memory desired? With what type of program information is the user furnished after the program is compiled? What is the speed advantage of the compiler? Is the compiled program (object code) longer (and if so, how much longer) than the original program (source code)? How good is the error-handling capability of the compiler? Is it easy to use? Is the documentation complete and easy to follow? Will the compiler handle the many different types of routines demanded by the user, such as graphics, string handling, and I/O routines?

The Galfo compiler allows users of Integer BASIC to make their programs not only faster, but also smaller! This somewhat paradoxical situation is due to the fact that the Integer BASIC Compiler (or IBC) can produce two varieties of output at the user's option:

1. Pure GSL Code
2. Mixed GSL and 6502 Code

GSL stands for "Galfo Stack Language," and is the machine code for an idealized 6502 stack-

...allows users of Integer BASIC to make their programs not only faster, but also smaller!

oriented computer. (Compare Sweet-16 code, which is the machine code for an idealized 16-bit, register-oriented, 6502-like machine). The GSL generated by IBC for a typical Integer BASIC program is more compact than the corresponding tokenized internal form used by the Integer BASIC Interpreter. Even with the addition of 6502 code mixed with the GSL code, reasonably compact programs are achieved. Hence, smaller programs!

A runtime system is used to execute the GSL object code. The GSL.SYS program is a Galfo Stack Computer Emulator (Again, compare this to the Sweet-16 program, which is a Sweet-16 Computer Emulator).

It does not have to perform any translation tasks such as the Integer BASIC Interpreter does – such as locating variables or line numbers by searching through memory, converting numbers from ASCII strings to binary, etc. Therefore, it executes the same BASIC program much faster than the Integer BASIC Interpreter can.

About the only overhead is the "fetch-execute" cycle in the emulation. This means retrieving the next Galfo Stack Computer opcode from the object code and dispatching a call to the appropriate subroutine to emulate that opcode. In programs which have a mixture of GSL code and 6502 machine code, this overhead is totally eliminated for those parts of the program in 6502 code. The upshot of all this is that the IBC compiled programs run from 7 to 50 times as fast as their interpreted counterparts. This is the claim made by the documentation. Let's examine the claim.

Benchmarks

The Instruction Manual provided with the compiler

contains an Appendix listing some benchmark data. The programs tested to provide that data were obtained from articles appearing in *Kilobaud* magazine, in 1977. The measured speeds for those programs using the normal Integer BASIC Interpreter ranged from 1.4 to 28 seconds. The Appendix lists two corresponding sets of numbers for the same programs when compiled under IBC. One set measures them as compiled to pure GSL code, and another set measures them as compiled to mixed GSL and 6502 code. The data and one of the benchmarks are shown in Figure 1.

Figure 1.

Program #	IBC/GSL (Opt. speed)	IBC/GSL (Opt. space)	APPLE Integer BASIC	APPLE Applesoft BASIC
BM1	0.16	0.16	1.4	1.3
BM2	0.33	0.46	3.2	8.0
BM3	1.5	1.8	8.0	16
BM4	1.0	1.2	7.0	17
BM5	1.2	1.3	9.0	19
BM6	2.1	2.3	18	28
BM7	2.9	3.4	28	45

Listing of BM7:

```

300 PRINT "START"
400 K=0
430 DIM M(5)
500 K=K+1
510 A=K/2*3+4-5
520 GOSUB 820
530 FOR L=1 TO 5
535 M(L)=A
540 NEXT L
600 IF K<1000 THEN 500
700 PRINT "END"
800 END
820 RETURN

```

BM7 was compiled in an attempt to verify the claimed data. The data were gathered using a stop watch, and may not be as accurate as data obtained on a system with a realtime clock. (The Instruction Manual does not comment on how its data were obtained).

These results show that IBC is able to produce most efficient code which really zips along. In fact, the author's suggestion that IBC is the fastest 6502-based high-level language just may be accurate.

Other Speed Tests

A compiler gains much of its speed because there is no longer any need for interpreting each statement.

This means different programs will speed up by differing amounts. For example, compiling a FOR-NEXT loop containing the multiplication of decimal numbers will not speed up very much, as most of the time is used in the multiplication. The same loop multiplying Integers will undergo a great increase in speed.

The compiler was also tested using the Benchmark program from *Call-Apple*, March/April, 1980, with the loops increased to 10000. The Benchmark programs do the following: 1. Simple FOR/NEXT loop 2. IF/THEN loop 3. compute using loop variable 4. compute using constants 5. GOSUB 6. GOSUB with additional loop 7. Storing a variable in an array.

The compiler can compile either for speed or space. The speed difference between the two was about 10%. The increase in speed compared to normal Integer BASIC is tremendous. Time is in seconds. Again, timing was done with a stop watch and not a built-in clock. The shorter times are, therefore, somewhat inaccurate:

TEST #	1	2	3	4	5	6	7
INTEGER BASIC	14	35	81	46	130	245	360
COMPILED FOR SPACE	2	6	19	6	14	24	34
COMPILED FOR SPEED	2	4	17	4	12	22	30

Compile time for the Benchmark program was about five seconds.

The compiler was tested under actual conditions. Four pre-existing Integer BASIC programs were compiled using both GSL code (conserving disk space) and mixed code (for optimum program speed). One of the programs compiled was a pinball game. Have you ever tried to play computer-pinball while the ball literally flies across the screen? The compiled program ran so fast that it was impossible to play the game. A second Integer program that played a musical tune was compiled. The individual notes sounded in such rapid succession that the tune played like a continuous musical slur. The individual notes no longer seemed to be separate notes. The time required to *compile* these programs was of such short duration that it bears little mention. Suffice to say that a typical 300 line program compiled in seconds!

There were a few surprises in store when comparing the disk space used by a compiled program to the original program's disk space. When compiling for maximum speed, disk space used increased from a low of 29% to a high of 58% more than the original program. When compiling for maximum economy in disk space, the space used by the compiled program actually *decreased* in every case! Space *saved* ranged from a low of 20%

to a high of 40% of the original program's disk space usage. Additionally, programs compiled for disk space ran almost as fast as those compiled for speed.

The compiler can be used with one disk drive, but this creates an awkward operating situation. It is recommended that the compiler be utilized in a two-drive system.

Using The Compiler

Space does not permit a complete step-by-step description of the compilation process, so the most important procedures and features will be described. Always begin operating by booting the *system* diskette in drive 1. This automatically loads the routines necessary for proper operation of the compiler. It is suggested that a cold start be effected if any utility programs are present in RAM such as the Program Line Editor. Various problems were encountered while attempting to compile with utility programs in RAM. Compiling after a cold start eliminates these problems.

After the system diskette is booted, load the program you wish to compile in the usual manner (from drive 2). Replace your program diskette with the *compiler* diskette and type "BRUN IBC,D1". This command begins the compilation process. The first prompt you will see asks whether you wish to compile using execution speed or disk-space as a priority. This compiler produces code that is *so* fast and so compact, that this option usually becomes a relatively minor consideration. The resultant object code runs almost as fast, and in many cases *as fast*, as a compilation for speed.

The user is then given a number of additional options such as choosing a starting address for the object code and executing or saving the program on disk (as a binary file). An excellent feature is that the object code produced by this compiler will run on *any* Apple II computer. This means that an Integer BASIC program compiled with the Galfo compiler will run on an Apple II+ (a system without Integer BASIC in ROM). This feature was tested, and the code does indeed execute problem-free.

There is a short (3K) program entitled, "GSL.SYS" which must be present on your diskette in order to run the object code (compiled program). The procedure is simple. Using Apple's FID copy program, copy the GSL.SYS program from the "system" diskette to your program diskette. Any compiled program that is BRUN from your program diskette will automatically look for, and then load and run, the GSL. The GSL therefore, must be resident on the program diskette. The GSL program loads at \$8800 in memory by default. An advantage noted, when comparing this compiler to others, is that the comparable programs used with the other compilers become an integral part of *each*

compiled program. This unnecessarily increases program size and, consequentially, decreases available space on the diskette.

Added Features

Integer BASIC restricts the length of strings to 255 characters. A string length of 32767 is permissible with the Galfo compiler. A symbol table is presented to the user after compilation, listing all variables encountered in the program, the type of variable, (string, integer, or array) and the location of each in memory. A method is provided whereby the user can trick the computer and cause two variables to share the same memory location. This enables the user to refer to either variable during the course of a program and yet retrieve the same information from the variable table. The method used is simple, fully described in the manual, and can easily be managed by even a novice programmer.

The compiler provides the user with many new and modified commands, too numerous to be fully documented in this review. These commands are implemented by typing DSP before each command. Some of the commands that can follow the DSP prefix are: HOME, CLEAR, INVERT, FLASH, NRML, FULL, MIXED, LO, HI, H2, POINT, LINE, and SHAPE. These commands control printing to the CRT, and graphics implementation. If you inspect the commands, you will realize that they emulate the commands available to you in Applesoft. These commands are especially useful as they eliminate the need for the usual cumbersome POKes (their counterparts in Integer BASIC). The author of the program has ingeniously reconfigured Apple's DSP command, and used it to his advantage for the special operatives.

When writing an original program for compilation or when converting an existing one, the user should be aware of two potential trouble spots. DIM statements *must* be defined by using integers, as the compiler will not function with variables in DIM statements. Additionally, variables used in GOTO's or GOSUB's will cause a large increase in program size. This is because the compiler builds a variable table which is searched each time a variable is encountered in a GOSUB or GOTO statement.

Compiled programs are callable from either Integer or Applesoft. However, after running the program by calling it from Applesoft BASIC, strange errors occur unless the memory pointers are reset by doing an FP. Whether calling compiled Integer BASIC programs from Applesoft is a useful capability is difficult to say. The license to use the run-time system in programs for sale is stated as \$5. If this is a one-time fee, it is reasonable. It is not clear whether this fee is for each program sold or is a sub-license fee.

A Few Minor Caveats

The compiler enables the TRACE mode while compiling, and the computer is left in this mode after the compilation is done. The user must then manually execute the NOTRACE command. This may seem like a trivial problem until you run the program only to have line numbers begin printing on the CRT each time. Also, there is no provision made whereby the user may protect a given portion of memory. For example, if one wished to protect the HI-RES page from being overwritten, the only way found to easily effect this was to load the entire object code *after* the HI-RES page in memory.

Several errors of omission were encountered, although none were serious. For example, a file entitled "HI-RES Driver" is needed to utilize the HI-RES routines supplied. The manual states that the file must be *loaded* for the routines to work, while in actuality it must be *run*. Additionally, no mention is made as to how one may automatically effect this. If Apple's HELLO program is used to BRUN the HI-RES Driver, then, after the HI-RES file is loaded, the program will stop. An EXEC file must be created in order to first BRUN the HI-RES Driver and then BRUN your own compiled program. No mention is made of this in the manual.

General Overview

- Panelist #1: "Generally great. Look forward to Galfo Applesoft Compiler."
- Panelist #2: "For heavy users of Integer BASIC, the IBC is well worth having. It should enhance existing programs as well as open many new avenues of application that were formerly unavailable for reasons of performance."
- Panelist #3: "The Galfo Integer BASIC Compiler is an extremely useful utility. Its advantages and features far outweigh its shortcomings (which are few) and future revisions will almost certainly correct these. Source code is compiled extremely fast and object code produced by this compiler executes almost as fast as pure machine language. This is a package that all Integer BASIC programmers should own."

Galfo Integer BASIC Compiler. Galfo Systems, 6252 Camino Verde, San Jose, CA, 95119. \$149.50. ©

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The Atari GTIA Chip: Here At Last!

Steve Steinberg
Washington, DC

If you've never heard of the legendary Atari GTIA chip, here in brief is the story:

The designers of the Atari 400/800 computers originally had planned on three additional graphics modes – Graphics 9 to provide 16 intensity levels of one color, Graphics 10 to provide nine colors in varying intensities, and Graphics 11 to provide 16 colors. Both Atari BASIC and the Computer's Operating System were designed to access these three graphics modes, but at the time the Atari computers were first released, in 1979, there were still some bugs to be ironed out in the graphics chip, known as the GTIA. The company decided to go ahead, using a less powerful chip, the CTIA, without these three modes.

The bugs in GTIA have long since been dealt with and the question for some time for many of us has been just how and when Atari would release the chip. The GTIA is now being installed in all Atari 400s and 800s coming off the production line and the really good news for those of us who have waited and wondered and hoped is that it is also being shipped to facilities that service Atari computers, to upgrade existing models. I paid \$23.92 for mine and, although installation costs depend, of course, on who you are dealing with, replacement of the CTIA is a relatively uncomplicated procedure. I have also heard that it is simple enough that some computer stores are doing it on a "while you wait" basis.

The Legend Is True

The best news of all is that the legend turns out to be quite accurate, and the chip does everything it was said to do. Documentation, as of this writing, is a bit hard to come by, so here is a preliminary effort. One warning for recent Atari owners. If you type in the accompanying programs and get nothing on your screen but a blue (default) background and a series of graphics control characters, it means you don't have the new chip. My suggestion is to buy one.

The first brief program gives you 15 color bars against a black background in Graphics mode 11, the bars representing colors 1 through 15 as described in the table on page 50 of the *Atari Operators Manual*. As you can see, these colors are accessed in BASIC by simply calling up colors 1 through 15. If the colors are off, you may want to adjust the tint controls on your TV set.

The colors in Graphics 11 are set at a default intensity, but you can vary it. Insert a line 15 SETCOLOR 4,0,0. The four does nothing (I'm simply used to it for setting background colors), but the first zero sets the background as black and the second zero sets the luminance at its darkest shade. You can change the background color by changing the second zero to any number up to 15 and you can change the intensity of the 15 displayed colors just as you would with Graphics modes 0 through 7, by changing the last number.

Next, change line 10 to Graphics 9. As you can see, you now have 16 shades of whatever color you have entered in the SETCOLOR command. It's worth noting here that, while all other Graphics modes give you only eight color intensity levels, this one gives you 16, which means that the total number of colors accessible on the Atari computer are now doubled, from 128 to 256 colors altogether.

Graphics mode 10 is a bit more complex than the other two. As I've noted, this is strictly a preliminary look at the GTIA, but let's try it now by changing line 10 to GRAPHICS 10. If you don't have a SETCOLOR statement in line 15, or if the statement is 4,0,0 you should get a long band of black, four different colors, another band of black and the four colors repeated.

Try turning the color level all the way down on your television and you will see that you do have different intensities in the different colors. But there are only five here, where are the other four? First, enter a SETCOLOR in line 15, for example SETCOLOR 4,5,12. The second band of black should now become light violet. Now, enter line 16 POKE 704,15:POKE 705,32:POKE 706,42:POKE 707,52. POKEing into those four memory locations will give you additional hues and intensities, enough for a total of nine colors, including the background. This is as far as my knowledge of this graphics mode has taken me, to date, although I am sure there are many other possibilities to be explored.

Program 2 is simply a primitive attempt at a demo of these dramatic new graphics capabilities for the Atari. All three modes give you 80 pixels across by 192 down. Each of these pixels is actually four pixels wide, which means, for example, that drawing a square requires that the vertical length should be four times the horizontal length.

The large number of variables in line 10 of Program 2 were designed to give you an opportunity to do as much fiddling around with the program as you choose. While it is in GRAPHICS 10, it's no problem to try out the other two new modes by changing line 20. If you get tired of squares, and like the works of Piet Mondrian, eliminate line 70. You should enjoy the results.

One final comment seems appropriate on the occasion of this first hardware update for the Atari computers. All of us who have worked with the Atari, and especially those of us who became introduced to computer programming through the Atari, know that we have one magnificent machine. With the addition of the GTIA chip, its graphics capabilities far surpass those of any other home computer on the market. We were told, when we made the decision to buy, that this was a "friendly" computer, and one that wouldn't be outdated overnight. I feel that this is one company that has lived up to its promises. I have found in my own dealings with people at Atari that if the computer occasionally isn't all that friendly, they certainly are. I'd simply like to express my thanks to, and admiration for, all of them.

Program 1.

```
10 GRAPHICS 11
20 C=1
30 COLOR C
40 A=A+1
50 PLOT A,1:DRAWTO A,180
60 IF A=79 THEN GOTO 60
70 IF A/5=INT(A/5) THEN C=C+1:GOTO 30
80 GOTO 40
```

Program 2.

```
10 M=64:N=150:P=6:Q=24:R=150:T=12:U=T:Y=
1:C=A+P:D=B+Q
20 GRAPHICS 10
30 SETCOLOR 4,5,10
40 POKE 704,15:POKE 705,28:POKE 706,33:POKE 707,54
50 A=(INT(RND(1)*M)+1)
60 B=(INT(RND(1)*N)+1)
70 C=A+P:D=B+Q
80 FOR Z=1 TO T:SOUND 0,A+B,10,U-Z:NEXT Z
90 FOR Z=1 TO T:SOUND 1,A,10,U-Z:NEXT Z
100 Z=(INT(RND(0)*15)+1)
110 COLOR Z
```

```
120 K=INT(RND(1)*3)
130 IF K=2 THEN GOSUB 180
140 PLOT A,B:DRAWTO C,B:DRAWTO C,D:DRAWTO A,D:DRAWTO A,B-1:DRAWTO C,B-1
150 SOUND 0,0,0,0:SOUND 1,0,0,0:SOUND 2,0,0,0
160 IF Y>R THEN GOTO 150
170 GOTO 50
180 PLOT A,B:DRAWTO C,B:DRAWTO C,D:DRAWTO A,D:DRAWTO A,B:DRAWTO C-1,B:DRAWTO C-1,D-1:DRAWTO A+1,D-1
190 DRAWTO A+1,B+1:DRAWTO C-2,B+1:DRAWTO C-2,D-2:DRAWTO A+2,D-2:DRAWTO A+2,B+2:DRAWTO C-3,B+2:DRAWTO C-3,D-3
200 FOR Z=1 TO T:SOUND 2,A/2,12,U-Z:FOR W=1 TO 20:NEXT W:NEXT Z
210 GOTO 50
```

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This program lets you visualize geometry. It's for the Apple (Applesoft with 48K memory) and for the Atari.

Computer-Assisted Geometry Discovery

Fred Ventura
Westlake Village, CA

During the summer of 1981, Intergate, Incorporated of Westlake Village, California offered a number of courses for gifted and talented youngsters. We selected the Atari 800 computer for our computer literacy and computer programming courses. Our program presented a unique opportunity for exceptional children ranging in age from seven to 14 to be challenged by the computer. The courses included an introduction to computer programming, problem solving with the computer, computer-assisted algebra, and an interesting course in which parents and children worked together to learn about computers.

One student, Ricky Masters of Oxnard, California, age 11, developed a clever program that might be of interest to mathematics teachers. The program allows the user to specify the directions for a series of vectors which are simultaneously plotted on the screen in graphics mode seven. From a starting point in the center of the screen, any of eight directions can then be chosen. A maximum of one thousand vectors can be used with 32K RAM, which is more than enough for very complicated designs.

By entering the digit "0" for a vector, the screen is then cleared and the computer proceeds to redraw the design. However, the program takes the drawing one step further and reflects the figure across the x and y axis.

It was rewarding as a teacher to share in the excitement with which each student watched the

computer transform a simple design into an intricate, symmetrical computer graphic display. But, more than providing an amusing experience, the program can be used by teachers as a springboard for the study of the geometry of reflection.

Valuable mathematical discoveries were made by the students who used the program. For example, figures which were drawn so that the intersection of lines of symmetry which corresponded with the center of the graph did not change when reflected, (See example 1). Also, the end points of rotated vectors are determined by a change in sign of the magnitude which is held constant. This can be seen by examining the subroutines used for plotting the reflected figure (starting at lines 90, 510, 710, and 910). It should be pointed out to students who use the program that vector 1 is the result of addition of vectors 2 and 4. This also applies to vectors 3, 6 and 8. In this way, the concept of addition of vectors can be introduced to students.

Students were fascinated by the optical illusion, in many of the designs, which seemed to move in and out from the screen. Follow-up activities for students who used the program were provided to extend the student's learning. Students were presented with figures drawn in one quadrant of a Cartesian plane and were asked to predict what the reflected image would look like. Discussions of integers and their opposites were also used in an analysis of the plotting subroutines.

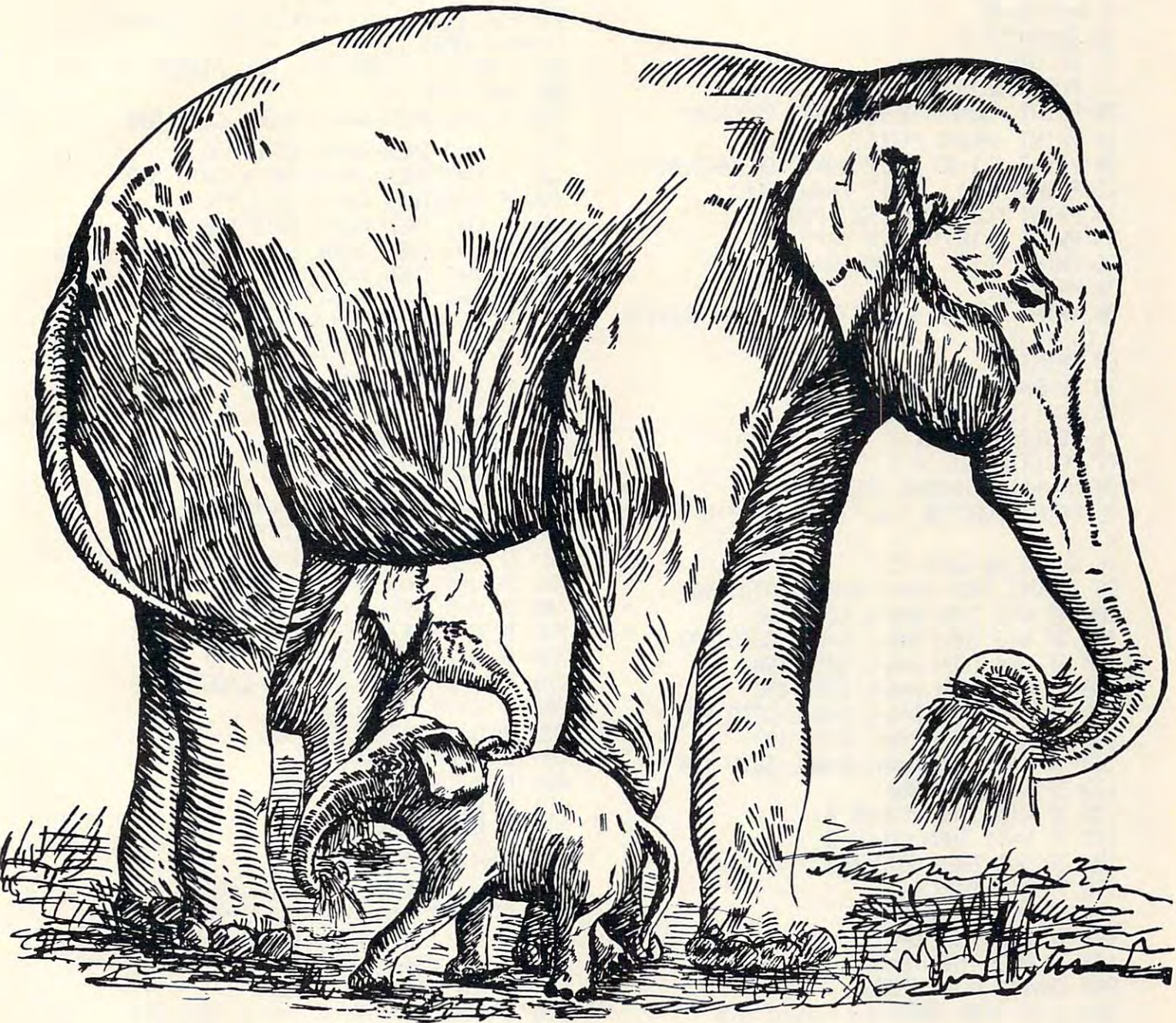
I found that using the computer to illustrate a rather abstract mathematical concept leads to greater understanding. The learning process was an enjoyable experience for all.

The program described above was originally written on an Atari 800. An adapted version was prepared for the Apple computer with Applesoft and 48K. Both listings are presented for comparison. In the Apple version, improvements were made to the program so that either reflection or rotation can be selected. In addition, option (O) permits the overlay of the reflected figure on the rotated figure. Some of the syntactical differences of the two BASICs can be studied by examining the two programs.

Examples And Challenges:

1. Enter a magnitude of 10 and the following series of vectors: 3,4,4,8,8,4,4,3 and 0 to reflect. You will notice that, since the hourglass shape is symmetrical and centered, no change occurs when reflected.
2. Try to enter the correct vectors to make a 3-d cube. When reflected, this figure makes an interesting illusion.
3. Enter the vectors for a complicated figure and predict the reflected image.

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Program 1: Atari Version

```

5 DIM V(1000)
6 A=79:B=40
10 GRAPHICS 0
11 COLOR 2
15 POSITION 5,7
20 PRINT "COMPUTER GRAPHICS PROGRAM"
21 PRINT :PRINT "CODES: "
22 PRINT "(1-8) DIRECTIONS FOR VECTORS"
23 PRINT "(9) RESET DRAW MODE"
24 PRINT "(0) REFLECT FIGURE"
25 PRINT "(10) COLOR OFF"
26 PRINT "(11) COLOR ON"
30 PRINT
50 PRINT "ENTER A LENGTH FOR EACH SEGMENT (1-10)"
60 PRINT " >>>";:INPUT L
70 GRAPHICS 7:PLOT A,B
75 POSITION 20,30:? " 1 2 3 "
76 POSITION 20,30:? " 4 5 "
77 POSITION 20,30:? " 6 7 8 "
80 N=N+1:IF N=1000 THEN 200
85 PRINT "VECTOR ";N;": ";:INPUT V:V(N)=V
90 IF V=1 THEN A=A-L:B=B-L:GOTO 190
100 IF V=2 THEN B=B-L:GOTO 190
110 IF V=3 THEN A=A-L:B=B-L:GOTO 190
120 IF V=4 THEN A=A-L:GOTO 190
130 IF V=5 THEN A=A+L:GOTO 190
140 IF V=6 THEN A=A-L:B=B+L:GOTO 190
150 IF V=7 THEN B=B+L:GOTO 190
160 IF V=8 THEN A=A+L:B=B+L:GOTO 190
170 IF V=9 THEN 300
175 IF V=10 THEN COLOR 0
177 IF V=11 THEN COLOR 2
180 IF V=0 THEN GOTO 400
190 IF A<0 THEN A=0
191 IF A>157 THEN A=157
192 IF B<0 THEN B=0
193 IF B>79 THEN B=79
200 DRAWTO A,B:RETURN
300 A=79:B=40:GRAPHICS 7:PLOT A,B
310 N=0
320 GOTO 75
400 GRAPHICS 7:A=79:B=40:PLOT A,B
410 FOR I=1 TO N-1:V=V(I):GOSUB 2000:GOSUB 90:NEXT I
415 A=79:B=40:PLOT A,B
420 FOR I=1 TO N-1:V=V(I):GOSUB 2000:GOSUB 510:NEXT I
430 A=79:B=40:PLOT A,B
435 FOR I=1 TO N-1:V=V(I):GOSUB 2000:GOSUB 710:NEXT I
440 A=79:B=40:PLOT A,B
445 FOR I=1 TO N-1:V=V(I):GOSUB 2000:GOSUB 910:NEXT I
449 A=79:B=40:PLOT A,B
450 FOR I=1 TO N-1:V=V(I):GOSUB 90:NEXT I:N=N-1:GOTO 75
500 GRAPHICS 7:REM DRAW AND MIRROR
505 N=0:GOTO 75
510 IF V=1 THEN A=A+L:B=B-L:GOTO 590
515 IF V=2 THEN B=B-L:GOTO 590
520 IF V=3 THEN A=A-L:B=B-L:GOTO 590
530 IF V=4 THEN A=A+L:GOTO 590
540 IF V=5 THEN A=A-L:GOTO 590
550 IF V=6 THEN A=A+L:B=B+L:GOTO 590
560 IF V=7 THEN B=B+L:GOTO 590
570 IF V=8 THEN A=A-L:B=B+L:GOTO 590
580 IF V=10 THEN COLOR 0
585 IF V=11 THEN COLOR 2
590 IF A<0 THEN A=0
600 IF A>157 THEN A=157
610 IF B<0 THEN B=0
620 IF B>79 THEN B=79
630 DRAWTO A,B:RETURN
710 IF V=1 THEN A=A-L:B=B+L:GOTO 790
715 IF V=2 THEN B=B+L:GOTO 790
720 IF V=3 THEN A=A+L:B=B+L:GOTO 790
730 IF V=4 THEN A=A-L:GOTO 790
740 IF V=5 THEN A=A+L:GOTO 790
750 IF V=6 THEN A=A-L:B=B-L:GOTO 790
760 IF V=7 THEN B=B-L:GOTO 790
770 IF V=8 THEN A=A+L:B=B-L:GOTO 790
780 IF V=10 THEN COLOR 0
785 IF V=11 THEN COLOR 2
790 IF A<0 THEN A=0
800 IF A>157 THEN A=157
810 IF B<0 THEN B=0
820 IF B>79 THEN B=79
830 DRAWTO A,B:RETURN
910 IF V=1 THEN A=A+L:B=B+L:GOTO 990
915 IF V=2 THEN B=B+L:GOTO 990
920 IF V=3 THEN A=A-L:B=B+L:GOTO 990
930 IF V=4 THEN A=A+L:GOTO 990
940 IF V=5 THEN A=A-L:GOTO 990
950 IF V=6 THEN A=A+L:B=B-L:GOTO 990
970 IF V=8 THEN A=A-L:B=B-L:GOTO 990
980 IF V=10 THEN COLOR 0
985 IF V=11 THEN COLOR 2
990 IF A<0 THEN A=0
1000 IF A>157 THEN A=157
1010 IF B<0 THEN B=0
1020 IF B>79 THEN B=79
1030 DRAWTO A,B
1050 RETURN
2000 REM SOUND EFFECTS
2010 SOUND 1,INT(RND(1)*255),10,8
2020 FOR T=1 TO 10:NEXT T

```


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2030 SOUND 1.0,0.0
2040 RETURN

Program 2: Apple Version

```

10 REM *** GEOMETRIC EXPLORATIONS
20 REM *** FRED VENTURA
30 REM *** INTERGATE, INCORPORATED
40 REM *** WESTLAKE VILLAGE, CA
50 DIM V(1000)
60 X1 = 139:Y1 = 79:C = 3
70 X = X1:Y = Y1
80 TEXT
90 HOME
100 VTAB 2: HTAB 2: PRINT "GEDAR
    T - A COMPUTER GRAPHICS PROGRAM"
110 PRINT : INPUT "ENTER THE MAGNITUDE OF THE VECTORS: ";M
120 PRINT : PRINT "ENTER THE NUMBER FOR THE DIRECTION OF EACH VECTOR. YOU DO NOT NEED TO PRESS RETURN. OTHER COMMANDS ARE: "
130 PRINT : PRINT " (Q) QUIT.
    (S) START OVER. "
140 PRINT : PRINT " (O) OVERLAY REFLECTED FIGURE. "
150 PRINT : PRINT " (F) REFLECT.
    (T) ROTATE. "
160 PRINT : PRINT " (C) CLEAR Hires SCREEN. "
170 PRINT : PRINT "PRESS RETURN TO CONTINUE. ";: INPUT X$
180 HGR
190 VTAB 21: HTAB 30: PRINT "1 2
    3"
200 VTAB 22: HTAB 30: PRINT "4 *
    5"
210 VTAB 23: HTAB 30: PRINT "6 7
    8"
220 N = N + 1: VTAB 23: HTAB 1: PRINT "ENTER VECTOR ";N:": ";: GET V$
230 IF V$ = "Q" THEN END
240 IF V$ = "S" THEN RUN
250 IF V$ = "O" THEN GOTO 330
260 IF V$ = "C" THEN HGR : GOTO 220
270 I = N:V(I) = VAL (V$)
280 IF V$ = "F" THEN 310
290 IF V$ = "T" THEN 880
300 GOSUB 380: GOTO 220
310 REM REFLECT FIGURE
320 HGR
330 X = 139:Y = 79: FOR I = 1 TO N - 1: GOSUB 380: NEXT I
340 X = 139:Y = 79: FOR I = 1 TO N - 1: GOSUB 480: NEXT I
350 X = 139:Y = 79: FOR I = 1 TO N - 1: GOSUB 580: NEXT I
360 X = 139:Y = 79: FOR I = 1 TO N - 1: GOSUB 680: NEXT I
370 GOTO 220
380 REM PLOT VECTORS
390 IF V(I) = 1 THEN X = X - M:Y = Y - M
400 IF V(I) = 2 THEN Y = Y - M
410 IF V(I) = 3 THEN X = X + M:Y = Y - M
420 IF V(I) = 4 THEN X = X - M
430 IF V(I) = 5 THEN X = X + M
440 IF V(I) = 6 THEN X = X - M:Y = Y + M
450 IF V(I) = 7 THEN Y = Y + M
460 IF V(I) = 8 THEN X = X + M:Y = Y + M
470 GOSUB 780: RETURN
480 REM PLOT VECTORS Q2
490 IF V(I) = 1 THEN X = X + M:Y = Y - M
500 IF V(I) = 2 THEN Y = Y - M
510 IF V(I) = 3 THEN X = X - M:Y = Y - M
520 IF V(I) = 4 THEN X = X + M
530 IF V(I) = 5 THEN X = X - M
540 IF V(I) = 6 THEN X = X + M:Y = Y + M
550 IF V(I) = 7 THEN Y = Y + M
560 IF V(I) = 8 THEN X = X - M:Y = Y + M
570 GOSUB 780: RETURN
580 REM PLOT VECTORS Q3
590 IF V(I) = 1 THEN X = X + M:Y = Y + M
600 IF V(I) = 2 THEN Y = Y + M
610 IF V(I) = 3 THEN X = X - M:Y = Y + M
620 IF V(I) = 4 THEN X = X + M
630 IF V(I) = 5 THEN X = X - M
640 IF V(I) = 6 THEN X = X + M:Y = Y - M
650 IF V(I) = 7 THEN Y = Y - M
660 IF V(I) = 8 THEN X = X - M:Y = Y - M
670 GOSUB 780: RETURN
680 REM PLOT VECTORS Q4
690 IF V(I) = 1 THEN X = X - M:Y = Y + M
700 IF V(I) = 2 THEN Y = Y + M
710 IF V(I) = 3 THEN X = X + M:Y = Y + M
720 IF V(I) = 4 THEN X = X - M
730 IF V(I) = 5 THEN X = X + M
740 IF V(I) = 6 THEN X = X - M:Y = Y - M

```



```

750 IF V(I) = 7 THEN Y = Y - M
760 IF V(I) = 8 THEN X = X + M:Y
    = Y - M
770 GOSUB 780: RETURN
780 REM PLOT
790 HCOLOR= C
800 IF I = 1 THEN HPLLOT 139,79
810 IF X < 0 THEN X = 0
820 IF X > 279 THEN X = 279
830 IF Y < 0 THEN Y = 0
840 IF Y > 159 THEN Y = 159
850 HPLLOT TO X,Y
860 VTAB 21: HTAB 3: PRINT "X=";
    X;" Y=";Y;" "
870 RETURN
880 REM ROTATE FIGURE
890 HGR
900 X = 139:Y = 79: FOR I = 1 TO
    N - 1: GOSUB 380: NEXT I
910 X = 139:Y = 79: FOR I = 1 TO
    N - 1: GOSUB 950: NEXT I
920 X = 139:Y = 79: FOR I = 1 TO
    N - 1: GOSUB 580: NEXT I
930 X = 139:Y = 79: FOR I = 1 TO
    N - 1: GOSUB 1050: NEXT I
940 GOTO 220
950 REM ROTATE Q2
960 IF V(I) = 1 THEN X = X - M:Y
    = Y + M
970 IF V(I) = 2 THEN X = X - M
980 IF V(I) = 3 THEN X = X - M:Y
    = Y - M
990 IF V(I) = 4 THEN Y = Y + M
1000 IF V(I) = 5 THEN Y = Y - M
1010 IF V(I) = 6 THEN X = X + M:
    Y = Y + M
1020 IF V(I) = 7 THEN X = X + M
1030 IF V(I) = 8 THEN X = X + M:
    Y = Y - M
1040 GOSUB 780: RETURN
1050 REM ROTATE Q4
1060 IF V(I) = 1 THEN X = X + M:
    Y = Y - M
1070 IF V(I) = 2 THEN X = X + M
1080 IF V(I) = 3 THEN X = X + M:
    Y = Y + M
1090 IF V(I) = 4 THEN Y = Y - M
1100 IF V(I) = 5 THEN Y = Y + M
1110 IF V(I) = 6 THEN X = X - M:
    Y = Y - M
1120 IF V(I) = 7 THEN X = X - M
1130 IF V(I) = 8 THEN X = X - M:
    Y = Y + M
1140 GOSUB 780: RETURN

```

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This article shows beginners how to use joysticks with the VIC-20 and it also contains an excellent game.

The Joystick Connection: Meteor Maze

Paul L. Bupp and Stephen P. Drop
Kent, WA

Let the games begin! Your VIC can be easily connected to the readily available Atari joysticks. We will show the new VIC-20 owner how to use these joysticks. Also there's a new VIC game called "Meteor Maze," which demonstrates the use of the joystick.

Program 1.

```

10 PRINT CHR$(147)
15 PRINT SPC(3) CHR$(95) "JOYSTICK
   DIRECTION"
20 PRINT SPC(3) CHR$(95) "BUTTON"
25 PRINT SPC(177) CHR$(144) "*** JO
   YSTICK DEMO ***"
30 POKE 37154,127
35 PRINT CHR$(19)
40 A = ( PEEK(37137) AND 28) OR (P
   EEK(37152) AND 128)
45 A = ABS((A-100)/4)-7
50 ON A GOSUB 100,110,120,,130,140
   ,150,,,,160,170,180
55 B = PEEK(37137) AND 32
60 PRINT CHR$(19)
65 PRINT
75 IF B GOTO 85
80 PRINT " ON": GOTO 90
85 PRINT "OFF"
90 POKE 37154,255
95 GET A$: IF A$ = "" GOTO 30
99 END
100 PRINT " SW": RETURN
110 PRINT " NW": RETURN
120 PRINT " W": RETURN
130 PRINT " S": RETURN
140 PRINT " N": RETURN
150 PRINT " ": RETURN
160 PRINT " E": RETURN
170 PRINT " NE": RETURN
180 PRINT " SE": RETURN

```

But first, let's look at how the joystick connects to the VIC. Program 1 is a BASIC joystick demonstration program. A line-by-line description of the program follows:

```

10 PRINT CHR$(147)
15 PRINT SPC(3) CHR$(95) "JOYSTICK
   DIRECTION"
20 PRINT SPC(3) CHR$(95) "BUTTON"

```

Lines 10 through 20 clear and print the display screen used by the program. CHR\$(95) prints the left arrow.

```

25 PRINT SPC(177) CHR$(144) "*** JOYSTICK
   DEMO ***"

```

Line 25 uses the SPC command to print 177 spaces, then a CHR\$(144) turns on the Black print mode before printing the title of the program.

```

30 POKE 37154,127

```

This line resets the direction of the 6522 A side Data Direction register which was already set by the system to check the keyboard. The other Data Direction register used by the joystick is already set by the system default. (Note: With this register altered, some keys will now no longer be recognized by the system. See important note to line 90 below.)

```

35 PRINT CHR$(19)

```

This line homes the cursor to the top left of the screen.

```

40 A=(PEEK(37137) AND 28) OR (PEEK(37152)
   AND 128)

```

This line pulls together the two input register values used by the joystick and combines them to make a single value (A).

```

45 A=ABS((A-100)/4)-7

```

This line reduces the joystick value (Variable A) from line 40 to a simple number value between one and thirteen, with some number values (four and eight through ten) not being used. This value is kept in variable A. For each direction of the joystick, Figure #1 provides a visual display of the original value (boxed) and the condensed value placed in variable A by lines 40 and 45.

```

50 ON A GOSUB 100,110,120,,130,140,150,,,160,
   170,180

```

This line directs the program to go to the chosen joystick direction subroutine and then return to the next line of BASIC.

```

55 B=PEEK(37137) AND 32

```

Here the variable B is set to zero if the joystick button is pushed, or set to 32 if it is not being pushed. This PEEK is looking at only the one bit which shows whether the button has been pushed by the player.


```
60 PRINT CHR$(19)
65 PRINT
```

These two lines home the cursor and move it down one line to place it at the right location on the screen to print whether the button is ON or OFF.

```
75 IF B GOTO 85
```

This IF statement only goes to line 85 if the variable B is not zero. In this case, it means the button was not pushed. Otherwise the IF fails and the BASIC program proceeds to the next statement.

```
80 PRINT "ON":GOTO 90
85 PRINT "OFF"
```

These lines print whether the button is ON or OFF depending on the IF statement in line 75.

```
90 POKE 37154,255
```

This line resets the Data Direction register altered in line 30. This internal system register is used to check the keyboard. With this POKE, all the keys are again recognized by the VIC-20. If, in your program, the STOP button is pushed, or for some other reason the program is accidentally stopped, this Data Direction register becomes correctly reset by using the RUN/STOP and RESTORE button combination or by using POKE 37154,255.

```
95 GET A$:IF A$="" GOTO 30
```

This line of BASIC provides a way to end the program by looking at the keyboard input buffer with the GET, and then, if no key has been pushed, the program branches back to line 30 to begin again.

Lines 100 through 180 are the direction indicator subroutines which print the direction indicator at the top of the screen. These are reached from line 50 above.

This BASIC program is written in "portable" code which can be simply typed into the VIC-20. However, for those planning to include the Joystick Connection in their own programs, the routine can be speeded up and condensed to take up less room. A condensed version of the same routine is included in the Meteor Maze game (Program 2). That completes the discussion of the Joystick Connection and how it works.

Now, let's look at the game program "Meteor Maze."

Meteor Maze

Meteor Maze is a fast game using the Joystick Connection routine described above. The object of the game is to move your Scout Ship through the meteor field to the Base Ship at the bottom of the screen as quickly as possible. Two levels of play are available, Novice and Advanced. The difference in levels is

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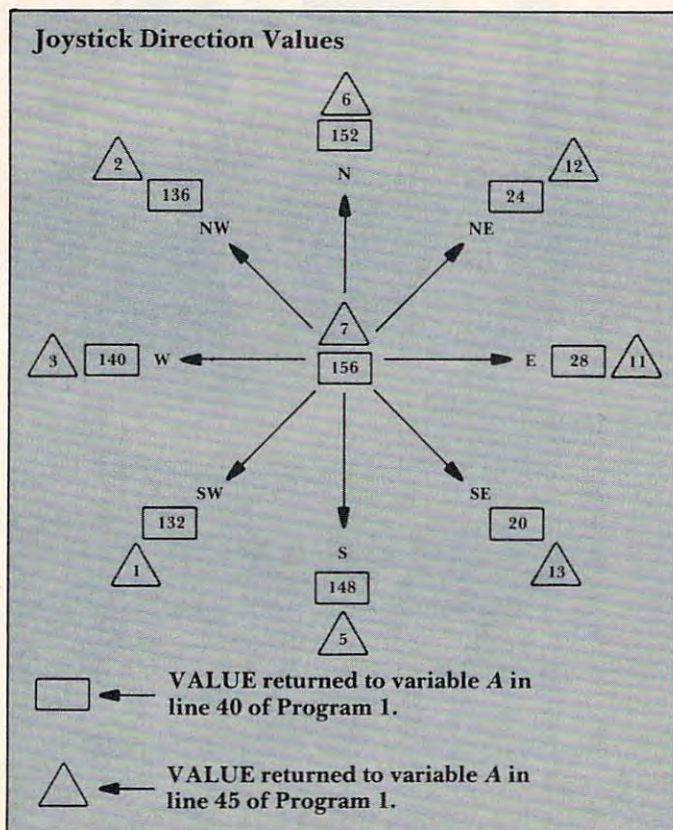
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the computer's tolerance for navigational error. Details of these differences can be displayed by pushing Function Key #1 (F1). Speed is of the essence. The player must learn to manipulate the controls well to be the fastest to reach the Base Ship.

Figure 1.



```

) *12+1,1);:NEXT
8 PRINT"[RED]@LM{PUR}{REV} ELAPSE
  D TIME      {OFF}{RED}NO{0
  7 LEFT}{REV}{PUR}";:POKE81
  85,16:POKE38905,2:TI$="000
  000"
9 A=(PEEK(37137)AND28)OR(PEEK(371
  52)AND128):A=ABS(A-100)/4-
  7:IFA=7THENA=F
10 ONAGOSUB90,91,92,,93,94,,,,95,
  96,97:F=A
11 A=PEEK(37137)AND32:IFATHENPOKEV
  ,0:GOTO27
12 POKEN,255:POKES,220:POKEV,3:IFP
  EEK(C)>6GOTO27
13 IFPEEK(C)GOTO19
14 POKE30720+C,7:POKEC,PEEK(L):POK
  EL,0:L=C:IFC<>8161GOTO27
15 GOSUB99:POKE8161,22:PRINT"{13 L
  LEFT}DOCKING";:POKEV,15
16 FORL=1TO4:FORC=180TO235STEP2:PO
  KES,C:FORA=1TO10:NEXT:NEXT
  :POKES,0
17 FORA=1TO10:NEXT:READA,B:POKE816
  1,A:POKE8162,B:NEXT
18 RESTORE:FORA=1TO208:READB:NEXT:
  K=0:GOTO4
19 ONGGOTO21
20 GOSUB99:POKEC,7:POKEN,255:FORA=
  15TO0STEP-1:POKEV,A:FORB=1
  TO35:NEXT:NEXT:GOTO27
21 GOSUB99:POKEN,220:FORA=16TO1STE
  P-1:POKEV,A:FORB=A*16-1TO(
  A-1)*16STEP-1:POKEV+1,B
23 NEXT:NEXT:POKE36865,132:POKEV+1
  ,59:POKE36869,242:K=K+1:GO
  SUB99
24 PRINT"{CLEAR}{BLK}{OFF}SCOUT"K"
  TO BASE:{DOWN}":PRINT"REQU
  EST"INT(EXP(K))"BOTTLES":P
  RINT"OF SUPER GLUE!
25 FORA=131TO0STEP-1:POKE36865,A:F
  ORB=1TO45:NEXT:NEXT
26 PRINT"{CLEAR}":GOSUB99:POKE3686
  5,25:GOTO4
27 PRINTMID$(TI$,3,2):"MID$(TI$,5
  )"{05 LEFT}";
28 GETA$:IFA$=CHR$(133)GOTO40
29 IFA$<>CHR$(135)GOTO9
35 IFE=0ORPEEK(C)>8GOTO9
36 GOSUB99:POKEN,220:FORA=15TO0STE
  P-1:POKEC,8:POKEV,A:FORB=1
  TO20:NEXT:POKEC,0
37 FORB=1TO20:NEXT:NEXT:GOSUB99:E=
  E-1:GOTO9
40 POKEV+1,127:POKE36869,242:PRINT
  "{CLEAR}{OFF}{RED}      $$$
  $$$$$$"SPC(12)"{REV}SELECT
  
```

Program 2.

```

2 PRINT"METEOR MAZE"SPC(96)"FOR I
  NSTRUCTIONS"SPC(34)"PRESS"
  SPC(40)"F1
3 POKE56,28:POKE52,28:CLR:FORA=71
  68TO7375:READB:POKEA,B:NEX
  T
4 V=36878:N=V-1:S=N-2:POKE37154,1
  27:L=7680:GOSUB97:F=13:IFG
  THENE=3:GOTO6
5 E=99
6 POKE36869,255:POKEV+1,27:PRINT"
  {OFF}{YEL}{CLEAR}V{BLK}";:
  FORA=1TO480:GETA$:IFA$=CHR
  $(133)GOTO40
7 PRINTMID$("@A@B@C@D@E@F",RND(TI
  
```



```

ONE{BLK}{DOWN}
41 A$="  -ABLE TO DESTROY":PRINT"
   F1=NOVICE LEVEL":PRINTA$
42 B$="  -SHIP WILL ":PRINT"      9
   9 METEORS":PRINTB$"SURVIVE
   "SPC(5)"METEOR COLLISIONS{
   DOWN}
43 PRINT" F3=ADVANCE LEVEL":PRINTA
   $SPC(7)"3 METEORS
44 PRINTB$"EXPLODE"SPC(5)"ON IMPAC
   T WITH A"SPC(6)"METEOR{DOW
   DOWN}
45 PRINT" F5=INSTRUCTIONS{DOWN}":P
   RINT" F7=END THE GAME{02 D
   DOWN}":PRINT"* CURRENT LEV
   EL
46 IFGTHENPRINT"{HOME}"SPC(198)"*
   :GOTO48
47 PRINT"{HOME}{03 DOWN}*"
48 POKE37154,255:GETA$:IFA$="GOTO
   48
49 A=ASC(A$)-132:ONABS(A)GOTO51,52
   ,55,80
50 GOTO4
51 G=0:GOTO4
52 G=1:GOTO4
55 POKEV+1,127:PRINT"{BLK}{CLEAR}{

```

```

DOWN}GOAL-MOVE IN FRONT OF
   THE DOCKING BAY AND T
   HE BASE WILL LAND
56 A$=" YOUR SHIP.{DOWN}":PRINTA$
   :PRINT"JOYSTICK WILL POINT
   "A$
57 PRINT"FIRE BUTTON WILL MOVE "A$
58 PRINT"F1 ALLOWS CHANGE OF      G
   AME DIFFICULTY.{DOWN}
59 PRINT"F5 DESTROYS METEORS      T
   HAT ARE IN FRONT      OF"A$

60 PRINT"{02 DOWN}HIT A KEY TO CON
   TINUE
61 GETA$:IFA$="GOTO61
62 GOTO40
80 SYS4096
90 POKEV,24:C=L+21:RETURN
91 POKEV,23:C=L-23:RETURN
92 POKEV,20:C=L-1:RETURN
93 POKEV,18:C=L+22:RETURN
94 POKEV,17:C=L-22:RETURN
95 POKEV,19:C=L+1:RETURN
96 POKEV,21:C=L-21:RETURN
97 POKEV,22:C=L+23:RETURN
99 POKEV,0:POKEV,0:POKEV,0:RETURN
1000 DATA0,0,0,0,0,0,0,0,0,12,62,127

```



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,62,28,0,0,32,120,28,62,60
 ,24,0,0
 1002 DATA24,60,126,124,60,56,28,0,0,
 70,55,114,120,60,28,0,0,0,
 16,88,124,56,28,0
 1004 DATA56,126,60,32,6,15,2,6,10,84
 ,4,161,34,136,133,40,234,5
 6,239,78,98,198,48,96
 1006 DATA0,0,0,0,0,114,127,114,0,0,0
 ,0,0,7,7,7,63,83,143,143,1
 37,174,254,174
 1008 DATA63,83,143,143,137,142,142,1
 42,255,255,255,255,255,72,
 75,72,0,0,0,0,0,0,127,159
 1010 DATA142,137,143,143,83,63,255,6
 3,78,24,255,255,255,255,25
 5,231,8,28,8,8,28,28,28,28

 1012 DATA28,28,28,28,8,8,28,8,0,0,11
 4,127,114,0,0,0,0,0,78,254
 ,78,0,0,0
 1014 DATA0,6,6,24,56,112,32,0,0,32,1
 12,56,24,6,6,0,0,96,96,24,
 28,14,4,0
 1016 DATA0,4,14,28,24,96,96,0,63,83,
 143,143,137,190,190,190
 1018 DATA9,12,10,11,0,25,0,12

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An ATARI Learning Program

Language Lab

Steve Steinberg
Washington, DC

Language Lab is a program to use your ATARI to help you build vocabulary in a foreign language. It is basically a computerized version of that old standby of language education, the flash card set, and I have found it extremely simple and effective to use. It is structured so that you can drill and score yourself on as many words as you like, but I find it most useful if you display a fifteen or twenty word vocabulary drill on the screen, spot the errors and review them, then try again. If you have enough memory, you can also use it to create a fair sized foreign language dictionary.

I have used a handful of French words in the program example but you can easily change this to any language you want. Simply change line 55 `LANG$="FRENCH"` to `LANG$="GERMAN"`, `"SPANISH"`, `"NAVAJO"` or whatever you like and enter the appropriate word pairs in DATA.

The DATA, beginning on line 1000 is easy to expand as your language skill increases and can be used in conjunction with either a self teaching or school language course. Just enter the DATA in word pairs, the first in English, the second in whatever language you are working with.

The key to the vocabulary drills is the random word subroutine, lines 500 through 550. In line 510 `X=(1+INT(RND(1)*25))` the 25 is equal to the number of word pairs entered as DATA. As you increase the number of word pairs by adding new DATA this number should also be appropriately increased. You can also alter this line to drill yourself on only part of your total foreign language vocabulary.

Let's assume, for example, that you have 600 word pairs in DATA but only want to drill yourself on the last 100 words you have entered. In that case, change line 510 to `X=(500+INT(RND(1)*100))`.

Lines 160,180,260,280,330 and 430 use the ATARI cursor advance and line "up" arrow keys to provide a format that will display as much of your language drill or translations on the screen at one time as possible, but you can replace these with just "PRINT" statements if you prefer. This would be useful if you want to use the program for drill and translation of whole phrases and sentences instead of just single words. Don't forget, however, to increase the size of the appropriate string di-

mensions (`ENGLISH$,WORDS$,TRANSLATE$`) in line 50.

One final note; if you happen to own IRIDIS 2 (and if you have an ATARI computer I don't think you can find a better bargain in software) you can easily add the appropriate subroutine to use Language Lab for Russian, Greek, Hebrew or

...basically a computerized version of that old standby of language education, the flash card set.

whatever you wish by adding the foreign alphabet in lower case. I am currently using the program to teach myself Classical Greek. I hope this program will be useful for budding language students and in any case good luck with it, bon chance, and auf wedersehen.

```

0 DIM A$(20),B$(20),C$(20),U$(44),X$(20)
,Y$(1),P(16):GOTO 2000
1 DATA 1,IM____,NOT,NOT
2 DATA 2,MIS____,WRONG,WRONG
3 DATA 3,CON____,WITH,TOGETHER
4 DATA 4,SUB____,UNDER,UNDER
5 DATA 5,SUPER____,OVER,OVER
6 DATA 6,PRE____,BEFORE,BEFORE
7 DATA 7,INTER____,BETWEEN,AMONG
8 DATA 8,TRANS____,ACROSS,ACROSS
9 DATA 9,EX____,OUT OF,FROM
10 DATA 10,EX____,OUT OF,FROM
110 OPEN #1,4,0,"E:"
115 Q=0:M=0:POKE 752,1:?
120 U$=""
      "
125 TRAP 150
130 READ P,A$,B$,C$
140 GOTO 130
150 TOTAL=P
160 X=INT(TOTAL*RND(0))+1)
170 RESTORE X
180 READ P,A$,B$,C$
190 B1=LEN(B$):C1=LEN(C$)+LEN(C$)+4
200 ? "          HOMEWORK PRACTICE"
205 ? "
210 ? :? :? :? :? :POKE 752,0
220 POKE 85,17-LEN(A$)/2:? A$:" ? ";
230 INPUT #1;X$
240 POKE 752,1:? :?

```



```

250 IF X$=B$ OR X$=C$ THEN GOSUB 1000:GO
TO 500
260 ? "WRONG.....TRY AGAIN."
270 M=M+1:Q=Q+1:P(Q)=P:IF Q>15 THEN ? CH
R$(125):GOTO 600
280 ? :? :POKE 752,0
290 POKE 85,17-(LEN(A$)/2):? A$;" ? ";
300 INPUT #1;X$
310 POKE 752,1
320 IF X$=B$ OR X$=C$ THEN GOSUB 1000:GO
TO 500
330 ? :? :? "NOPE.....THE CORRECT A
NSWER IS":? :?
340 IF B$<>C$ THEN POKE 85,19-C1/2: ? B$;
" or ";C$:GOTO 360
350 GOTO 370
360 POKE 85,19-C1/2: ? U$(1,C1):GOTO 500
370 IF B$=C$ THEN POKE 85,19-B1/2: ? B$
380 POKE 85,19-B1/2: ? U$(1,B1)
500 ? :? :? :?
510 ? " PRESS RETURN FOR ANOTHER PROBLE
M":? " OR TYPE L FOR A LIST OF MISTAKES
";
520 INPUT #1;Y$
530 IF Y$<>" " AND Y$<>"L" THEN 510
540 ? CHR$(125)
550 IF Y$="L" THEN 600
560 GOTO 160
600 SETCOLOR 1,12,4:SETCOLOR 2,12,0
610 ? "          LIST OF MISTAKES"
615 ? "
620 IF M<1 THEN 700
630 FOR R=1 TO Q
650 RESTORE P(R)
660 READ P,A$,B$,C$
670 PRINT A$;
680 IF B$=C$ THEN ? ".....";B$
685 IF B$<>C$ THEN ? "....";B$;" or ";C$
690 NEXT R
700 PRINT
710 ? "DO YOU WANT MORE PRACTICE ";:INPU
T Y$
720 IF Y$="Y" THEN FOR R=1 TO 16:P(R)=0:
NEXT R:M=0:Q=0:GRAPHICS 0:POKE 752,1:GOT
O 160
730 ? :? "O.K., GOODBYE FOR NOW."
740 ? :? "IF YOU ADDED NEW PROBLEMS THIS
":? "TIME, BE SURE TO CSAVE THIS PROGRAM
."
750 FOR TIME=1 TO 1400:NEXT TIME
997 GRAPHICS 0:POKE 752,0
998 CLOSE #1
999 END
1000 ? :? :?
1010 FOR FLASH=1 TO 7

```

```

1020 POKE 85,15: ? "CORRECT !";
1030 FOR TIME=1 TO 10:NEXT TIME
1040 POKE 85,15: ? "CORRECT !";
1050 FOR TIME=1 TO 10:NEXT TIME
1060 NEXT FLASH
1070 POKE 85,15: ? "CORRECT !"
1080 RETURN
2000 ? CHR$(125)
2005 POSITION 10,2: ? " HOMEWORK PRACTICE
"
2010 POSITION 8,10: ? "DO YOU WANT TO ENT
ER":POSITION 8,11: ? "NEW HOMEWORK PROBLE
MS ";:INPUT Y$
2015 IF Y$<>"Y" AND Y$<>"N" THEN 2010
2020 IF Y$="N" THEN 110
2030 POKE 752,1: ? CHR$(125):POSITION 3,1
1: ? "PLEASE WAIT WHILE I GET READY....":
FOR TIME=1 TO 250:NEXT TIME
2040 SETCOLOR 1,9,4:POKE 752,0
2050 TRAP 2080
2060 READ P,A$,B$,C$
2070 GOTO 2060
2080 IF P>100 THEN GRAPHICS 0: ? :? "CHEC
K DATA STATEMENTS !!":? :? "LINE 100 IS
HIGHEST ALLOWED FOR DATA.":STOP
2085 FOR ERASE=1 TO P
2090 SOUND 0,4*ERASE*RND(1),12,8
2100 ? CHR$(125)
2110 ? "↓";ERASE
2120 ? :? :? "CONT"
2130 POSITION 0,0
2140 POKE 842,13:STOP
2150 POKE 842,12
2160 NEXT ERASE
2200 SOUND 0,0,0,0: ? CHR$(125):SETCOLOR
1,9,10
2210 ? :? :? "O.K., I'M READY FOR YOUR"
2211 ? "NEW HOMEWORK PROBLEMS."
2220 ? :? :? "IGNORE ";CHR$(34);"STOPPED
AT LINE 2270";CHR$(34);"."
2230 ? :? "....Use this format for enter
ins...."
2240 ? " 24 DATA 24,QUESTION,ANSWER 1,ANS
WER 2"
2250 ? :? "TYPE CONT WHEN YOU HAVE FINIS
HED."
2260 ? :? :? "TYPE IN YOUR NEW PROBLEMS
NOW....": ? CHR$(253)
2270 STOP
2300 ? CHR$(125):POKE 752,1:POSITION 4,1
0: ? "O.K., I'M READY TO TEST YOU ON"
2310 POSITION 4,11: ? "YOUR NEW HOMEWORK
PROBLEMS...."
2320 FOR TIME=1 TO 300:NEXT TIME:POKE 75
2,0
2330 RESTORE :GOTO 110

```


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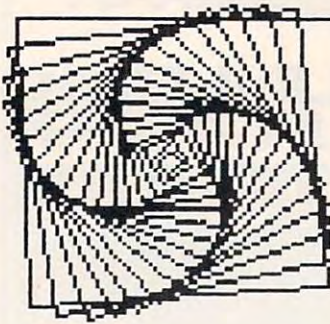
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Friends Of The Turtle

David D. Thornburg
Los Altos, CA

Your letters keep pouring in, and I am writing answers as fast as possible. Many of you have asked about the availability of Apple LOGO. There are rumored to be several versions of this language which either are, or will be, available from several vendors (it is risky writing columns a month or so in advance in a field as active as this one). The version available from Apple is a product of Logo Computer Systems Inc. I have looked at it and like it very much. I also saw two draft manuals – one reference manual and one introductory manual which introduces LOGO through the use of the turtle. Readers with 64K Apples will be most impressed with this language.

COMPUTE! reader Thomas Granvold wrote to tell me that he and his wife use Atari WSFN's turtle graphics to help them in quilt design. His wife selected the pattern resulting from the following procedure for use in a quilt pattern:

HCN8 (R8(R15F))

This procedure draws eight octagons around a common point. These will then be put in a square which circumscribes the octagon to form the basis for the quilt pattern. For those of you who don't understand the alphabet soup of WSFN, the above procedure translates as follows: "Home, Clear, point North, repeat 8 times the task of turning right by 45 degrees and 8 times turning right by 45 degrees and drawing a line 15 units long." In WSFN the R command turns the turtle to the right by 45 degrees and the F command moves the turtle forward by one unit.

Randolph Schleef of the Miami-Dade Community College (11380 NW 27 Ave., Miami, FL 33167) is particularly interested in the use of turtle geometry with disabled users. Any of you who have information concerning applications in this area should contact him directly.

Is This Trip Really Necessary?

This winter I had the opportunity to teach computer programming to children at a local school. Each week I spent one-half hour in each class from second through sixth grade. The principal teaching tool was (of course) the turtle – both in the form of Atari PILOT and the Milton Bradley Big Trak.

During these classes I was delighted to see that children have a pretty accurate intuitive sense when it comes to geometry. One of my favorite geometrical rules is called the Total Trip Theorem. This theorem states that if you send the turtle off to trace out a simple closed path, that by the time the turtle has returned to its original location and orientation it will have turned by exactly 360 degrees.

A few examples should convince you that this is a plausible idea. Suppose we first have the turtle trace out a square. In Apple LOGO, we would type:

```
REPEAT 4 [FORWARD 30 RIGHT 90]
```

to draw a square 30 units on a side.

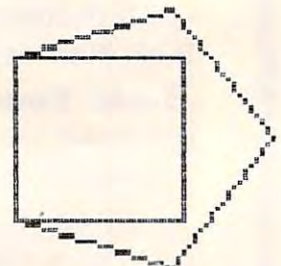


```
REPEAT 4 (FORWARD 30 RIGHT 90)
```

Figure 1.

Notice that in drawing this square, the turtle turned 90 degrees four times, or 360 degrees overall. To draw a pentagonal path with the same length sides, we would type:

```
REPEAT 5 [FORWARD 30 RIGHT 72]
```



```
REPEAT 4 (FORWARD 30 RIGHT 90)
REPEAT 5 (FORWARD 30 RIGHT 72)
```

Figure 2.

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F.G. Newton

Full Graphics Newton. This version of Isaac Newton presents all data in graphic form. Because data is graphic rather than symbolic, this game is suitable for very young children. Players may select difficulty levels challenging to the most skilled adults. **\$49.95**

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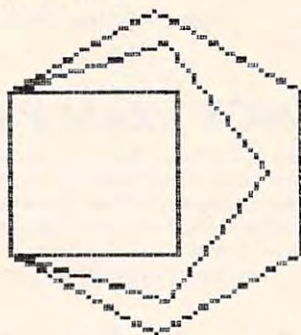
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For this figure, the turtle turned 72 degrees five times, or 360 degrees overall. Finally, let's look at a hexagonal path:

REPEAT 6 [FORWARD 30 RIGHT 60]



```
REPEAT 4 [FORWARD 30 RIGHT 90]
REPEAT 5 [FORWARD 30 RIGHT 72]
REPEAT 6 [FORWARD 30 RIGHT 60]
```

Figure 3.

It should come as no surprise to find that the total amount turned is once again 360 degrees.

Abelson and diSessa cover this topic quite thoroughly in their book *Turtle Geometry*; and, as I said before, grade school children seem to have an intuitive feel for this result.

But if this theorem works well for a turtle walking on a flat surface, how does it work for a turtle walking on another surface – say that of a cube?

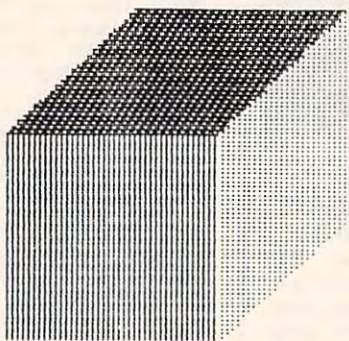


Figure 4.

Suppose the turtle starts off at the center of the front face and is pointing up. We could have the turtle walk forward to the center of the top face, being careful to walk straight over the edge without turning.

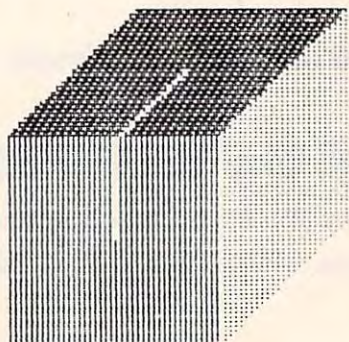


Figure 5.

Next, we can have the turtle turn to the right by 90 degrees and walk in a straight line to the center of the right face.

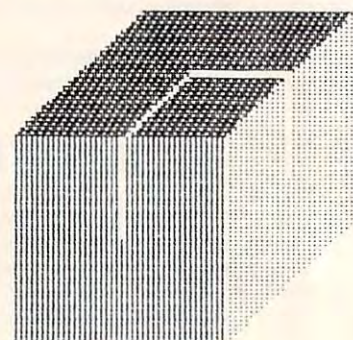


Figure 6.

Once the turtle has arrived there, the turtle once again turns to the right by 90 degrees and walks in a straight line to the center of the front face. When it turns right by 90 degrees, it is then back at its starting location and direction.

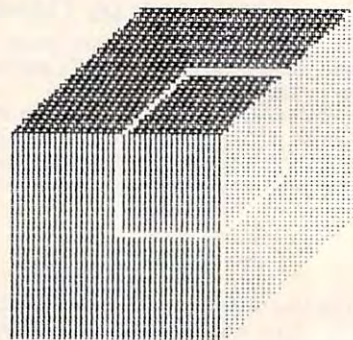


Figure 7.

If you have been keeping up with the number of turns, you have probably noticed that our turtle has made a nice closed path but has only turned 270 degrees. What happened to the missing 90 degrees?

To see what happened, we only need to spread part of the cube out into a flat surface (since we know what turtles do on flat surfaces). If we fold the front and right face up to be on the same surface as the top of the cube we see this picture:

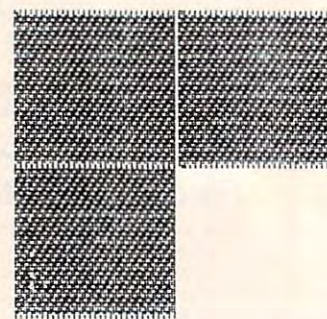


Figure 8.

Now let's have the turtle trace its path once again. Seeing what happens with the first few steps is pretty simple. The turtle moves forward and turns right twice.

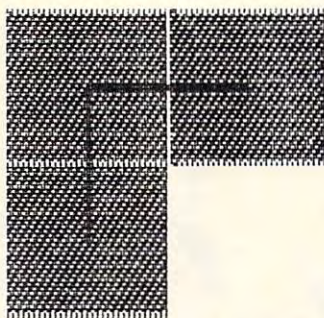


Figure 9.

Next, the turtle has to get back to its starting position. Since the cube was opened flat, the edges of the front and right side which normally touch are now spread apart. As you can see, they are spread

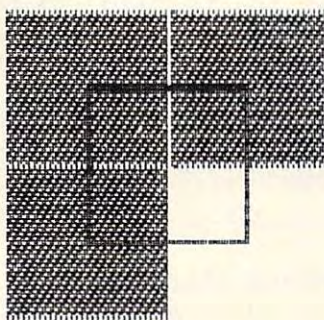


Figure 10.

apart by 90 degrees. So if we want to complete the closed path, we have to turn the turtle the extra 90 degrees to make it connect with its starting point. This shows that, if the turtle isn't walking on a plane surface, the total turning angle for a closed path may not be 360 degrees. If the angle is some other value, then the difference between this value and 360 degrees is the size of the angular "gap" that would be created by spreading the curved surface flat.

I hope you find little excursions like this to be interesting. One of the nice features of turtle geometry is its ability to make some difficult mathematical concepts easy to see.

If you know any other of these types of illustrations (or would like me to find some more of my own) let me know what you have or want, and I will share the results with you all.

Once again, please keep me posted of your activities and interests with turtles so that I can share them with your fellow Friends of the Turtle.

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The World Inside The Computer



Last month **COMPUTE!** welcomed Fred D'Ignazio, whose The World Inside the Computer column will appear each month.

Fred is a computer enthusiast and author of several books on computers for young people. He is presently working on two major projects: he is writing a series of books on how to create graphics-and-sound adventure games. He is also working on a computer mystery-and-adventure series for young people.

As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device.

Down The Rabbit Hole

... this bottle was *not* marked "poison," so Alice ventured to taste it, and, finding it very nice (it had, in fact a sort of mixed flavour of cherry-tart, custard, pine-apple, roast turkey, toffy, and hot buttered toast), she very soon finished it off.

"What a curious feeling!" said Alice, "I must be shutting up like a telescope!"

And so it was indeed: she was now only ten inches high, and her face brightened up at the thought that she was now the right size for going through the little door into that lovely garden.

Lewis Carroll

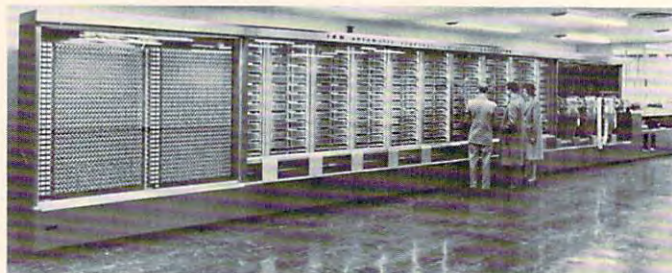
Alice's Adventures in Wonderland

From Pickles to Sugar Wafers

Once upon a time, less than a lifetime ago, computers were very, very large. But they are dwindling fast. Already they are very, very small. Soon they will be even smaller.

The Mark I, the world's first general-purpose digital computer, was built in the early 1940's. The Mark I filled an entire wall inside a red brick physics

building at Harvard. When the Mark I was working, one could go in and listen to its horde of electromechanical relays gently clicking, like a roomful of ladies knitting.



The Harvard Mark I in the early 1940s: The computer 'world' filled an entire wall. Credit: Courtesy of IBM.

Then came the world's first electronic computer, the ENIAC. The ENIAC had 20,000 vacuum tubes – hot, glowing "pickles" that acted as switches and amplifiers inside the computer's brain. Each time you turned the ENIAC on, two of its "pickles" would explode, just from the surge of current.

In 1947, the transistor was invented. Instantly, each logic and memory cell inside the computer shrank to the size of a tootsie roll. Each transistor was individually packaged with three protruding wires, representing input, output, and control voltages.

Even with the advent of the transistor, most computers in the late 1940's and early 1950's were

enormous vacuum-powered "dinosaurs," corralled inside warehouse-sized research laboratories. The Whirlwind computer at MIT, for example, was the granddaddy of the minicomputer. Yet it consumed 150 kilowatts of electricity and filled a two-story building.

In 1959, scientists at Texas Instruments and Fairchild Semiconductor uncovered a trapdoor to smallness. They found a way to flatten a barrel-shaped transistor into a paper-thin "sugar wafer" – the integrated circuit.

The scientists created each circuit – each transistor by photographing its circuits, reducing the photo and "printing" the circuits on a small slice of silicon using a gourmet recipe of chemicals and light.

During the 1960's, scientists found ways to etch transistor circuits into smaller and smaller plots of silicon real estate. As a result, more and more transistors, like sardines in a can, were squeezed into fingernail-sized integrated circuits. By the late 1960's, engineers were able to fit 10,000 logic elements, or "gates," on a sliver of silicon only a quarter of an inch square.

Then, in 1969, a major breakthrough occurred. Ted Hoff and a team of engineers at Intel Corporation built a microprocessor, a tiny computer "brain" on a single chip.



*Computer on a Daisy: The Intel 8748 Microcomputer.
Credit: Courtesy of Intel Corporation.*

During the 1970's, miniaturization proceeded at a rapid pace. By the mid-1970's, whole computers were constructed on chips.

Now it's the early 1980's. Scientists at Bell Labs are fabricating computer brain chips with a million components. In Japan, circuit designers are building

memory chips capable of storing a quarter of a million bits of information. Million-bit memory chips are forecast by the late 1980's or early 1990's.

As these new chips emerge from the labs, they head like homing pigeons to people's houses and alight inside their personal computers. Three-year-olds are now playing with "typewriters" that can outthink million-dollar electronic brains of just a decade ago.

The Candle Flame

Like a telescope shutting up – like Alice in Wonderland – computers are shrinking. The question is, how far can they go? How small can they get?

As Alice got smaller and smaller, she began to worry:

... "for it might end, you know," Alice said to herself, "in my going out altogether, like a candle. I wonder what I should be like then?" And she tried to fancy what the flame of a candle looks like after the candle is blown out, for she could not remember ever having seen such a thing.

New, ultra-miniature computers are created by circuit designers. Circuit designers are like surgeons. Using a scalpel made of light, they etch circuits, like fine incisions, into the flakes and wafers of silicon.

But the silicon surgeons' light-wave scalpel has become a hefty sculptor's chisel. It is too big, too clumsy, and too blunt to slice the tiny circuits required to shrink computers even smaller. As a result, scalpels made of light waves are being replaced by scalpels made of X-rays and scalpels made of electrons. X-rays and electron beams' smaller wavelengths give them a super-thin, razor-sharp cutting edge.

Using these new tools, designers have etched channels in silicon only 100 billionths of a meter wide. A mere two hundred silicon atoms, strung like pearls on a necklace, would bridge one of these tiny trenches.

How small can computers get? How narrow can circuit channels become?

One of the designers' latest scalpels – the X-ray – has a wavelength equal to the diameter of a single atom of silicon. So circuit channels can get even smaller: from 200 atoms wide, to 100, then to 50, 20, then 10.

Alice wondered what a candle flame looked like after the candle was snuffed out. Similarly, what does a circuit "pipe" look like when its surface is only twenty atoms thick, or ten atoms, or only five? Is the surface still solid? Or is it something else?

The world of the super-small computer is stranger than anything Alice ever saw in Wonder-



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land. It is a world where dozens of entire circuits – an entire chip – could be laid like tiles on the surface of a single red blood cell. It is a world where the radioactivity of common objects – of tables, walls, your fingertips – is a threat.

It is a world where electrons leak from transistors, a world of “soft” switches and “fuzzy” memory cells. It is a world where quantum mechanics replaces common-sense cause and effect. At this level, computer circuits’ polished edges become rough and grainy. It is a world of uncertainty and surprise.

Yet the computer may shrink even further.

Scientists at Cornell University, Bell Laboratories, and elsewhere have begun research into “breeding” organic molecules that could be used as memory and logic components inside a future computer. A single protein molecule – say, inside the hemoglobin in a red blood cell – could act as a logic switch or carry a bit of information.

How?

Scientists have observed that organic molecules change their shape slightly in the presence of an electric charge. Thus, an egg-shaped molecule might represent a “1” bit and a golfball-shaped molecule a “0” bit.

How small is this new computer world? Molecular computers would be a thousand times smaller than computers etched with X-ray beams.

Is this the end? Perhaps. Yet if we can have molecular computers, why not atomic computers? If atomic computers, why not computers made from quarks?

The Frozen Baseball

We have descended into the nether world of fundamental particles. Now we need to return to our super large, everyday world. To do that, let's follow Alice's lead. After Alice became small, she found a tiny glass box underneath a table in the rabbit-hole. Inside the box was a very little cake, with the words EAT ME marked in currants. Alice ate the cake, and like a telescope opening up, she quickly grew larger.

Let's eat the cake, too, and grow larger.

As we do, we swiftly leave behind the world of the very small, and we return to an “everyday” world where scientists are starting to design computers out of the microscopic building blocks we have just examined.

What sort of computers are they designing?

The latest “race horse” of the microminiature world is the Josephson Junction, a switching device that achieves incredible speeds since it is super-cooled to a temperature near Absolute Zero (-460 degrees Fahrenheit, or -273 degrees Celsius).

Scientists at the University of California predict

that, in the near future, we will be able to build a Josephson Junction computer. It will come equipped with tiny refrigerators called micro-coolers. It will be only slightly bigger than a baseball. Yet it will fly! Operating on a lightbulb's power, it will process information faster than the largest computer now available.

We won't see a Josephson Junction personal computer for awhile. Yet other types of frozen computers are not tucked away in the far-off future. The Japanese, for example, are spending \$400 million to build a supercomputer for the 1990's. The computer will use Artificial Intelligence techniques built into tiny, frozen circuits and be the first of a new generation of true “thinking machines.”

By 1985, another frozen computer, the Cray-2, will be in operation. Computer genius, Seymour Cray, has submerged entire cards of microminiature circuits in a bathtub filled with a super-cooled liquid. The densely packed circuits never overheat, and the electric pulses move at incredible speeds, six to twelve times faster than one of today's fastest computers, the Cray-1.

Elsewhere, scientists at MIT and Carnegie-Mellon are constructing a radically new computer with the motto: divide and conquer! The computer will consist of a network of hundreds of microprocessor chips that would split up a complex problem into tiny, simpler parts. Each mini-problem would be attacked simultaneously by a separate chip, much the way our brain carves up problems and feeds them to the high-level neurons – the tiny processors inside our brains that solve problems and manage the huge flood of information pouring in from our senses.

These new fishnet computers – dubbed “omni-computers” and “ultracomputers” – may eventually evolve into 3-D computers. That is, today's flat, two-dimensional computer chips and wafers will be replaced by computer cubes, boxes, and baseballs. In a 3-D computer, information will no longer enter single-file in snakelike strings. Instead it will be shovelled in in great gobs. Likewise, it won't be processed sequentially or emerge sequentially. Instead, it will emerge as two-dimensional “slices” of the cube – as gigantic “burps” of trillions of bits.

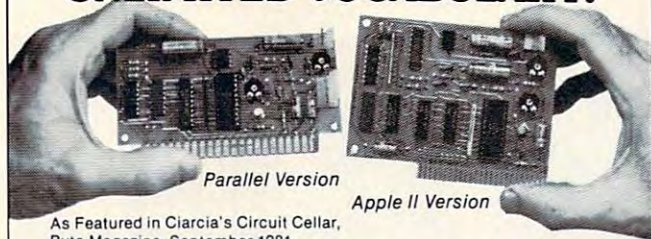
Street Map of the US

According to one expert, by 1990, circuit designers will be able to fabricate a computer chip with a level of detail equal to a street map of the entire United States.

And therein is the metaphor, the focal point of this column: the street map, the city, the world inside the computer.

Take a photo of a chip and blow it up large,

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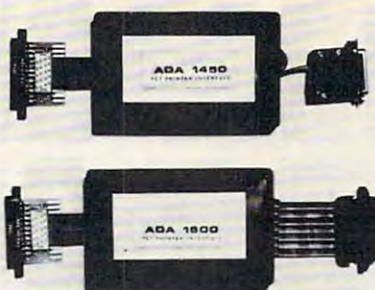
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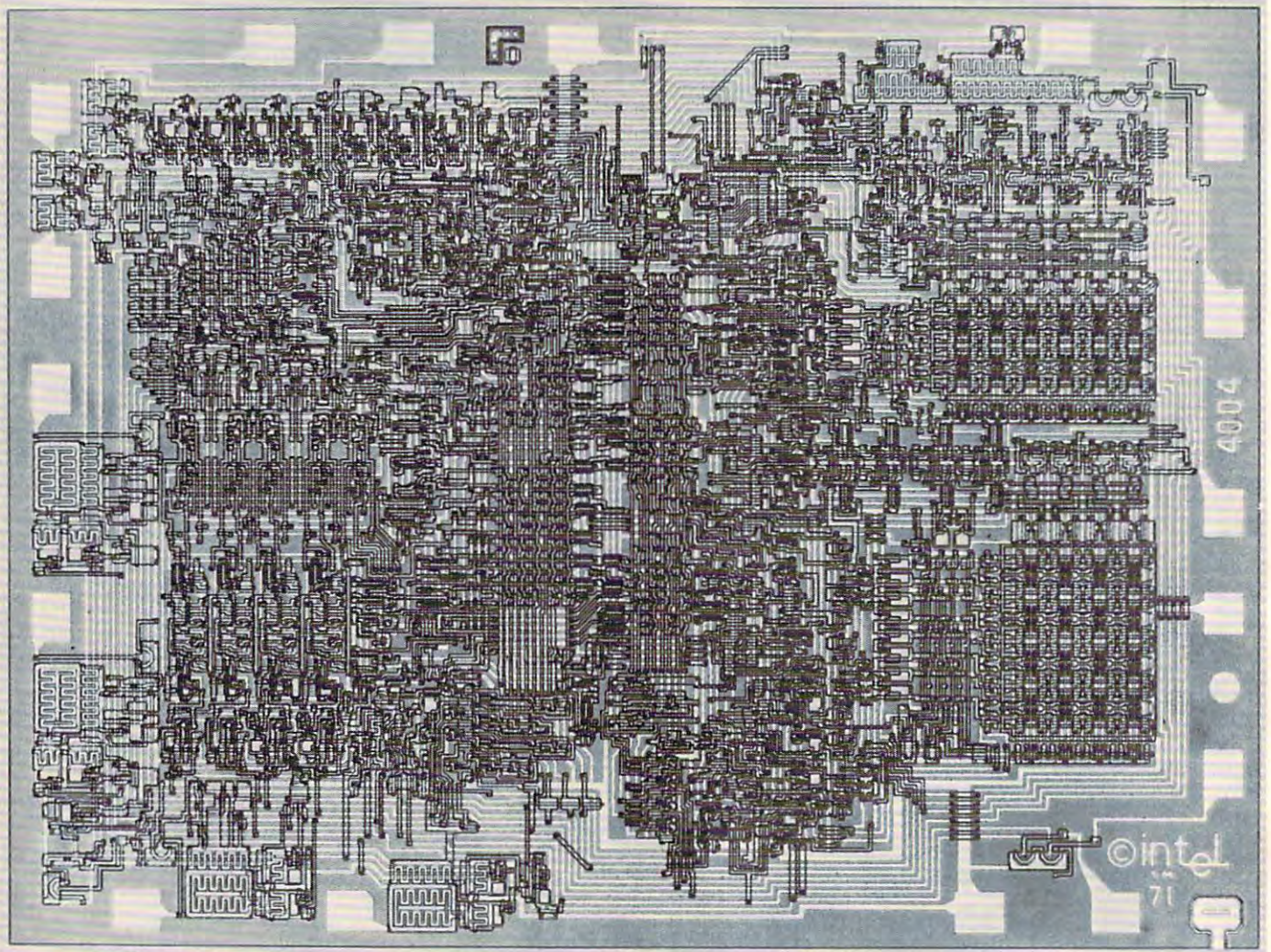
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The Intel 4004: The First Microprocessor on a Chip. Credit: Courtesy of Intel Corporation.

really large. What do you see?

I'll tell you what *I* see. I see a tiny world. I feel like Jules Verne floating in a hot-air balloon over Manhattan. I have a bird's-eye view of entire city blocks, of monuments, trees, elliptical promenades. I see parks, cathedrals, railroad tracks, warehouses, and bus stops. I see more than a city. I see an entire world.

Until recently, these tiny, chip-sized worlds – these Oz-like “Emerald Cities” – were nearly all alike. They were all optical echoes of some master image created by computer designers cloistered in some futuristic semiconductor laboratory.

Microscopic trenches and overpasses formed tiny transistors. The transistors were grouped into logic *gates* to help the computer make decisions and process information, or into memory cells, such as capacitors, where information, a bit at a time, could be safely filed away. The gates and memory cells, in turn, formed orderly ranks, like soldiers on parade. En masse, they became a computer's ALU (Arithmetic-Logic Unit), CPU (Central

Processing Unit), or its RAM (Random Access Memory) or ROM (Read Only Memory).

Through The Electronic Looking Glass

A couple years ago, I wrote a picturebook, called *Katie and the Computer* (Creative Computing Press, 1979). The story is about a little girl named Katie. Katie is a modern Alice – an “Alice in Computerland.”

In the story, Katie's father brought home a personal computer. Katie climbed atop a tall stool. She began typing the word *FLOWER* on the keyboard to get a program to display a bright yellow daffodil on the picture screen. As she searched for the letter *R*, she leaned too far forward, lost her balance, and toppled into the picture screen:

But instead of bumping her nose on the glass, she went right through it and began spinning and falling, just as if she'd tumbled off the top of a tall mountain.

Inside the computer it was snowing. As

Katie fell, a snowflake as big as a house fluttered past her. "Wow!" she thought. "I'm really getting tiny!"

Katie landed in a feathery bank of snow. Up rushed a "Colonel," who represented the computer's control program, or operating system. The Colonel took Katie on a tour of Cybernia, the world inside the computer, and showed Katie how the computer processed her program and "painted a flower" on the picture screen.

Katie visited all the major tourist spots in the world of the silicon chip. ROM was the chilly, mountainous region where the Colonel lived. The CPU was a huge, bustling train station. RAM was a huge hotel, so tall it "reached into the clouds." There was even a bug – a ferocious robot spider that loved to gobble yellow airplanes.

The point is, the world Katie visited was a familiar world, repeated inside of billions of computer chips. Cybernia's major landmarks – RAM, ROM, the CPU – were duplicated endlessly. If you had, like Katie, visited one world inside a chip, you had seen them all.

Yet this is no longer true.

Scientists can squeeze so many circuits on a chip, why stick just to the traditional landmarks like the CPU, or ROM, or RAM?

Consequently, radically new chips are being designed. The new chips create whole new silicon cities and worlds. There are now chips with rings of processors, circling around a control processor like planets around the sun. There are chips with dozens, hundreds of tiny CPU-RAM pairs. There are chips with entirely new kinds of processors and memories.

In 1981, only a fifth of the \$12 billion in chips sold were custom-made and non-standard. Now experts predict that by 1985, more than half of all chips will be custom-made.

Using *gate arrays* and other new building blocks, silicon building contractors will erect entire new cities, entire new systems, all on a plot of matter only a quarter of an inch square.

These new cities will be just as complex, just as diverse as human cities, from Anchorage to Rawalpindi, from Rio de Janeiro to Baghdad, from Melbourne to Novosibirsk.

The Neighborhoods and Boroughs of Silicon City

Many of the new chips will be special purpose "engines," each an expert or specialist at some task.

The chips will perform a myriad of functions, but, the essence of their job will be to reproduce – to mimic – a real-world event or process. The chips will become increasingly good at creating miniature electronic copies of our regular, natural world and everything in it.

Music-engine chips will make music. Machine-vision chips will "see." Speech-understanding chips will "hear." Graphics chips will produce dazzling pictures and animated cartoons and games. Speech-synthesis chips will talk like people. Expert-system chips will advise scientists and help doctors perform diagnoses.

Meanwhile the circuits inside the chips will continue to shrink. The time is not far off when the many specialist chips will shrink and become specialist "neighborhoods," coexisting inside a single "metropolis" chip.

Imagine a chip with neighborhoods and districts, just like in New York City. Each neighborhood would consist of a maze of microminiature circuits – specialists in music, machine vision, or in brute, high-speed computation.

Each neighborhood in a chip "metropolis" would have its own specialty. Like a real-world neighborhood, it would also have its own flavor, its own personality, its own reality.

A number of highly respected computer scientists believe that what they are all working toward is not AI, but "AL" – *Artificial Life*. Machine vision, machine touch, machine speech, machine mobility, machine intelligence will eventually merge and become machine life. Human beings will act as midwives to help give birth to a new species.

This development is probably many, many years away. It may have to wait until computer circuits shrink to the size of molecules, or until the electronic computer is replaced by new, light-based *optical* computers.

The reality of life on a chip, of entire, living cities existing on a chip is still sometime in the far future. But, in the meantime, the *illusion* of life on a chip is growing, as scientists are able to fit more and more complex structures onto tinier and tinier motes of matter.

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The Architects of the Micro World. And what does all this have to do with personal computers and our children? ©

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This program, for VIC with the usual 5K of memory, demonstrates an extraordinary method of getting numbers from the user. You can enter expressions like $3 + 2$ as well as the simple number five.

Amortize

Amihai Glazer
Assistant Professor Of Economics
University Of California, Irvine

You're planning to buy a new house. Or perhaps a new car. But money is short and you must take out a loan. What is the monthly payment on the loan? What is the total interest charge? How much interest can you deduct from your income tax in the first year? Answers to these and other questions are provided by the program Amortize. As an added bonus, the program incorporates some techniques which you may want to use in your own programs.

Key in the program. On line 63993, simultaneously press the SHIFT key and the letter "O" key; this is an abbreviation for GOTO. On line 63992 the PRINT statement consists of a quote mark, a blank space, pressing the CTRL and the "2" keys simultaneously, and finally a quote mark. On line 63996 to enter the PRINT statement type a quote mark, then press the CTRL and the "7" keys simultaneously, then press the space bar seven times, and then close with a quote.

Once the program is in memory, type RUN and you will be prompted for the input. Notice that you can type as input not only numbers, but expressions as well. For example, suppose we let the loan be for ten years, so that for the number of months we enter $10 * 12$; we let the interest rate be $13 + 3/8$, and the amount of the loan (the principal) is 50000. Your friendly VIC20 will respond by showing that the monthly payment on the loan (PMT) is \$757.65. You will then learn that after your third payment (MONTH = 3) you still owe \$49392.20, you will have paid a total of \$1665.15 interest over these three months, and that \$552.80 out of your third payment went to pay interest.

Look at the results for the last month, month 120. You will find that the total interest paid on the loan is \$40918.87. (Yes, that sure is a lot of interest). Don't let the small amount of principal remaining, 87¢, bother you; such inaccuracies are inevitable when you can't make monthly payments including

a fraction of a cent. One final caveat: some consumer lenders use the Rule of 78s to determine the reduction in principal each month. Therefore, the results the program gives you for any but the last month may be slightly different from what the bank may tell you. But the program will still give you the correct value for the monthly payment, and the correct value for the total interest charge.

The INPUT Technique

That's it for you folks who want to use the program without worrying about how it works. As mentioned, the user's input can be in the form of an expression, not merely a number (which is what the INPUT statement allows). Here's how this is done. Suppose we want to get a value for variable N. In statement 50, the computer printed out the characters "N = ". The user types in any expression, say $10 * 12$. Lines 63990 and 63991 accept the characters for this expression and print it out. The screen will now show $N = 10 * 12$. (The pokes into locations 204 and 207 allow the cursor to be shown when the GET is invoked.) We then switch (in statement 63992) to printing in white so that the user will not be confused by the tricks we are about to play.

In statement 63993 the computer prints G 63996. In statements 63994 and 63995 we POKE (into the keyboard buffer) instructions to go up to the screen line which says $N = 10 * 12$, to execute that line, to go to the screen line which says G 63996, and to execute that line. These instructions are executed when the END in statement 63995 is encountered. (For further details on this technique, see the fine article by Jim Wilcox, "Automatic Line Numbers" in the Premiere issue of *Home and Educational COMPUTING!*)

Having executed the instruction on the screen to GOTO 63996, the computer is now executing that statement. The computer switches back to printing in blue, erases from the screen all the garbage which it had printed in its machinations, and returns to the calling program.

The subroutine which starts in statement 63990 can be used in any program you wish. The calling sequence is exactly as shown in statement 50.

There is another useful technique in lines 132-136. These instructions allow the user to stop execution by pressing any key, and to continue execution by pressing that or any other key; the instructions transform the keyboard into a toggle switch. The logic is simple: if no key is pressed when line 132 is encountered, the program does not stop. If any key is pressed, the program waits until all keys are released, and then waits until a key is pressed. Execution then continues.