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FOR THE BEGINNING BEGINNER

ANOTHER GOOD IDEA BOOK FROM ENRICH
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ATARI
FOR THE BEGINNING BEGINNER

An easy and helpful introduction to computers and programming

Judy Chamberlain
Tom Chamberlain

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The authors collected information and experiences for this book from their inservice activities with children and adults. Tom has worked with the Computer Tutors in Palo Alto. Judy teaches computer awareness and literacy courses to teachers, parents, and students in Cupertino. Both have been presenters at computer conferences throughout California.

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INTRODUCTION

Welcome to the beginning beginners' computer book! It is all about the fascinating world of the ATARI Home Computer—a tough machine that works very quickly at the tasks you give it to do.

Even though this book was written for the ATARI 400/800, all of the programs may be used with the new ATARI 1200XL.

Since you are probably a novice, like most, you will need to start at the absolute beginning. This book does just that, starts at the beginning.

Don't be afraid to experiment with the computer; it won't yell at you. Computer programmers have developed an easy method for communicating with the computer. This book will help you learn this method. You will be in complete control and make the computer do amazing things.

This book will not make you an "expert", but it will give you enough information about computers to make you "computer literate". This means that the next time a group of people start talking about computers, YOU will be able to join in.

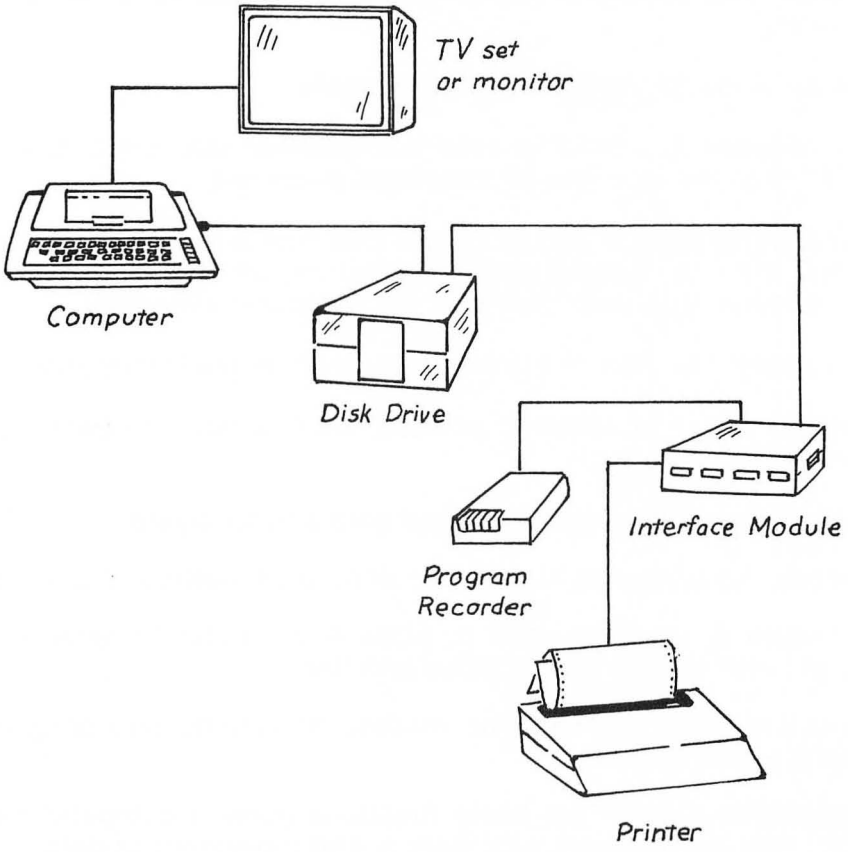
This book also gives you enough "hands on" experiences so that you are able to write and run your own programs. With this knowledge, we know that you will want to go on and learn more about the world of ATARI Home Computers.

Remember—Don't be afraid to experiment. You can't hurt the computer by pressing the keys. This book is meant to guide you as you discover what this computer can really do. Each new step will be given with easy to follow directions. Your effort and curiosity will pay rich rewards. Prop this book up by your computer and let's get started.

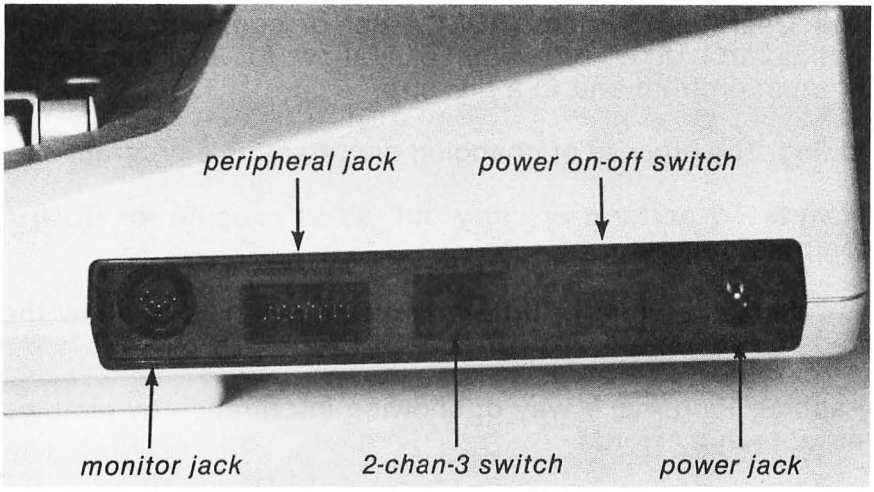
STARTING OUT

Checking Out The Equipment

The ATARI Home Computer operator's manual will show you how to unpack and hook up the various parts of your computer system. Read and follow these instructions carefully. The diagram below shows how a basic setup should look when all the wires are properly connected. Don't be concerned! It's easy!



Remember—if you are using your TV set as a monitor, you must turn the TV controls to channel 2 or 3. Choose the channel that you will not be using for TV viewing. (Whichever has the poorer picture). Now set the "2-CHAN-3" switch on the right hand edge of the computer to the same channel. See the location of the switch in the photo below.



Now, that wasn't hard was it? You may have noticed that across the front edge of the computer there are 4 additional

sockets. Did you purchase *paddles* or *joy sticks* with your computer? Joy sticks or paddles are used to play some of the

ATARI Computer games and are connected to the computer using these additional sockets.

To avoid damaging the computer, it is important that the computer must be the *last* of the various pieces of equipment *to be turned on* and the *first to be turned off.*

After you have done this a few times it will become second nature to you.

Starting Up

First turn on the monitor or TV set. The screen should appear white with perhaps some snow. The sound control need not be turned on. However, you will learn to use the sound system later in Chapter 4 and discover that the ATARI Computer produces very interesting and useful sounds.

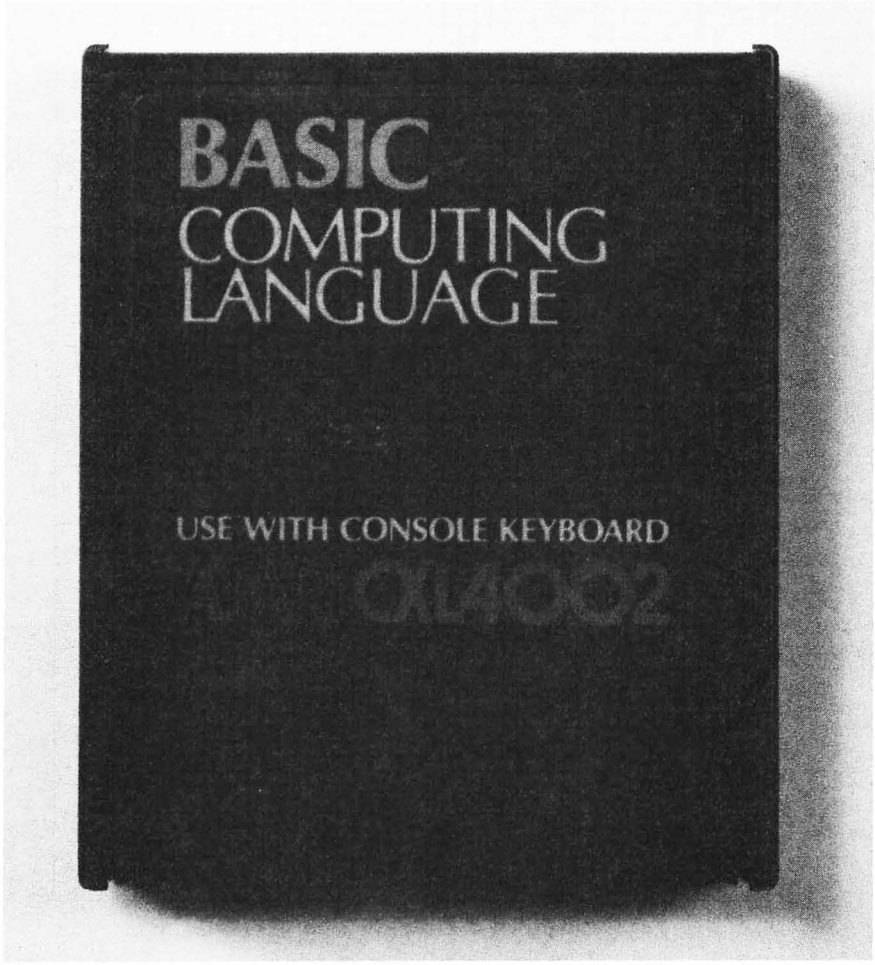
The computer unit actually has two ON-OFF switches. The main switch is located on the right hand edge of the computer toward the rear of the machine. (See diagram above.) Push this main power switch to ON.

The second switch is built into the cartridge door of the machine. This switch is designed to prevent damage to the computer or program cartridge when the door is opened. This door is located directly behind the keyboard.

Open the cartridge door by gently pulling forward on the door catch in the middle. The door catch is labeled PULL-OPEN. The door will now spring up showing the cartridge slots. The ATARI 400 Home Computer has a single slot while the ATARI 800 Home Computer has two—a left and a right slot. At the present time only the left slot is used, the right is reserved for future up-grading of the system. Future improvements will still fit your present day machine saving you the need to buy a later model!

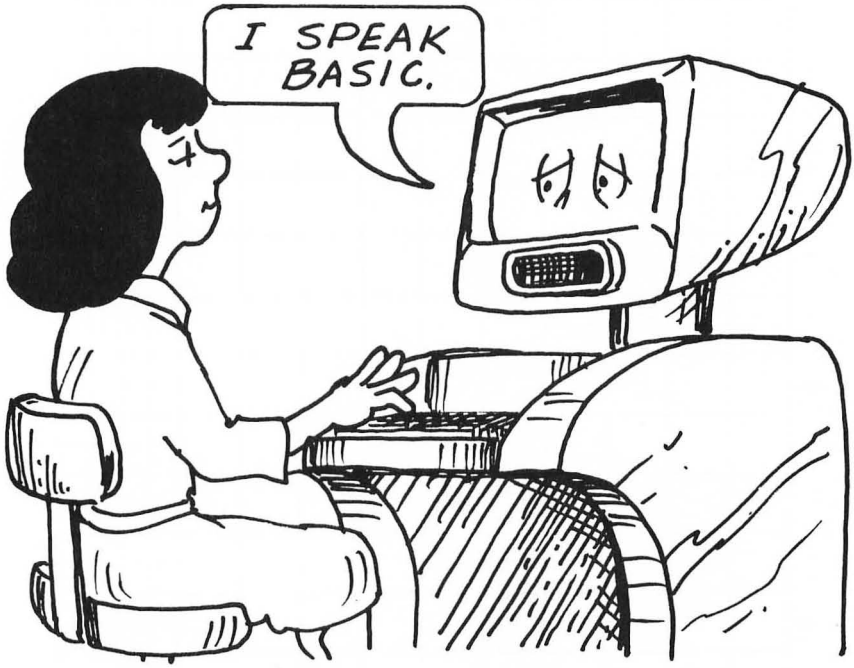
What Are Cartridges?

Cartridges are small plastic boxes that contain instructions for your computer. The cartridge is designed to plug into the computer adding to its memory and allowing the computer to perform special tasks. Cartridges may adapt the computer to play a game, teach a lesson, solve an accounting problem or speak and understand commands given in different computer languages.



BASIC

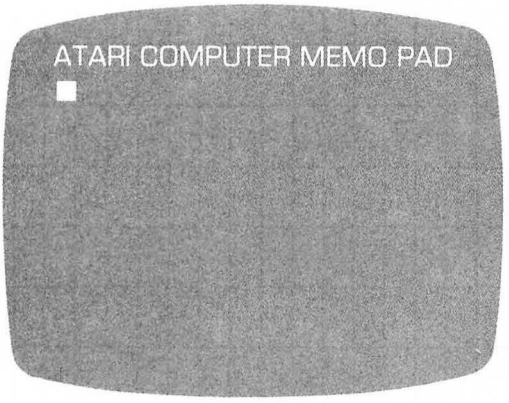
The computer doesn't speak English. But don't worry. Most of the languages it uses to communicate are very simple and easy to learn with a little instruction and practice. The most common language used by computers is called BASIC. You have an ATARI BASIC Computing Language cartridge. BASIC stands for (hold on to your hat) *B*eginner's *A*ll-purpose *S*ymbolic *I*nstruction *C*ode, but is nearly always referred to by the short title, BASIC. Thank heaven for little favors!



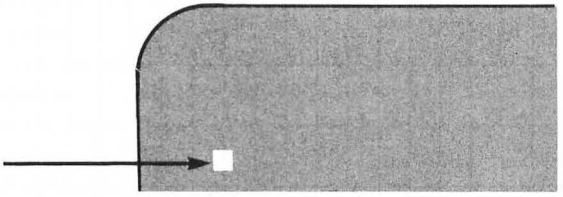
We will begin our explorations without a language cartridge in place. If the BASIC Language Cartridge, furnished with your computer, has already been plugged into the left cartridge socket, remove it by lifting it straight up. Now close the cartridge door firmly. The ATARI Computer will automatically turn on as indicated by the power indicator light glowing red in the lower right hand corner of the keyboard.

Memo Pad Mode

The monitor screen will show that the ATARI Computer is in the Memo Pad mode. It should look like this:



Do You See The Little White Square?



The screen now reads, ATARI COMPUTER MEMO PAD, and there is a little white square under the words. This little square is called a *cursor* and shows where the next mark will be recorded on the screen. As one key is pressed, that symbol is printed on the screen and the cursor moves one space to the right. If you should run out of space on a line of typing, or if you press the RETURN key, the cursor moves to the far left and down one line. Anytime you would like to clear words or pictures off the screen,hold down the SHIFT key (either one) and press the CLEAR < key.

Like a Typewriter

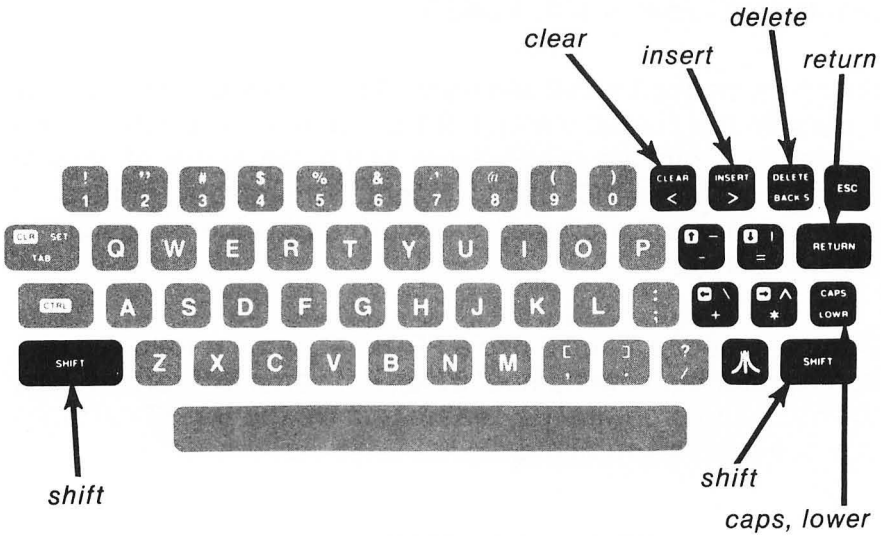
The computer is now in Memo-Pad mode. That means that it is only able to work in the same manner as an ordinary typewriter. All the keys will work, and the screen will show you what you have typed. You will be able to make corrections and changes, but without the BASIC cartridge, the ATARI Computer will not understand any commands. It will only act as a simple typewriter—recording on the screen what you type on the keyboard.

Because of its limited use, this mode is seldom used. It does offer us a chance to try out the computer keyboard without worrying about commands, special functions, etc.

You could also use this mode to leave a note for someone.

The Keyboard

You will notice that the keyboard of the ATARI Computer looks much like any modern typewriter. The letter keys are located in the same place although there are extra keys you normally don't see on a typewriter. The computer will automatically set itself to type all capital letters when you turn it on.



Clear the screen by holding down the SHIFT key and pressing the CLEAR key; then type this:

IT IS A FAR, FAR BETTER THING THAT I DO

Is the display in all capital letters? Perhaps you discovered that if you held any key down too long, the letter repeated over and over. Did any of your letters repeat? Try this by choosing any key and holding it down.

Now press the RETURN key. What happened?

The RETURN key works like the typewriter's carriage return lever, moving the cursor back to the beginning of the next line. It also gives the computer a special command to record the line you have just typed into its memory. In this mode,without having a language cartridge installed in the cartridge slot, the computer is not able to understand this command and does nothing except move you to the beginning of the next line.

Locate the CAPS LOWER key in the lower right portion of the keyboard. Press it once, and retype your sentence.

The sentence should now show on the display in all lower case letters. To get back to upper case letters again you must press SHIFT and while holding it down, again press CAPS LOWER. This key acts like a lock—holding the keyboard in upper case. This will only work for the letter keys. The special symbols over the numbers, punctuation marks, and other non-alphabet symbols can only be typed while holding down the SHIFT key with one finger and pressing the desired key with another. Type this:

1 2 3 4 5 6 7 8 9 Ø RETURN

Now hold the SHIFT key down and repeat the line—1234567890. Your display should now read:

! " # $ % & ' @ ( )

No, the ATARI Computer is not swearing at you!

The SHIFT key caused the computer to print the symbols above the numbers. These symbols can be very handy. For example:

OUCH!

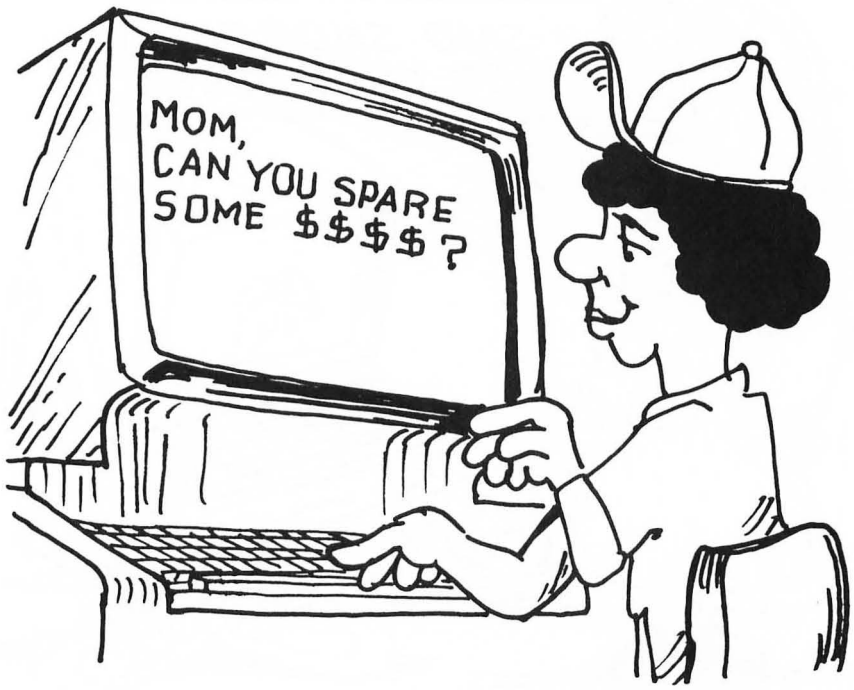
or

MOM, CAN YOU SPARE SOME $$$$?

or

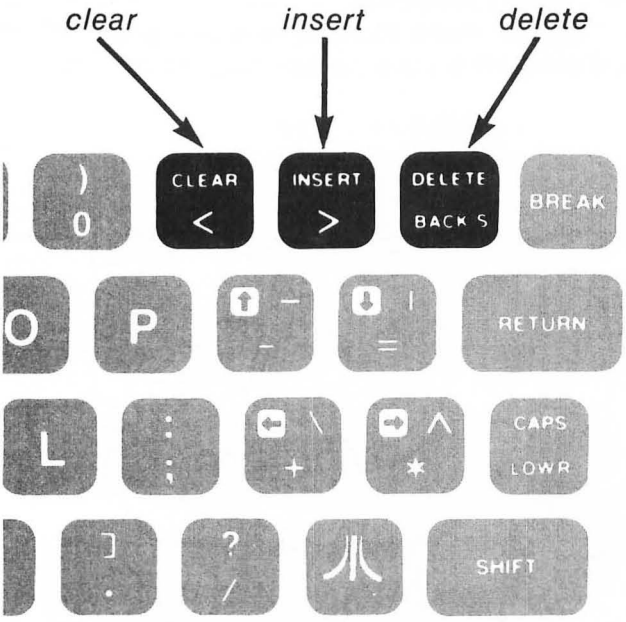
! " # $ % & ' @ ( )

(if you go in for swearing).



Some Special Keys

In the upper right hand corner of the keyboard there are some special keys.



These keys do special things. Let's try some of them. Press the keys marked CLEAR < and INSERT >.

The screen should now show a < and a >. Is that what you expected?

"Erase" the screen (except for the cursor) as you did before. Hold down the SHIFT key and press CLEAR <.

Type the following sentence, but do not press [RETURN] at the end of the line. Type the entire following sentence on one line if you can.

NOW IS THE TIME FOR THE COMPUTER TO COME TO THE AID OF ALL GOOD MEN.

Notice that the computer automatically started a second line when it ran out of space on the first line. A normal line of typing on the ATARI Computer has space for 38 letters or symbols. After 38 have been typed on a line, the computer simply moves down one space and continues on the next line. The end of the first line, however, is not always at a convenient place. You may have noticed that the word COME is split in half with the "CO" showing at the end of the first line and the "ME" starting the second line.

Type the sentence again, but this time press [RETURN] after "...THE COMPUTER TO", and the cursor will move to the beginning of the next line, and the word COME will not be cut in two.

Now find the [CTRL] key and hold down while you press the  key.

What happens? Did you notice that the cursor moves down in the direction that the arrow is printed on the key? Try it again only this time hold the arrow key down.

The cursor should have moved down several spaces. Did it?

Now while still holding down on the [CTRL] key press the  key.

Is that what you expected to happen? The  and the 

keys will move the cursor to the left or to the right in the same way. Try each of these "arrow" keys again and practice moving the cursor around to different places on the screen. You will even be able to move it over lines that you have already typed without bothering them in any way. This won't be true if you hold the SHIFT key instead of the CTRL key.

(Yes, you would get the symbols on the upper right of the arrow keys.) If you press the arrow key alone, you will get the math symbols shown.

Remember, the cursor tells you where the next bit of information to be typed on the screen will be located. Give it a try. Practice moving the cursor around the screen, but don't get lost.

Welcome back. Now let's try some other special keys. This time type a row of A's by holding down on the A key.

AAAAAAAAAAAAAAAAAAAAAAAAAA

When you have finished, press the DELETE BACK S key.

Did you see what happened? Hold the key down for a few seconds. See! As it backs up, it also erases as it goes. No correction fluid or erasers needed!

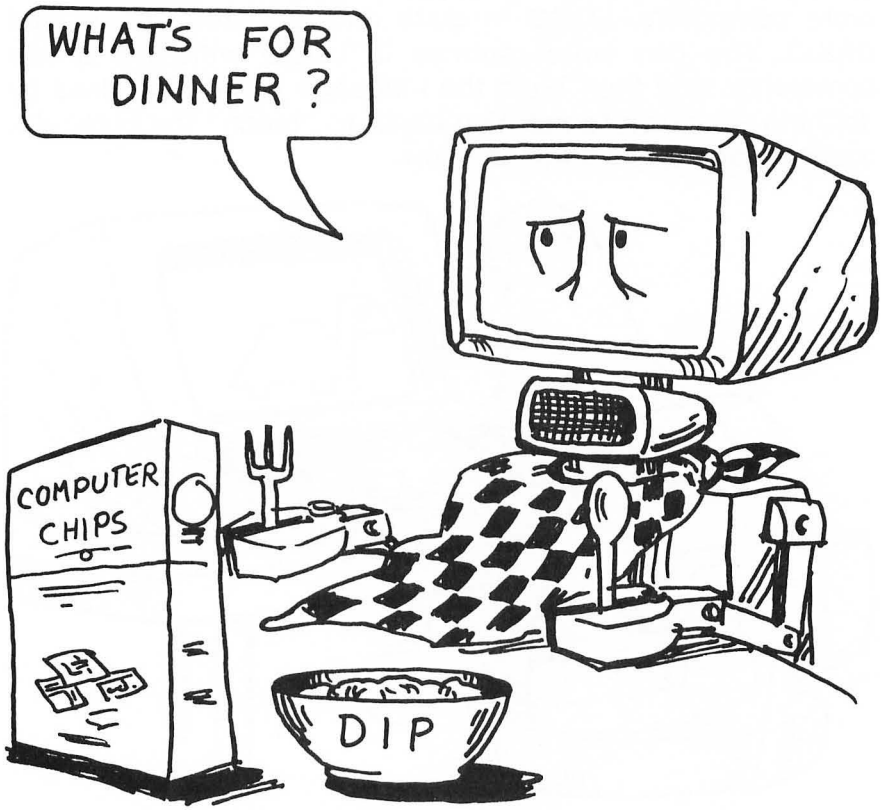
It's nice and easy to use the arrow keys and the DELETE BACK S key to locate, erase, and correct errors in your typing.

Fixing an "Oops"

Now let's be honest, we all make mistakes in our typing. Correcting these typing errors is called EDITING. Let's try a

little simple editing. The ATARI Computer makes this quite easy. Type this:

WHAT7S FOZ DINNER?



We could, of course, correct our spelling errors by just holding down the DELETE BACK S key until the cursor has moved back to the first mistake. This would, of course, erase everything as it goes, and after changing the (7) to an apostrophe ('), you would then have to re-type the erased part of the line correcting the 2nd mistake as you went.

Let's try it a simpler way. Use the [CTRL] key and the "arrow" keys to move the cursor until it is directly over the 7 in the first word. Now hold down the [SHIFT] key and press the [' 7] key. This should put an (') in place of the 7. Now again using the "arrows", move the cursor until it is directly over the "Z" in the next word. Now press the [R] key and [RETURN].

The question should be correct now. One might ask, "What is the answer?" but let's not get side tracked. This system is much simpler and faster especially if the mistake is at the beginning of the line or somewhere well up on the page.

Try it again. Type:

I'D RATHER BE WISHING!

Do you see the mistake? Move your cursor over the W in WISHING, and press the [F] key and [RETURN].

Of course, *you* would rather be using the ATARI Home Computer.

Making Space Where There Is No Space

Suppose that a letter had been accidentally left out and there is no room for it? Type this:

THERE IS NO BUSIESS LIKE SHO BUSINESS

Two letters have been omitted and there is no space for them. OK, let's make some space.

Again use the [CTRL] key and arrows to move the cursor to the place where the missing letter should have been printed. This would be over the "E" in BUSIESS. Only one letter was omitted, so only one extra space is needed. Hold down the [CTRL] key and press the [INSERT >] key *once.* Everything to the right of the cursor should move one space to the right leaving a space for the missing letter. Press the [N] key. Now move to the space beween SHO and BUSINESS. Press [CTRL] and [INSERT >] AGAIN. Now type in the missing "W" and [RETURN].

If the entire line moved down one space instead, you were holding down the [SHIFT] key instead of the [CTRL] key. This is done when you need to insert a whole line. Try adding some letters to a sentence of your own. Practice makes perfect.

The  Key

Have you been wondering about that interesting key in the bottom row with the ATARI trade mark symbol on it? This key does some interesting things. Let's see how it works. Press the

 key *once* and then type:

HELLO ATARI

Ooooh! Pretty nifty, huh!

Until this key is pressed again, everything you type will be printed with the color of the background and the letters reversed. This is very handy when printing titles, subject headings, or when you want some word or letter to stand out from the others. Type this:

JOHN, WOULD YOU TAKE OUT THE GARBAGE?

Now type:

JOHN,  PLEASE  TAKE OUT THE GARBAGE!

The second statement is sure to get better results!

Talk, Talk, Talk

It is time to start talking to the computer and getting it to answer some commands instead of just copying what you type on the keyboard. For the ATARI Computer to understand commands and use its memory, you must insert a language

cartridge. Follow these steps to insert the cartridge labeled BASIC Computing Language in the cartridge slot.

1. Open the cartridge door.
2. Insert the cartridge with the label facing you. (Remember in the ATARI 800 Computer, use the left hand slot.)
3. Press firmly until you feel it click into place.
4. Close the door firmly.

Did you notice that the computer shut itself off when the cartridge door opened? Did it come on again after you closed the door? Good! Now your screen is clear except for the word READY and the cursor in the upper left hand corner.

```
READY
■
```

OK,ATARI Home Computer, we're ready too! Type this:

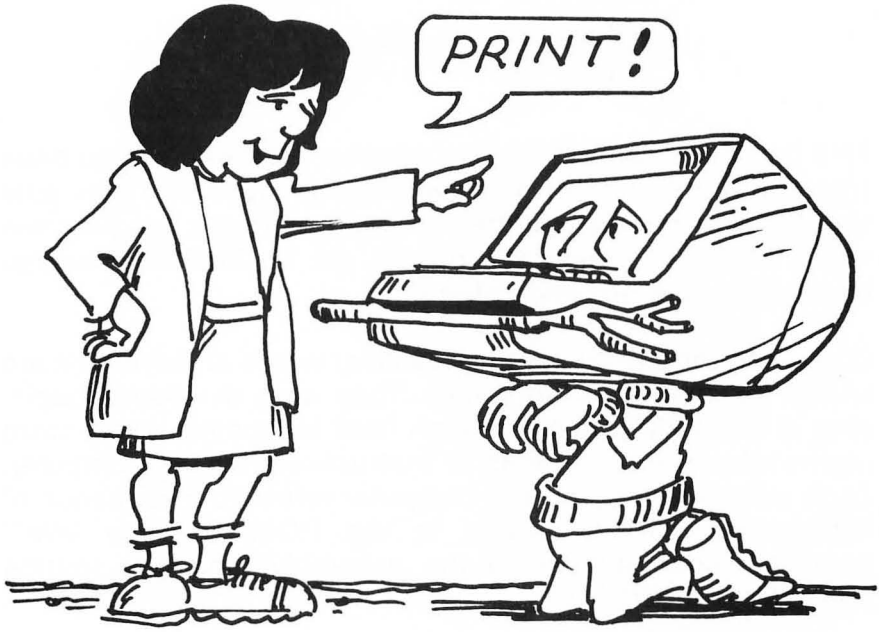
HELLO ATARI HOME COMPUTER, I AM YOUR MASTER.

Press the RETURN key. Whoops! Did your computer object? Did you get this ERROR message?

ERROR—HELLO ATARI HOME COMPUTER, I AM YOUR MASTER.

The ATARI Computer does not object to you as master. It is just trying to tell you that it does not speak English. In order to give orders to the ATARI Computer you must speak in a language it understands. When you put in the BASIC cartridge, you gave the computer the ability to speak *that* language. Just as you use a few simple command words such as COME, SIT, or STAY to train a dog, you must now learn a few simple command words in BASIC to talk to the computer.

The first command is PRINT.



Let's try speaking to the ATARI Computer in BASIC. Type this:

```
PRINT "HELLO ATARI HOME COMPUTER, I AM YOUR MASTER."
```

Be sure that you put quotation marks after the word PRINT and at the end of your statement. Otherwise you will get another ERROR message.

Now press the RETURN key. Your monitor should look like this.

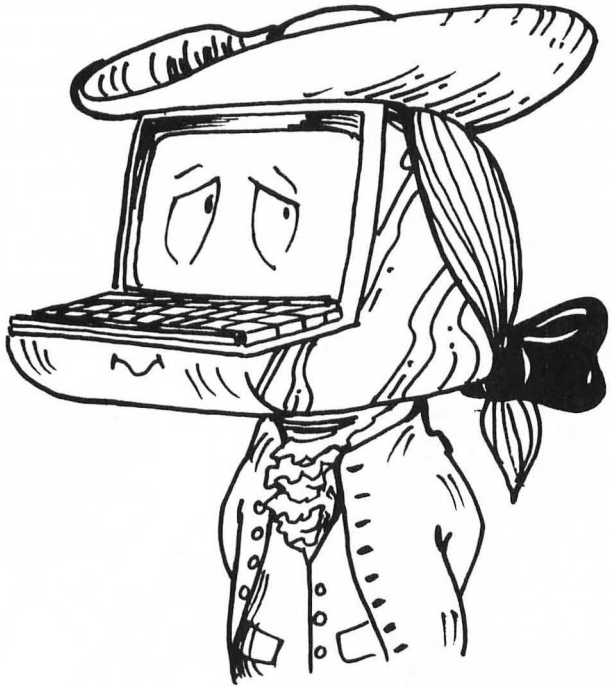
```
HELLO ATARI,
I AM YOUR MASTER
READY
■
```

Now you have an obedient computer that takes your orders when you speak a language it understands.

If you still get an ERROR message, recheck your spelling of PRINT. The ATARI Computer will not obey misspelled commands. The quotation marks are very important because they tell the computer that everything between them must be printed. The ATARI Computer will print exactly what you enclose in quotes including misspelled words or any other errors whether they make sense or not. Remember, you are MASTER.

Let's try this:

```
PRINT "COMPUTER, YOUR NAME IS GEORGE WASHINGTON"
```



Hmmm! A computer with a father of the country complex.

Try some other PRINT statements of your own. Be sure to type PRINT first and put what you want the computer to print inside quotation marks. You may want to have it print something with reversed color. Just press the key before and after the words you want printed this way. You can also print in lower case letters, if you wish, inside the quotation marks, but the statement PRINT must always be in capital letters. Practice a few PRINT statements; then go on to the next section to discover how the ATARI Computer can do arithmetic.

Add 'Em Up

The ATARI Computer can also be used to do math by using a PRINT statement *without* quotation marks. Let's give it some easy problems first. Type:

PRINT 15 + 35 RETURN

Wow! Are you surprised how fast it can do math?

PRINT 1776 – 999 RETURN

Alright, let's try this:

PRINT 17 + 38 – 42 + 57 + 108 – 62 RETURN

The computer uses the (+) and minus (-) for addition and subtraction just like when using paper and pencil. For multiplication the ATARI Computer uses the asterisk (*), and for division, the slash (/) key. Try:

PRINT 72 * 48 RETURN

Yeh!

PRINT 1932/69 RETURN

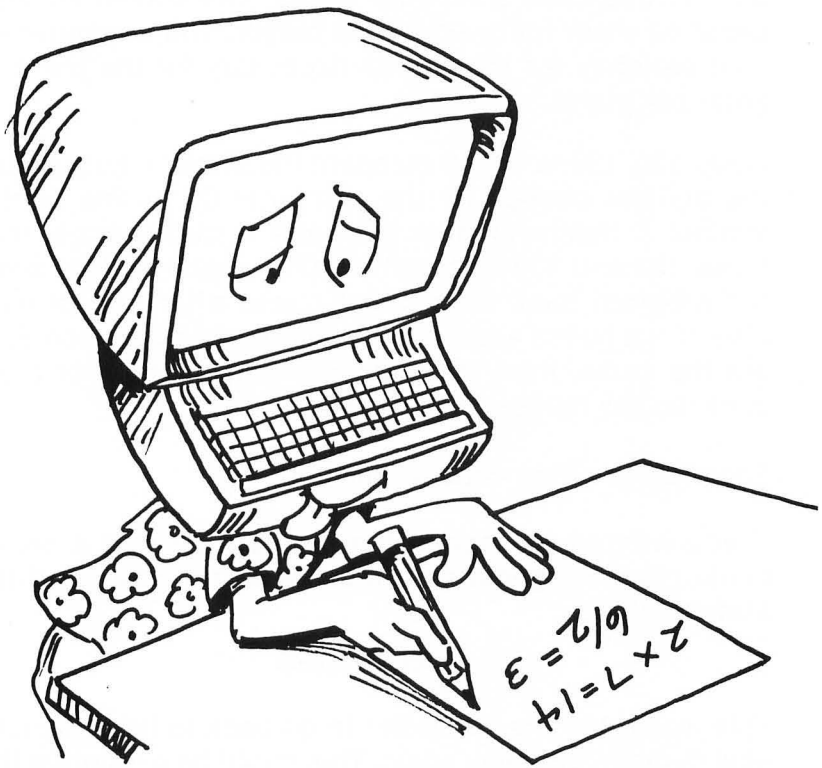
Egads!

Don't you wish you had had the ATARI Computer to do your math homework or balance your checkbook? How about getting it to do your income tax or figure the profit or loss on your stock market account. (Sorry, The ATARI Computer can't guarantee profits! But remember, you are still it's Master!)

Can the computer do +, -, *, and / all at the same time? Try this problem and see.

PRINT 2 * 7 + 15 – 6/2 RETURN

Did the computer answer 26? That is correct. Did you expect something else? If you try this problem on your hand calculator, you will get the answer 11.5. Most calculators do each operation in order from left to right. Computers follow the accepted rules of mathematics. All operations are done from left to right except that all multiplication and division is done first. This is called the "standard order of operations" and is accepted as the correct method to follow when doing math.



Here's how the computer did the problem:

```
The problem was 2 * 7 + 15 - 6/2
Mult. & Div. 1st 14 + 15 - 3
Now add & sub. 29 - 3 = 26
```

Try another problem or two. Figure out what the answer should be before you press RETURN. Then press RETURN and see if your computer agrees. Remember, computers never make mistakes!

```
PRINT 9 + 6 * 4 - 15/3
PRINT 17 * 3 - 27/9 * 6
```

Did you agree with the computer? The answers should have been 28 and 33. Take some time to try some math problems of your own. You will find that the ATARI Computer can also do algebra, geometry, and trigonometry when you are ready to try. Explore on your own. Come back when you are ready to go on.

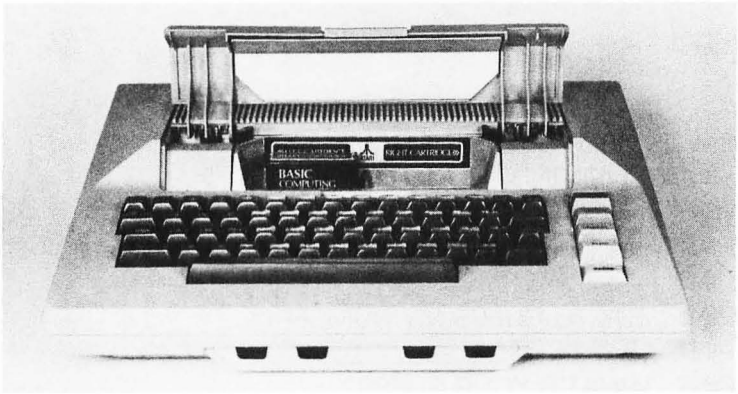
Set 'Em Up In The Next Alley

You may be wondering if you are going to spend the rest of your days typing orders for your computer to follow. Fortunately you may give your computer orders by putting in instructions that have been written by others. This information may be saved on tape, on disk, or in cartridge form. In order for the ATARI Computer to be able to follow these instructions, you must first copy the information into the memory of the computer. This is called "loading" the computer, and the command is **LOAD.**

The ATARI Computer probably came with one or two other pieces of equipment for this purpose.

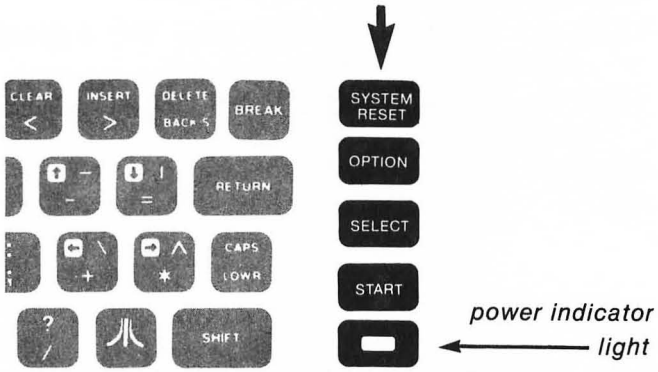
If You Have Other Cartridges

Many exciting games and special activities can be "loaded" into the ATARI Computer just by changing cartridges. Remember, cartridges must go into the left slot and are inserted just as we did the BASIC cartridge earlier in this chapter—with the label facing you.



The Key Systems

On the right side of the keyboard there are 4 keys that are used to select different starting positions with a cartridge,start and stop it.



Complete instructions for using these keys come with each cartridge.

If You Have a Program Recorder

A program recorder plays cassette tapes and sends the information into the computer through a wire. The tape used is very much like any cassette tape that you might use to record your favorite musical group. If you listen to the tape of the computer's instructions, it will sound like static to your ears.

It is actually a code; the two machines are "talking to each other". Relax in the knowledge that the computer can understand the message and will be able to follow the instructions.

You should take good care of your computer cassettes. Treat them with the same care that you would any good cassette or tape. Don't let them get hot by leaving them on hot machines or in the sun. Don't touch the surface of the tape itself with your fingers as this could damage some of the information stored on the tape.

To LOAD from a cassette tape:

1. Be sure that the recorder is properly connected to the computer and plugged into a wall outlet.

2. Press **STOP EJECT.** This stops the recorder motor and opens the cassette door.

3. Place the cassette into the recorder and close the door.

4. Press **REWIND** to move to the beginning of the tape.

5. Now press **PLAY.** Don't be concerned if nothing happens. The program recorder will start when it receives the correct command from the computer.

6. Type CLOAD and press RETURN, and the computer will begin to read the program from the tape.

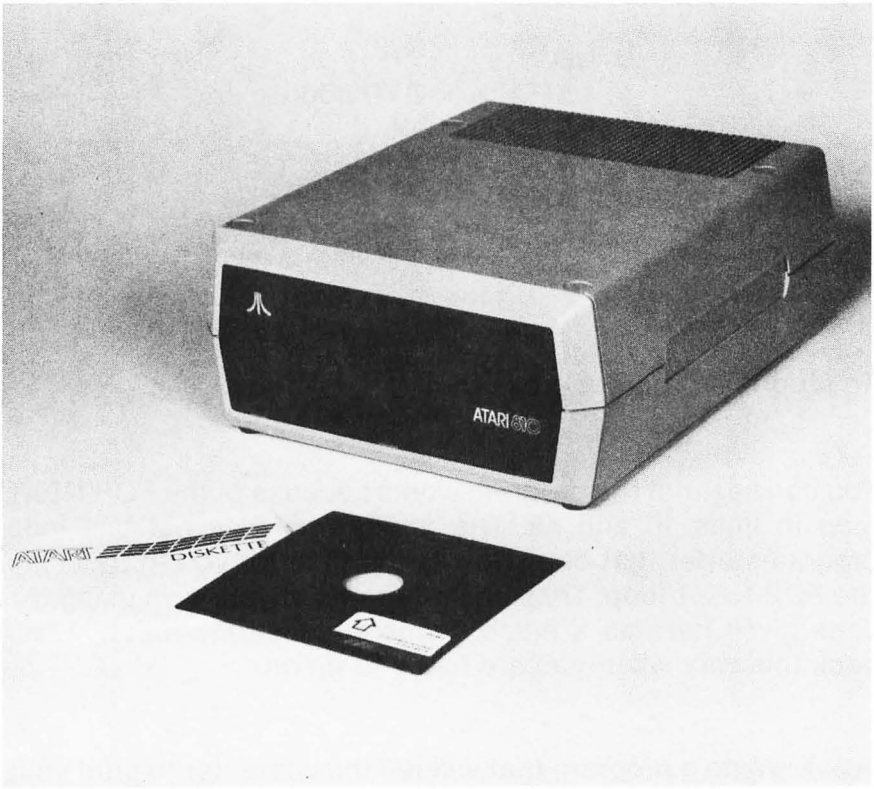
7. When the program is completely "loaded" into the computer, the tape will stop by itself. Press **STOP EJECT** to turn off the program recorder.

8. Now follow the instructions given on the program instruction sheet that came with the cassette to begin using the program. You may have to type a command on the keyboard, or you may simply have to press the START key on the ATARI Computer.

If You Have a Disk Drive

The Disk Drive is a unit that reads information stored on thin diskettes about the size of a 45 RPM record but much thinner. These diskettes are placed in the Disk Drive unit through a small door in the front. The diskette itself is called a "floppy disk" probably because it is thin and "floppy". The diskette is enclosed in a black plastic covering to protect the sensitive

recording surface. The diskette with the protective covering is kept in a paper storage jacket when not in use. Many programs or bits of information can be stored on one diskette.



The disk drive unit finds the information on the disk that you are asking for, and reads it into the memory of the computer. The information is then available to you—the computer "expert". As with the cassette, you are now able to use the keyboard to type information or changes into the program or use what is already there. If the program is changed, or if the computer is accidentally shut off, which would immediately wipe the program from the computer's memory, the original information is still preserved on the diskette.

Diskettes are recordings, and like any good record should be carefully handled. Do not store them in places where they can get hot. Keep them out of the direct sun and away from hot lamps and heating appliances. Remember also, a closed car sitting in the sun will get hot inside very quickly. This could ruin fragile diskettes.

There is a window in the protective covering of the diskette through which the Disk Drive reads the information. Do not touch the part of the disk that shows through the window because you may damage or destroy some of the information stored there. Do not bend a diskette or write on it. Never lay a diskette down on top of or near any piece of electrical equipment such as your TV, computer, disk drive or the like since the tiny magnetic field that is around them could damage the diskette. Keep your diskettes in their paper storage jacket when not in use.

To Load Information Into The Computer From A Disk Drive

Follow these steps *in order:*

1. Be sure that the disk drive unit has been properly connected to the computer and that it has been plugged into a wall outlet. Follow the manufacturer's instructions.

2. Turn on the disk drive first. You will hear a whirring noise and possibly a few loud clanks as the disk drive motor starts. Don't worry—Everything is okay. Two small red lights will come on. Wait for the top "Busy" light to go out before putting in the disk. The "Busy" light is on when the disk drive motor is moving.

3. Carefully holding the diskette by its label, slip it into the disk drive with the label up, and close the door.

4. Turn on the TV or monitor.

5. Now turn on the ATARI Computer with the switch on the side. Remember, the computer is turned on last.

   The disk drive will now begin to LOAD information into the computer. You will again hear whirring and clanking noises. When it is finished, it will automatically return to the ready position and stop. During this time, both red lights will be on. The bottom "Ready" light will continue to glow, but the "Busy" light will go off.

6. Now the program is in the computer's memory ready for use. The screen of your monitor or the printed instructions that came with the diskette will tell you what to do next. All you have to do is follow instructions.

Remember, if you treat your diskettes with loving kindness and care, they will last a long time and work well for you.

A Load By Any Other Name

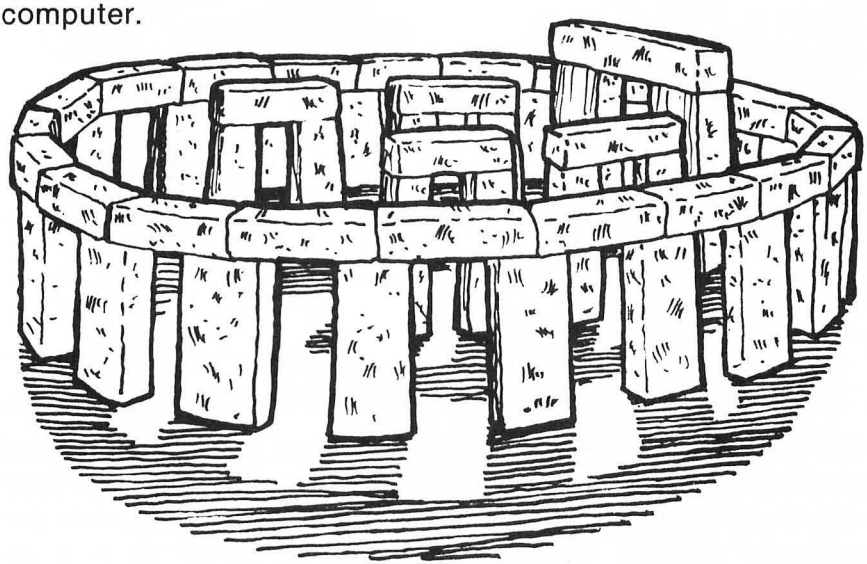
Whether you load instructions into the ATARI Computer's memory from the keyboard, a Cartridge, a Program Recorder, or a Disk Drive, you are in for many hours of enjoyment because you are Master.

HELLO ATARI HOME COMPUTER, I AM YOUR MASTER!

HARDWARE

Let Me Count The Ways

The word compute means to figure something. People have been computing for thousands of years. Probably the first "computers" were fingers; these "computers" are still in use today. Through the years there have been lots of other computing devices, such as the abacus. Even Stonehenge, the ancient group of huge stones set in a large circle in the countryside west of London, is said to be a kind of primitive computer.



What Is A Computer?

Computers are machines. You can give them information called **"data"** and instructions to do certain things with that information. A computer will follow your orders to do the job and show you the results when you ask for them. Computers also store information in their memory and use it when needed.

Computers, however, can't think or reason in the way people do. A computer can't, for example, collect several pieces of information and draw conclusions. Computers can't combine ideas or take the best parts of several ideas to come up with a brand new idea. This ability to think and reason is reserved *only* for the human brain.

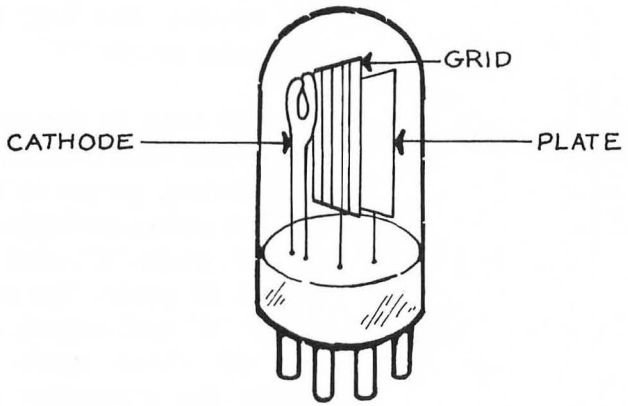
The computer *can* do many of the simpler things our brains can do, but can do them much faster. The computer can give you "yes" or "no" answers if you tell it exactly what data equals "yes" and what equals "no" and if it has this data in its memory. The computer can arrange bits of information in order and can sort things out that are alike or find those that are different. A computer's memory can store much information and it never forgets unless you tell it to or turn it off!

In order for a computer to work a *person* must give it two things:

- information (data)
- instructions on what to do with the information

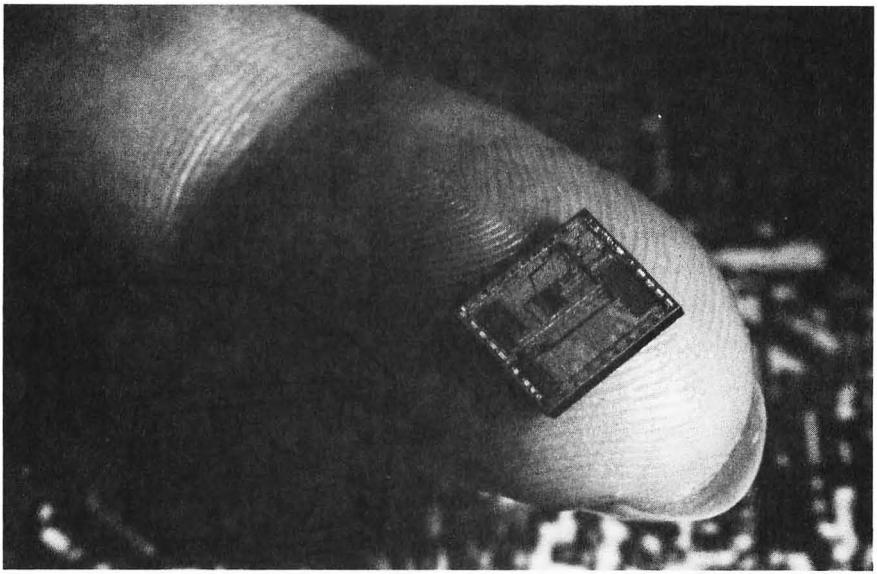
The Family Tree

Computers have been around for four generations. The first computer that could be called an ancestor of the present day microcomputer was the Mark I, which was invented in 1944. It is considered to be the first true computer because it could not only do calculations, but could store the instructions for carrying out a group of jobs. In the late 1940's, the first generation of computers in ATARI's family tree was invented. These first generation computers were very large, heavy machines in big metal cabinets. They were used mainly by the government to store large amounts of data. They would often take up entire floors of buildings. This first generation of computers was controlled by vacuum tubes like those in old time radios. These tubes were large, some as big as a six year old child. When used, vacuum tubes became very hot and tended to burn out quickly. As a result, vacuum tube computers were not very dependable.



With the invention of the transistor in the early 1960's, the second generation of computers was born. Transistors are smaller, run cooler, and serve the same purpose as the vacuum tube. Second generation computers were smaller and operated up to ten times faster than vacuum tube computers. Second generation computers were also cheaper and more dependable.

Around 1965, an improved computer that was controlled by integrated or printed circuits came on the market. These third generation machines could do a million calculations a second. They were even smaller and more reliable than the second generation machines. Third generation computers are still very much in use in business and government today.

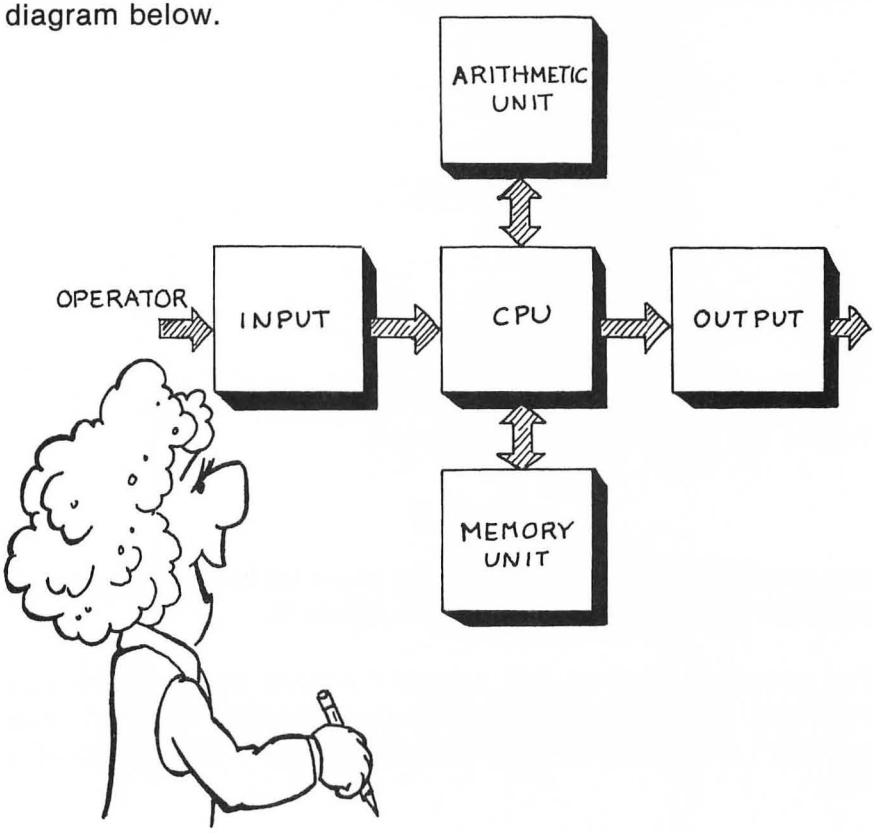


"Personal", or microcomputers, developed about 1976, are the fourth generation of computers. These computers are controlled by microchips. Microchips are tiny circuits etched onto crystals so small that they could pass through the eye of a needle. Each chip can hold as many as one thousand individual circuits. Microcomputers are much smaller, much cheaper, and fifty times faster than the third generation types. ATARI is a fourth generation general purpose computer.

The fifth generation computers are being developed now. They will be controlled by chips with many times the number of circuits found on current microchips but will be no bigger. With this development, a computer that once took up an entire floor of a building will fit in your pocket.

A Computer Is The Sum Of Its Parts

All computers, whether the large computers used in business or the small microcomputers like ATARI, have the same system parts. All parts are needed to make the system work. The five main parts in a computer system are shown in the diagram below.



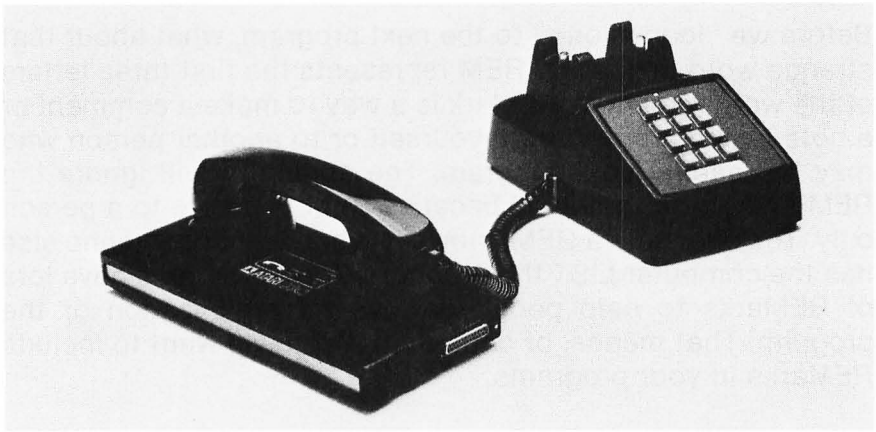
The pieces of equipment that make up these five parts are called **HARDWARE.** The term **SOFTWARE** is also used by computer buffs when speaking "computerese". SOFTWARE is the name given to the instructions that the computer follows. The computer game Pac Man™ is one example of SOFTWARE for the ATARI. Every cartridge or diskette that you use is also considered SOFTWARE.

Input

You may give information to your computer in several ways, just as you can give information to a friend in a letter, a telegram, or on the phone. Machines designed to put information into a computer are called **input** equipment. Examples of input equipment include:

- Card Reader
- Disk Drive
- Keyboard
- Tape Readers
- Program Recorder
- Modem

Large computers may use a card reader which reads punched cards or tape readers which read punched or magnetic tape. They may also use large disk drives which read stiff magnetic disks. Information can be typed directly into a computer by using a keyboard, and sometimes a person may even speak to the computer through a microphone unit. Also, a simple unit called a "modem" which will hold the family telephone, can be connected to your computer. This modem enables your computer to "talk" to another computer at the other end of the line. This receiving computer could be located at the library, the university, a friend's house, or anywhere computers are at work.



With the ATARI 400 or 800 Home Computers you will use a diskette in the small disk drive, or a cassette tape in the program recorder to "talk" to your computer. When you type on the keyboard, you are also "feeding" information *in*to the computer.

Memory

When you input information to the computer, it goes into the computer's memory unit after you press RETURN. The computer stores the information until it is needed. You, ATARI Master, have a memory unit too; it sits on your neck and has an outer covering of hair (in most models!).Even though the ATARI Computer may store as much as 48,000 **bytes** of information at one time, your memory unit is even better and *you* have the ability to think on your own. That's why *you* are Master!

There are two kinds of memory in the memory unit, the **RAM** and the **ROM.** The RAM (*R*andom *A*ccess *M*emory) has the capacity of storing information sent in through the input equipment. The advantage of the RAM is that you can change it easily to do something new. The disadvantage of RAM is that it forgets everything you have told it when the computer is turned off.

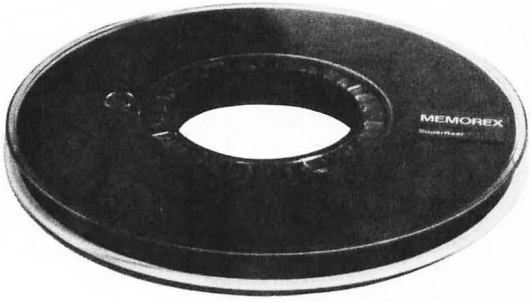
The other type of memory is called ROM. The ROM (*R*ead *O*nly *M*emory) has memory cells that are programmed at the factory with information about our number system, how to load and save information, and all those skills the computer must have to do its work. The advantage of the ROM is that it remembers its instructions even after the power has gone off and on again. The ROM, however, as its name implies, can be read only. It can't be changed by the input equipment and so does not act or react with you. You can see, therefore, that both RAM and ROM are needed as part of the computer's memory. The "double-good" twins, RAM and ROM, are both at work in the ATARI.

Three Cheers For The K's

You may hear people talking about the number of "K's" a computer has. They might say, "I have a 16K machine"; or "You have to have a 32K computer to run this program". "K" is a way of showing how large the memory unit is, or how much information the computer can remember at one time. The letter K stands for thousand, just as the "K" in *k*ilogram or *k*ilowatts. A computer that is 32K, for example, can remember 32,000 pieces, or bytes, of information at one time.

Storing Information Outside The Computer

Often businesses need to save "data" that won't be needed for awhile or that contains old records that must be saved. We do that too when we save photos in an album or put our last year's income tax records in a file box in the attic or basement. Computers can store information on punched cards, magnetic tape, or disks. These "records" can then be stored away in cabinets or files. By doing this, the computer's memory can be erased, making room for work that needs to be done now. This is sometimes called *bulk storage*, since a great deal of information can be stored. This bulk storage is much the same as information "stored" in the books in a library or the LP's in your record collection. Bulk storage items can be pulled out of storage and the information they contain can be fed back into the computer's memory for use anytime they are needed.



The Dynamic Duo

Once you "input" information into the computer, what happens to it? Information may be sent several different places depending on what needs to be done with it. Examples include sending it to memory for storage or sending it to that part of the computer that does arithmetic or combining it with other information already in the computer to become part of a picture on the screen. That part of the computer that decides where each bit of information is sent is the important **CONTROL unit.**

The CONTROL unit is very busy. It directs the movement of all information through the computer, acting as the "traffic director" like a policeman who directs traffic at a highway intersection. The control of the flow of information is important so that no data bumps into any other as it moves through the computer circuits to its destination. Just as two cars might be destroyed or damaged by a collision at an intersection, information that "collides" with other information may be destroyed.

The CONTROL unit also must remember exactly where each bit of information has been sent so that it can call back that information when it is needed again. All information that is stored in either the RAM or ROM memory is stored in a particular place. This place is called the "address" and identifies the location. The CONTROL unit remembers all these addresses.

The ALU

Another busy and important part of your computer is the **Arithmetic Unit,** which does all the math for the computer. All information entered into the computer's ROM (for example, numbers, letters, punctuation marks) is recorded using numbers. You can see, therefore, how busy the Arithmetic Unit is and how basic it is to the operation of the computer.

The Arithmetic Unit is often referred to as the ALU, which stands for *A*rithmetic *L*ogic *U*nit. The ALU has been "taught" how to do all kinds of arithmetic problems. That is, special instructions have been stored in the ROM memory that can be called on at any time to instruct the ALU. Your ATARI Computer is a *DIGITAL* computer. Digital refers to numbers, as in a digital clock or a digital thermometer.

> All the "work" that the computer does is processed by either the Control Unit, the Arithmetic Unit, or a combination of these two. These two partners make up the part of the computer called the *C*ENTRAL *P*ROCESSING *U*NIT or CPU.

Output

No matter how quickly a computer can follow instructions to do a job, it would be useless if there was not a way to get the information or solution from the computer. The equipment used to retrieve this information so that you can see or hear,or hold it is called *OUTPUT EQUIPMENT.*

Computers usually have a way to connect to a TV or monitor so that the operator will be able to see what is entered into the computer as well as see the computer's response. Reading the information on the screen is the easiest way to get information from the computer. The game pictures or the information

about your checkbook shows up on the screen. In this way, you can see the information entered into the computer by a cassette or a diskette.

If you want a written copy of the **output** from your computer, you can also connect the computer to a printer to record the information on paper. The printer may be a simple electric typewriter which receives information from the computer and automatically types it, or a high speed printer which is able to print the information on paper at speeds as high as 1200 lines a minute. These printers are also considered output equipment. You can also store output information on magnetic disks or tape, and on punch cards or tapes. Most INPUT equipment can also be used as OUTPUT equipment as well. Chapter 3 explains how to "save" information from your computer's memory on magnetic disks or tapes.

Now You Know

Okay, ATARI Master, you now know how this marvelous machine works. It's really quite simple when you think of its five basic parts. The input equipment, control unit, arithmetic unit, memory unit and output equipment are all ready to work for you. Remember the computer can't think on its own. It must have information and instructions from a *person.* You, ATARI Master, are the person needed. Go to it!

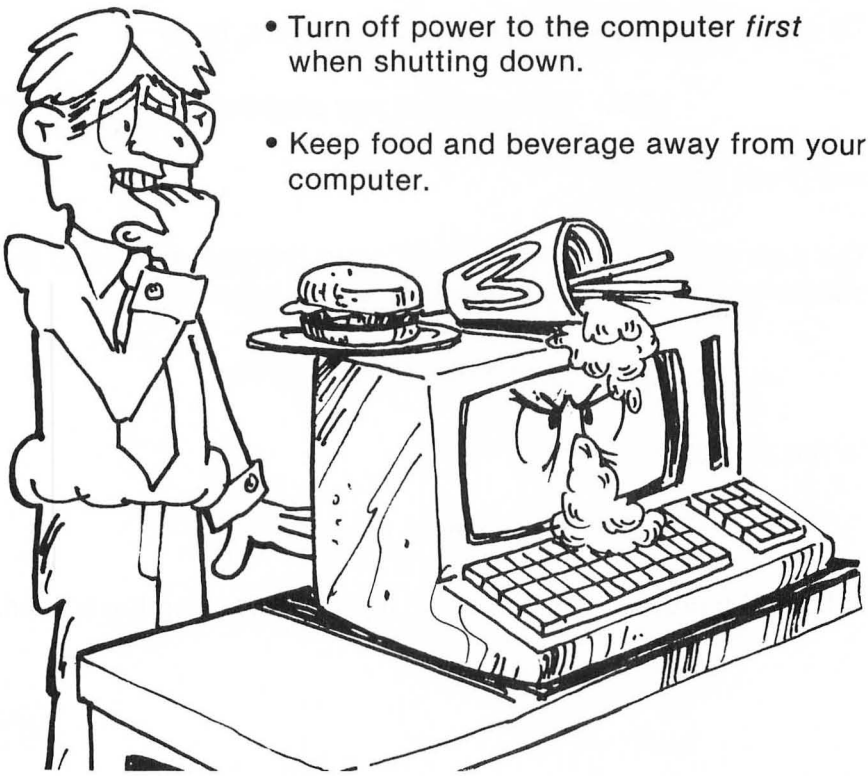
Crying Over Spilled Milk

The parts of your computer system do not take kindly to bits of cookie, other food, drops of milk, or soda spilled on it. Consider making it a rule that no one can eat or drink while using the computer. An accidentally spilled drink could mean many dollars worth of damage to the insides.

Words of Wisdom

Along the way in chapters one and two you were given words of caution in the care and feeding of the ATARI Computer. For carefree use review the following hints:

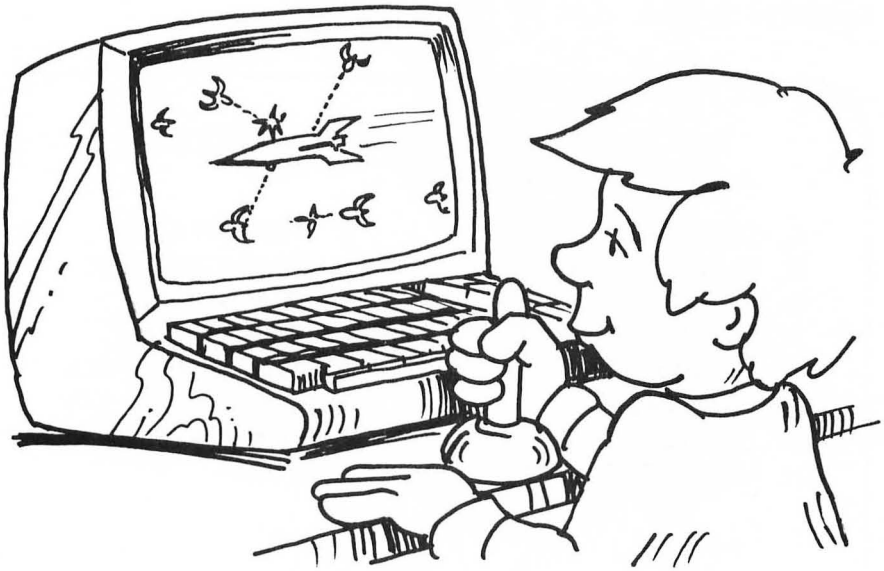
- Protect your diskettes from dust, heat, and electrical appliances.
- Turn on power to the computer *last* when starting up (after disk drive and TV).
- Turn off power to the computer *first* when shutting down.
- Keep food and beverage away from your computer.



PUTTING YOUR ATARI HOME COMPUTER TO WORK

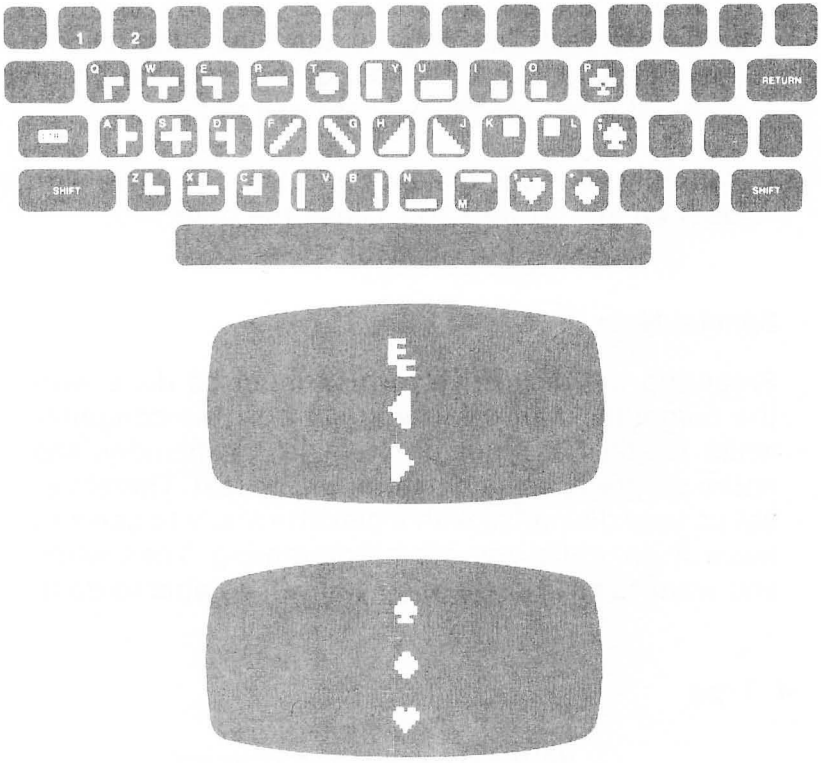
Let's See Some Action Here!

Unless you have been living on a desert island for the last few years, you must have seen the invasion of computer game machines. These fascinating machines are in stores and amusement parks all around us. Children and adults alike spend hours of time moving characters all around the screen, gobbling up everything in sight. Space fans "fly" their spaceships around the galaxy dodging and destroying enemy starships, invaders from space, and asteroids. What makes these games so exciting is actually seeing the action happening on the screen. Using your computer to draw pictures and to move around the screen on command is called GRAPHICS. The ATARI Computer can draw pictures in several ways.



The Control Graphic Keys

There are a number of symbols on the keyboard which do not show at first glance. You can see them when they are printed on the screen, but they don't show on the keys. When these special keys are pressed while the CTRL key is held down, the computer produces a variety of special shapes which can be used to draw pictures.



This picture shows which keys are used and the shape each makes. They are called CONTROL GRAPHICS keys because the CTRL key must be held down in order to get them. The ATARI Computer also has several other methods for drawing pictures called "Graphic Modes", which you will discover later

in this chapter. Let's begin with CONTROL GRAPHICS. Follow these steps!

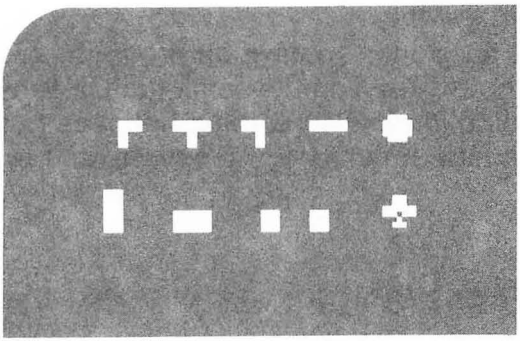
1. Open the cartridge door and remove the BASIC Language Cartridge if it is in place.

2. Turn on the TV or monitor.

3. Turn on the computer. (Remember the ON-OFF switch is on the right edge of the machine.)

4. Take an "inventory" of keys. Hold down the CTRL key and press each letter key in the first row reading from left to right beginning with the letter "Q".

You should get something like this:

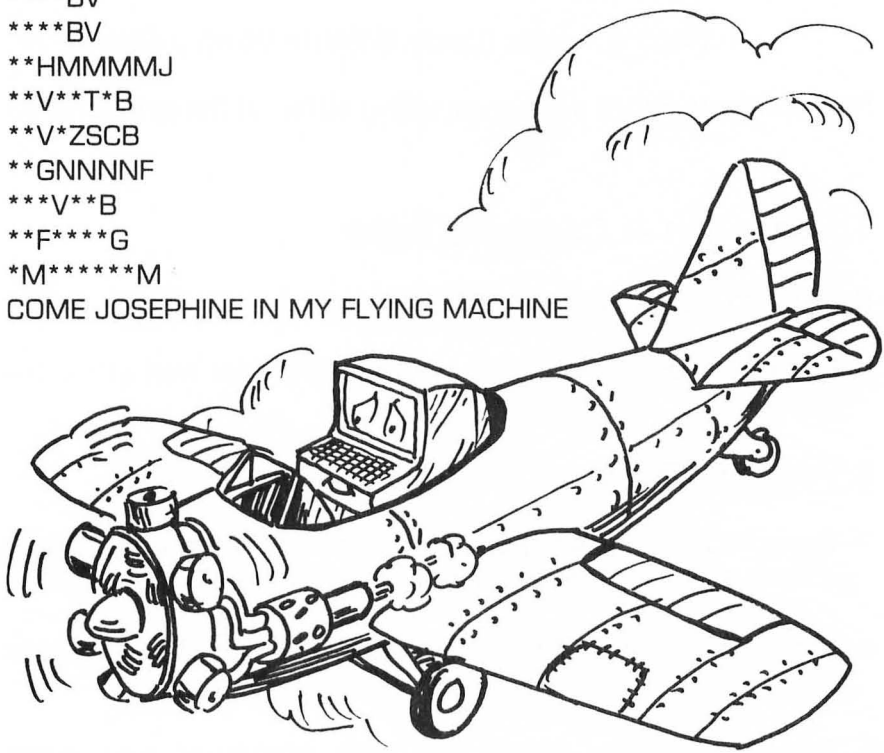


Continue taking "inventory" of the Control Graphics characters by holding down the CTRL key and pressing each of the letters and punctuation keys in the middle and bottom rows. Notice that the "arrow" keys do not have graphic characters, but continue to move the cursor. The ? / key is also not used to produce graphic characters.

You now can see all of the various shapes that are available. Using a little imagination, you can use these special shapes to draw a picture. Here's an example for you to try.

Remember to hold down the CTRL key while doing this. Type the following. After each line press RETURN. Be sure to leave the correct number of spaces in the proper places as shown. For the purpose of this drawing whenever you see the * symbol, *press the space bar once.*

```
NNNNNNNNNN
****BV
****BV
**HMMMMJ
**V**T*B
**V*ZSCB
**GNNNNF
***V**B
**F****G
*M******M
COME JOSEPHINE IN MY FLYING MACHINE
```



Now is the time for you to try making some Control Graphics pictures of your own. See what you can do by combining various shapes. It's fun!

Another Way To Draw

The ATARI Computer can also draw pictures by filling the squares on a graphics screen as you could be filling in the squares on a piece of graph paper. Let's find out how this works by doing the following steps:

1. Open the cartridge door and put the BASIC Language Cartridge in the left slot as you did in Chapter One.

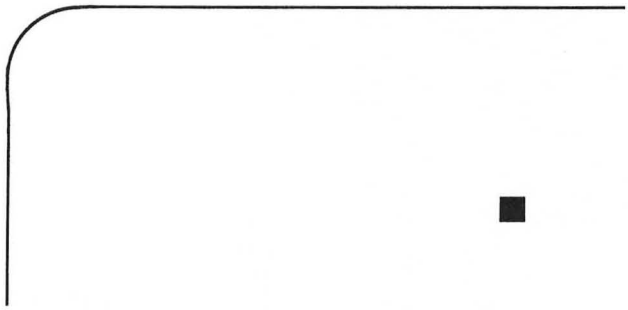
2. Type GRAPHICS 3

3. Watch the screen as you press the RETURN key. (The GRAPHICS statement clears the screen ready for drawing. At the bottom of the screen is a "window" 4 lines high which will be used for writing. Your next statements will appear in this window as you type.)

4. Type COLOR 1 and press RETURN. (You can see the words in your window, but nothing happened, right? This is because you've told the computer you want to draw in COLOR 1, but you haven't told it where on the screen you would like the color to be.)

5. Type PLOT 2Ø,1Ø and press RETURN.

   Does your screen look like this?



GRAPHICS 3

There are several screen layouts or "modes" that the ATARI Computer can use for GRAPHICS. When typing commands for the computer, the word GRAPHICS can be shortened to GR. to save time. The screen is like a piece of graph paper with rows and columns of squares. In GRAPHICS 3 there are 40 squares across and 20 squares down. The columns across go left to right from 0 to 39. The rows are numbered from top to bottom starting with 0 and continuing to 19. When you told the computer to PLOT 20,10 it went over 20 columns and down 10 rows and colored in that square. After you put the ATARI Computer in graphics mode by typing GR.3 and COLOR 1, follow these steps to locate other points on your GRAPHICS screen:

1. Type PLOT Ø,Ø and press RETURN .(You should get a square in the upper left corner of the screen.)
2. Type PLOT 39,Ø RETURN . (Did you get a square in the upper right corner? You should, Atari Master.)
3. Type PLOT Ø,19 RETURN .
4 Type PLOT 39,19 RETURN .

Rows Go Down

You name the row number with the second number of the PLOT Statement. If you PLOT 0,19 the computer will go to the first column and down to row 19 so that there is a square in the lower left corner of the graphics screen. The PLOT 39,19 locates a square in the last column over and in the last row down so that it appears in the lower right corner.

Error Time

If you forget the comma between the two plot numbers and type PLOT390, the computer will think you mean three hundred ninety. Since the computer doesn't have squares numbered as

high as 390, it will give you an ERROR - response. The ERROR CODE numbers are all listed on the inside front cover of the Basic Reference Manual which came with the ATARI Computer.

What happens if your finger slips and you type PLIT instead of PLOT? Try typing

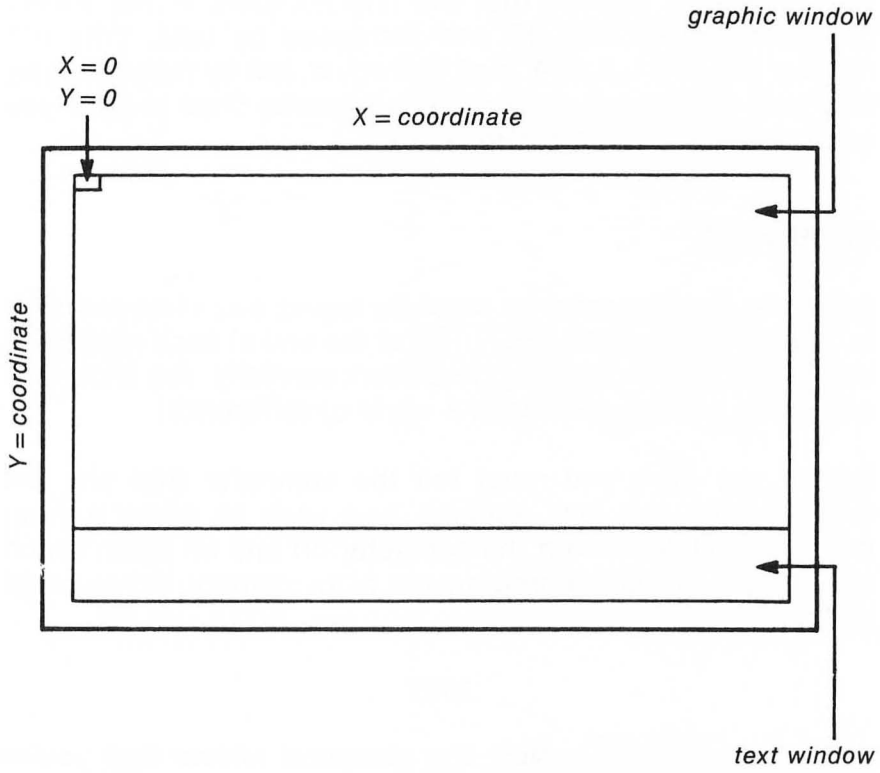
PLIT Ø,19 [RETURN]

The computer prints ERROR- after you press [RETURN] because it can only understand the language it knows; PLOT is a word in BASIC that the computer understands. The computer can't reason that the [I] key is right next to the [O] key, and what you *meant* to type was PLOT. The ERROR-message is the computer's way of saying "I don't understand." *You must type the statement again correctly if the computer gives you an ERROR- message.* Always use the [CTRL] and "arrow" keys to move the cursor down out of the ERROR message or other writing to a "clean" line before typing the statement again.

If you discover a typing mistake before you press [RETURN], you can easily make corrections in what you have just typed by using the [CTRL] and "arrow" keys to move the cursor around and make your corrections as you did in Chapter One, *Fixing an "Oops".*

More Plotting

Remember that the GRAPHICS 3 screen, known more familiarly as GR.3, looks like this.



What PLOT would you use to put a square in the lower right hand corner? Remember to name the "across" number first and the "down" number second. Don't forget to use a comma between the two numbers.

Did PLOT 39,19 RETURN mark the spot?

Let's try using what we know to draw a line across the screen. We could do it this way; type the following exactly. Remember to press the RETURN key after each line.

```
GR.3
COLOR 2
PLOT Ø,1Ø
PLOT 1,1Ø
PLOT 2,1Ø
PLOT 3,1Ø
PLOT 4,1Ø
```

What's happening? You should have the beginning of a line horizontally across the screen. Since you changed the first number of each PLOT to move across the screen, how can you draw a line down from the right end of your horizontal line?

Hint: the first square to PLOT is 4,11. Try it !

The Plot Thickens

Did you end up with a lot of short lines on your screen? To clean the screen so that you have a "clean slate" on which to draw a different way, type: GR.0 and press RETURN .

Fortunately there is a shortcut to line drawing so that you can draw a line all at once instead of only one square at a time. Let's start again. Be sure to type the following just as it is, being careful with punctuation marks and spaces.

```
GR.3 RETURN
COLOR 3 RETURN
PLOT Ø,11:DRAWTO 39,11 RETURN
```

That does speed things up! A line down is just as easy.

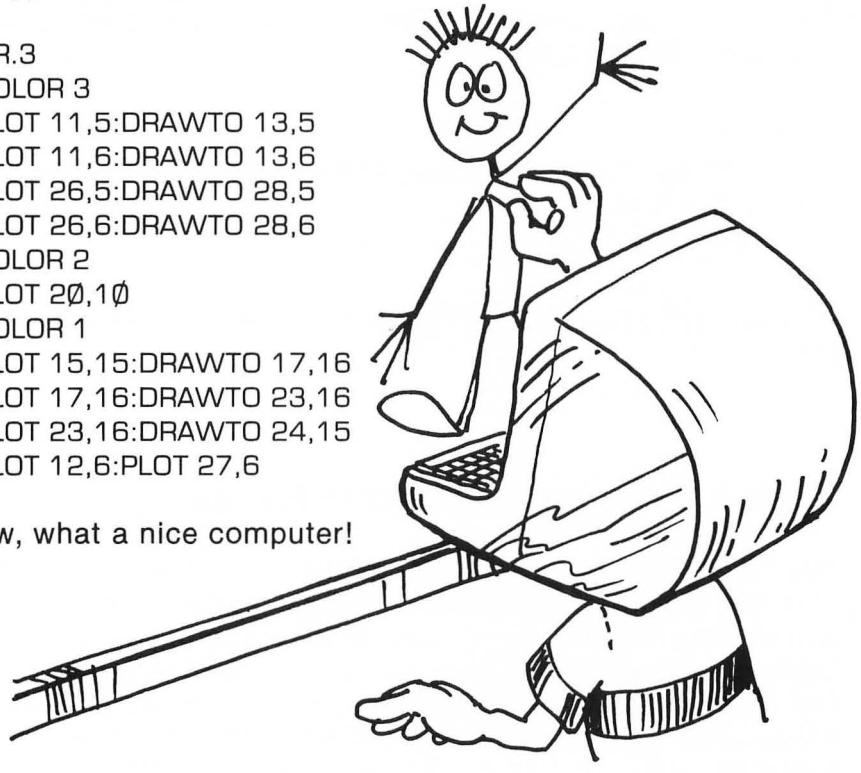
```
PLOT 2Ø,Ø:DRAWTO 2Ø,19 RETURN
```

Have you been wondering about that funny word, DRAWTO? It is a word in BASIC made up of the English words "DRAW" and "TO" put together. A statement such as PLOT 0,0:DRAWTO 39,0 tells the computer to start in the square 0,0 which is the upper left corner and draw all the way to square 39,0 in the upper right corner.

Type GR.Ø and press RETURN for another "clean slate". Draw this. Remember to type just these commands and press RETURN after each line. If you get an ERROR- just retype the command.

```
GR.3
COLOR 3
PLOT 11,5:DRAWTO 13,5
PLOT 11,6:DRAWTO 13,6
PLOT 26,5:DRAWTO 28,5
PLOT 26,6:DRAWTO 28,6
COLOR 2
PLOT 2Ø,1Ø
COLOR 1
PLOT 15,15:DRAWTO 17,16
PLOT 17,16:DRAWTO 23,16
PLOT 23,16:DRAWTO 24,15
PLOT 12,6:PLOT 27,6
```

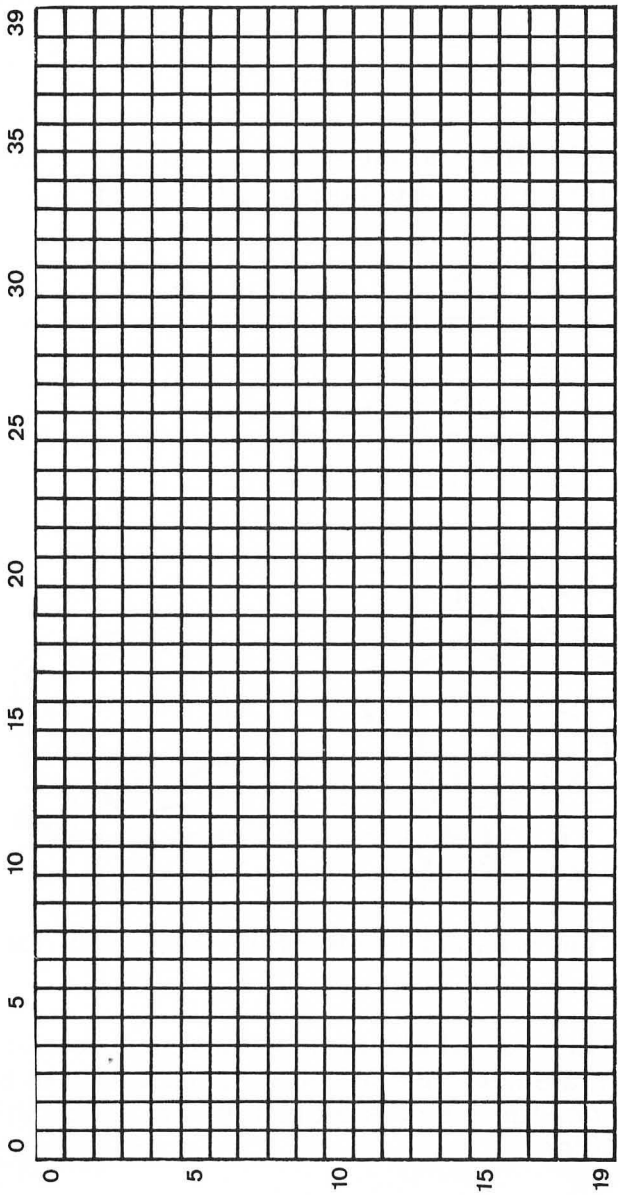
Aw, what a nice computer!



When you are ready to wipe the smile off the computer's "face", type

GR.Ø RETURN

Try some PLOT's and DRAWTO's of your own. The numbered graph paper below will help you plan your work.



Adding More Color

If you are using a color TV or monitor to display your graphics, you have noticed that so far we have used only 3 colors. In order to add a larger variety of colors we can use the SETCOLOR statement. If you liked dot-to-dot pictures when you were younger, you'll love the following. Type this:

(Press the RETURN key after each line.)

```
GR.3
COLOR 1:SETCOLOR Ø,12,8
PLOT 15,6:DRAWTO 15,13
PLOT 24,6:DRAWTO 24,13
PLOT 13,11:DRAWTO 13,13
PLOT 26,11:DRAWTO 26,13
PLOT 14,11:PLOT 25,11
PLOT 16,2:DRAWTO 16,5
PLOT 18,2:DRAWTO 18,5
PLOT 21,2:DRAWTO 21,5
PLOT 23,2:DRAWTO 23,5
PLOT 17,2:PLOT 22,2
PLOT 16,6:DRAWTO 23,6
PLOT 16,7:DRAWTO 23,7
PLOT 16,8:DRAWTO 23,8
COLOR 2:SETCOLOR 1,3,8
PLOT 16,9:DRAWTO 19,12
PLOT 2Ø,12:DRAWTO 23,9
SETCOLOR 4,1,8
```

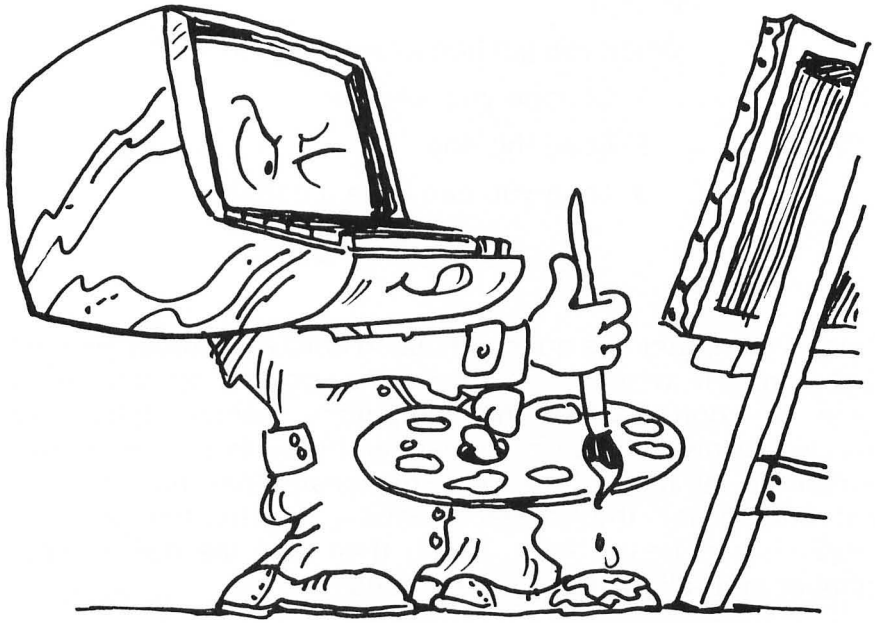
Are you humming "How much is that froggy in the window"?

Note that the COLOR 1 statement combined with a SETCOLOR is *not* the same as the COLOR 1 we used alone on the computer "face". COLOR 1 (or 2 or 3) when used with a SETCOLOR really means the *first* color to use (or second or third) rather than referring to a color hue.

Adding the SETCOLOR statement allows us to have a greater choice of colors for drawing in GRAPHICS 3. You will notice the SETCOLOR statement follows a COLOR statement and is made up of 3 numbers separated by commas. The first number in the chain depends on whether it is the first, second, or third color that is being used in the beginning of the statement. It is always one number less than the COLOR number of the statement. COLOR 1 has a 0 in the first place after SETCOLOR, COLOR 2 has a SETCOLOR 1, and COLOR 3 has a 2. The last statement in the program above (SETCOLOR 4,1,8) set the background color to gold.

The second number of the three that follow a SETCOLOR statement chooses the color hue and the third number in a SETCOLOR is for brightness.

You may clear the GRAPHICS off the screen at anytime by typing GR.Ø



The following table gives examples of how you can select different colors by changing the middle number of the three needed in a SETCOLOR statement.

COLORFUL NUMBERS

The following are the middle numbers to use in the SETCOLOR statements.

MIDDLE NUMBER	COLOR
0	gray
1	gold
2	orange
3	red
4	pink
6	purple-blue
7	blue
8	blue
9	pale blue
10	turquoise
11	green-blue
12	green
13	yellow-green
14	orange-green
15	yellow

NOTE: Colors may vary with different TV sets or monitors.

The final number in the SETCOLOR chain usually remains constant. The range for brightness, the final number in the SETCOLOR command, is an even number between 0 and 14. A final number of 8 has been used for the colors above.

You can see that COLOR 1:SETCOLOR 0,8,8 and COLOR 2:

SETCOLOR 1,1,8 followed by PLOT and DRAWTO statements will make blue and gold if you happen to be drawing a sunset. Now is the time for you to have some fun adding different colors to your own PLOTs and DRAWTOs. Experiment now with different SETCOLOR statements. Plan your picture on a piece of graph paper and let your color imagination go!

YOU'RE IN COMMAND

Giving Orders

As you worked through Chapter 3 and developed some exciting graphics of your own, you may have wanted to save some of your drawings to use later. Alas, when you turned off your computer, your art was lost. There is a way, however, to give orders to a computer in such a way that you can SAVE the instructions and LOAD them later to use again just as you load other tapes or disks.

This handy way of giving orders to a computer is called a COMPUTER PROGRAM. A computer program is a coded set of instructions or directions for the computer to follow. It's like leaving a list of instructions for a young child (or an old one).

Donna,

When you get home I want you to:

1. Change your clothes
2. Feed the dog
3. Then you can have a cookie

Mom

Since a computer has no real thinking ability you must also tell it the order in which to do things. You do that by numbering each direction. Part of the computer's memory tells it to always follow orders in numerical order from the lowest number to the highest number. This means that the computer will search for the lowest numbered instruction in your program and begin there. It will then find the next lowest number and follow those instructions.

Let's see how this works by doing some ATARI Computer "Master Programs". Try typing in the following instructions in program form. Remember to press the RETURN key at the end of each statement.

1Ø PRINT "HA, HA, HA, HO, HO, HO"	press RETURN
2Ø PRINT	press RETURN
3Ø GOTO 1Ø	press RETURN

Notice that nothing happens yet. The computer is waiting for the command to start or begin. The BASIC command for start is **RUN.**

Type the letters

RUN

and press RETURN.

Is the computer laughing at you? Remember, "He who laughs last laughs best". Press the BREAK key in the upper right corner of the keyboard for the last laugh. The ATARI Computer will obediently stop and report the line number of where you broke in.

If you want more laughter, type the letters CONT (short for *cont*inue), then press RETURN.

```
HA,HA,HA,HO,HO,HO

HA,HA,HA,HO,HO,HO
STOPPED AT LINE 1Ø
CONT
HA,HA,HA,HO,HO,HO
```

Notice the blank line in between each line of laughter? We'll find where it came from by looking back at the program itself.

Prints Valiant

In order to examine the instructions you have given the computer, first stop the program by pressing the BREAK key. Now type

LIST

and press RETURN and the ATARI Computer will obediently show you the list of instructions it is following.

Did you get this?

```
LIST
10 PRINT "HA,HA,HA,HO,HO,HO"
20 PRINT
30 PRINT GOTO 10
```

Line 10 of the program is the PRINT statement for all that laughter.

What about line 20? What does it do? Because nothing follows the PRINT statement, the computer is being told to print just that—*nothing.* The result is a blank line of space after each line of laughter.

Examine the LIST again. Do you notice a strange word in the line 30? GOTO is a command that directs the computer to leave the place it is in the program and go to another place. (Almost like going directly to jail without passing GO). When you use a GOTO statement, you must always tell the computer where to go or it will not understand. In the example, the computer is directed to go to line 10 and repeat the command in that line and continue from there with the program. The program you just wrote, in effect, has your computer going around in circles.

Try another print program. Don't forget to press RETURN after each line.

```
NEW
10 PRINT "I AM (your name), ATARI COMPUTER MASTER"
20 GOTO 10
RUN
```

Feel better? Press the BREAK key when you are ready to stop.

What a Difference a Comma Makes

You can really confuse your computer by using some of the common punctuation marks outside the quotation mark at the end of the print statement. List your program again by typing LIST and pressing RETURN. Move the cursor up to the end of line 10 by using the CTRL key and the arrows as we did before. With the cursor now located in the space after the quotation mark, type in a comma (,) and press RETURN. By pressing RETURN you have now added the comma to the end of line 10 in the computer's memory. Bring the cursor down out of the program under line 20 by using the CTRL and arrow keys. Now RUN the program again and see the change.

A comma after a quotation mark tells the computer to leave eight spaces and repeat.

Now change the comma to a semi-colon (;) and see what happens.

1. Press [BREAK] to stop the program.

2. Type LIST and press [RETURN].

3. Move the cursor on top of the comma by using the [CTRL] key and the arrow.

4. Press the semi-colon (;) key which will replace the comma and change line 10 to end with a semi-colon.

5. Press [RETURN] to make the change complete in the computer's memory.

6. Return the cursor to a position under the program.

7. Type RUN and press [RETURN].

Well, would you look at that! You're right. The semi-colon following the quotes tells the computer to repeat again immediately. Perhaps you would like to try the laughter program with a comma or a semi-colon outside the quotes. If you would, type the letters NEW and press [RETURN]. Remember you can clear the screen by holding down the [SHIFT] key and pressing the [CLEAR <] key. Now type the laughter program from page 67 and add a semi-colon outside the quotes at the end of line 10. Also remove line 20.

Graphics Program

By using this same idea, the program mode, you can write your favorite "graphics" directions so that they can be used again and again. *To produce a program for the computer to follow, simply enter a line number in front of each line of instructions.*

You may have noticed that the line numbers in the PRINT programs began with 10 and increased by tens. Why not number the line 1, 2, 3, 4, etc? You could, but by numbering by tens you are leaving extra spaces between lines in case you want to add more instructions later.

Greetings

Enter the next program by carefully typing each line just as it is. Remember to press RETURN at the end of each statement before you go on to the next line. Work carefully. You know that a missing comma can make a world of difference!

Before you start you must tell the computer that you are finished with the last program and wish to erase it from memory. You could turn the computer off and on again which would wipe any earlier program out of its memory, or you could just type

NEW

and press RETURN. Now the computer knows that you're doing something brand new. *Any time you type NEW and press RETURN, it clears all programs in the RAM memory of the computer.* You may clear the screen only (not the computer's memory) by pressing CLEAR while holding down the SHIFT.

```
NEW
10 GR.3
20 SETCOLOR 4,7,8
30 COLOR 1:SETCOLOR 0,1,8
40 PLOT 6,2:DRAWTO 6,17
50 PLOT 17,2:DRAWTO 17,17
60 PLOT 6,9:DRAWTO 17,9
70 PLOT 24,6:DRAWTO 24,17
80 PLOT 24,4
100 END
```

Do you notice a word that we haven't used in programs before? Line 100 reads **END.** The END statement tells the computer that the program is finished.

Start the new program, as we did before, by typing

RUN

and pressing RETURN .

And Hello to you, ATARI Home Computer!

Before you can LIST this program, you must change the computer out of the graphics mode which tells the computer to draw pictures. To do this, type GR.0 and press RETURN . Now list your program by typing

LIST

and pressing RETURN .

More Graphics Programs

To this point you have done graphics in GR.3 only. Let's use this program to see how some of the other "graphics" work. Line 10 sets the program in graphics 3 which you will remember is like working on a piece of graph paper 40 squares across and 20 squares down. To change this program to a different graphics mode:

1. List the program by typing LIST and pressing [RETURN]. (If you have turned the computer off, you will need to retype the "GREETINGS" program from page 72.

2. Move the cursor on top of the 3 in line 10 by using the [CTRL] key and the arrows.

3. Press the 5 which will replace the 3.

4. Press [RETURN] to make this change in the computer's memory.

5. Use the [CTRL] and "arrow" keys to move the cursor to a "clean" line under the program.

6. Type RUN and press [RETURN].

Look what happened! Did your greetings shrink? That's because graphics mode 5 is like a piece of graph paper that is 80 squares across and 40 squares down. The squares are smaller, so the picture is smaller.

Shall we try again?

Type:

GR.Ø and press [RETURN].
LIST [RETURN].

Change line 10 as you did in steps 2 to 6 before so that it is:

1Ø GR.7

then:

RUN [RETURN]

The greeting is still smaller because graphics mode 7 is 160 squares across and 80 squares down. Graphics mode 8 is 320 squares across and 160 squares down. Let's see how that looks. Type:

GR.Ø [RETURN]
LIST [RETURN]

Now change line 10 to read:

1Ø GR.8

Then:

RUN [RETURN]

Saving For The Future

When you have finished a program, you may want to save it so you can use it at a later time. Remember, if you turn off the power to your computer, any program in its memory will be erased and lost. Don't let your feet get tangled in the cords while you are working.

The ATARI Computer has two ways to SAVE a program:

- Record it on a cassette tape using a Program Recorder.
- Record it on a floppy diskette using a Disk Drive.

Here's how to SAVE a program using either of these machines.

To Save On A Cassette Tape

Be sure to follow these instructions carefully.

1. Place a blank tape in the program recorder and close the door.
2. Press **REWIND** to get to the beginning of the tape.
3. Press **PLAY** to move the tape forward until the counter has moved 4 or 5 numbers. Then press **STOP-EJECT.**
4. Reset your counter to 0000. You are now ready to SAVE your program.
5. Type the letters CSAVE on your computer and press RETURN. The computer will give you two beeps. This reminds you to press both the **PLAY** and the **RECORD** keys on your program recorder.

6. Press both keys down firmly and hold them down until they stay. Now press [RETURN] again on the keyboard, and the recorder will begin copying the program from the computer.

7. The cursor will disappear while the recorder is running. When the program has been copied, the recorder will stop and READY will appear on the screen with the cursor below it. If you get an ERROR message on the screen, press [SYSTEM RESET] on the keyboard, rewind the tape, and try again.

8. Be sure to label your cassette with the name of the program and the counter numbers for the beginning and ending points on the tape.

Play It Again, Sam

It is always a good idea to save all programs twice. You can copy your program again on the same tape. It is wise to have a backup recording in case something happens to the first one. Just move the tape forward 4 or 5 counts, and repeat steps 5 through 8.

To Save On A Disk

If your computer came with a disk drive, you will be saving and loading programs on diskettes.

Information is stored on diskettes in small pie-shaped segments that have been set up on the diskette in advance. This "setup" is called "formatting the diskette". All diskettes must be formatted before they can be used with your computer. You can format your own blank diskettes by using a Master Diskette or you can buy them already formatted. Diskettes that have been formatted before sale will have the

word "Formatted" on the label. Using a formatted diskette, follow these steps.

1. Select a name for your program. Choose a name that has 8 or less letters since that is the longest name the ATARI Computer will accept. Many programs can be saved on a single diskette, so the computer will search the diskette until it finds the program you have named.

2. Turn on the Disk Drive unit. Do not turn on the TV or computer yet! The door to the disk drive should be open. Two lights on the front of the machine will go on. Wait until the top "busy" light goes off.

3. Carefully slide the diskette into the disk drive with the label up and toward you. Close the door.

Special Note

Preparing the disk drive for use must be done with the computer shut off. If you shut off the computer while it still has your program in its memory, the entire program, as said before, will be lost. Therefore, set up your disk drive with a diskette ready to use and leave it on while you are programming. Then when you want to save something you will be able to do it.

4. Type

SAVE "D:name of your program"

and press RETURN .

5. The red "busy" light on the disk drive will go on, and you will hear some noises coming from the disk drive as it SAVES your program.

6. When it has finished, the disk drive will automatically stop and the "busy" light will go off. The "ready" light will remain on.

Remember, saving a program on a diskette doesn't remove it from the computer's memory. The disk drive only copies the program. If you want to work on something different on the ATARI Computer, you must first type NEW to erase the old program in the computer's memory.

IS IT THERE?

To check to see if your program is safely on the diskette, type the letters

DOS

(which stands for Disk Operating System) and press RETURN. The disk drive will turn on and a "Menu" of all the DOS choices will appear on the screen listing the 15 options available to you.

DISK OPERATING SYSTEM II VERSION 2.0S
COPYRIGHT 1980 ATARI

A. DISK DIRECTORY
B. RUN CARTRIDGE
C. COPY FILE
D. DELETE FILE(S)
E. RENAME FILE
F. LOCK FILE
G. UNLOCK FILE
H. WRITE DOS FILES
I. FORMAT DISK
J. DUPLICATE DISK
K. BINARY SAVE
L. BINARY LOAD
M. RUN AT ADDRESS
N. CREATE MEM.SAV
O. DUPLICATE FILE

Option A gives a directory of all the programs on the diskette. Type:

A

and press RETURN.

The screen will immediately show:

DIRECTORY—SEARCH SPEC,LIST FILE

Press RETURN again and you will see a listing of all the programs on the diskette by name. Is yours there?

To load your program back in the computer, type:

LOAD "D:the name of your program"

and press RETURN.

The disk drive will begin to "load" your program back into the computer. When it has finished, you can type:

RUN "D:the name of your program"

to run your program or:

LIST "D:the name of your program"

to have the program as you wrote it printed back on the screen.

The Program's The Thing

You can see that giving instructions to your computer in the program mode has some real advantages. Not only can the program be saved for use later, but you can change part of the directions without having to re-type the whole program. Since the computer knows that it must follow your instructions by starting with the lowest numbered line and working up to the highest numbered line, the order the instructions are typed doesn't matter. Try the following program to prove this to yourself. Remember to press RETURN at the end of every line.

```
NEW
1Ø PRINT "T"
5 PRINT "A"
3Ø PRINT "R"
5Ø END
2ØPRINT "A"
4Ø PRINT "I"
```

Do you remember the word in BASIC that means to start? Yes, you must type

RUN

and then, as always, press RETURN .

The computer "ran" the print statements starting at 5 and going to 50 even though that was not the order in which they were typed.

Now for another interesting bit of information list your program again. Yes, type

LIST

and press RETURN .

Now you can see that the computer has rearranged the instructions in order according to the line numbers.

I Hear You

One of the reasons that you'll be glad you have an ATARI Computer is that the ATARI can also "sing" to you. The ATARI Computer can play up to four different sounds at a time. That's enough for a barbershop quartet!

The sound statements used in a program can also be used to make sounds like whistles, explosions, airplanes, and so on. Each note produced requires 4 numbers; one each for voice, note, tone, and volume. Try the following program. Remember to press RETURN after each statement. Type the **word**

RETURN

in lines 310 and 410 before pressing the RETURN key.

```
NEW
1Ø PRINT "ON TOP OF OLD SMOKEY"
2Ø  SOUND Ø,144,1Ø ,8
25 GOSUB 3ØØ
3Ø SOUND Ø,Ø,1Ø ,8
35 SOUND Ø,144,1Ø,8
4Ø GOSUB 3ØØ
45 SOUND Ø,114,1Ø,8
5Ø GOSUB 3ØØ
55 SOUND Ø,96,1Ø,8
6Ø GOSUB 3ØØ
65 SOUND Ø,72, 1Ø, 8
7Ø GOSUB 4ØØ
75 SOUND Ø,85,1Ø,8
8Ø GOSUB 4ØØ
85 SOUND Ø,Ø,1Ø,8
9Ø GOSUB 3ØØ
95 SOUND Ø,85,1Ø,8
1ØØ GOSUB 3ØØ
1Ø5 SOUND Ø,108,1Ø,8
11Ø GOSUB 3ØØ
115 SOUND Ø,96,1Ø,8
12Ø GOSUB 3ØØ
125 SOUND Ø,85,1Ø,8
13Ø GOSUB 3ØØ
135 SOUND Ø,96,1Ø,8
14Ø GOSUB 4ØØ
2ØØ END
3ØØ FOR P = 1 TO 1ØØ
31Ø NEXT P:RETURN
4ØØ FOR P = 1 TO 3ØØ
41Ø NEXT P: RETURN
```

Turn up the volume on your TV monitor. Now type RUN and press RETURN. Okay, so it isn't the London Symphony, but it's better than your old typewriter! Would you like to try a sound program of your own?

You'll notice that there are a series of SOUND statements followed by GOSUB statements and some FOR-NEXT lines after the END statement. You will learn more about the FOR-NEXT in the next chapter. Let's examine how the SOUND statements work.

Look at line 20.

```
2Ø SOUND Ø,144,1Ø,8
```

The first number names the "voice" the ATARI Computer will activate; the range is 0-3. If we wanted to create a chord effect, we could use up to 4 voices at a time. A separate sound statement would be needed for each.

The second number names the note. For example, 72 is "A" above middle "C" and 121 is middle "C". In line 20, 144 is "A" below middle "C". A table of pitch values is shown on page 85.

The third number is the tone; the range is even numbers from 2 to 14. Ten is a pure musical tone and 12 is a buzzing sound. Varying this 3rd number creates special effect sounds like engine sounds and sirens.

The last number in the sound statement is for volume. It can be a number between 1 and 15. Number 1 is very soft and number 15 is loud. "Normal" volume is 8. For fun you can vary the volume to create loud and soft musical effects.

Now that you know how the SOUND statements work, what about all those GOSUB statements? The GOSUB 300 tells the computer to go to line 300 and use the information there. Lines 300 and 310 tell the computer to pause, thereby "holding" the note, and then return to continue at the next regular line and play the next note. The GOSUB 300 holds the note to a quick count of 100; the GOSUB 400 holds the note to a count of 300.

Without these GOSUB routines, the notes would play so fast that you would hear only a slight beep from the computer.

Now you have the information to create your own sound program. Try it, you'll like it! Don't forget to include line numbers for each statement and press RETURN after you have typed each line. Use an END statement to tell the computer when to turn off the sound. When you have entered all lines of your program, turn up the volume on the TV/monitor. Type RUN and press RETURN.

Happy experimenting. This may be the start of a new hobby for you!

Note Values For The Musical Notes

HIGH NOTES	C	29
	B	31
	A# or B♭	33
	A	35
	G# or A♭	37
	G	40
	F# or G♭	42
	F	45
	E	47
	D# or E♭	50
	D	53
	C# or D♭	57
	C	60
	B	64
	A# or B♭	68
	A	72
	G# or A♭	76
	G	81
	F# or G♭	85
	F	91
	E	96
	D# or E♭	102
	D	108
	C# or D♭	114
MIDDLE C	C	121
	B	128
	A# or B♭	136
	A	144
	G# or A♭	153
	G	162
	F# or G♭	173
	F	182
LOW NOTES	E	193
	D# or E♭	204
	D	217
	C# or D♭	230
	C	243

And now just for fun, try this sound graphics program, but warn your dog before you RUN it. We'll talk about how this program works in the next chapter.

```
NEW
10 FOR X = 0 TO 255
20 POKE 710,X
30 SOUND 1,X,10,15
40 NEXT X
50 GOTO 10
```

Type

RUN

and press RETURN.

When you have heard ENOUGH!, press the SYSTEM RESET.

LOOP DE LOOP

Here We Go Again

Do you remember this program from the last chapter?

```
10 REM LAUGHTER LOOP
20 PRINT "HA, HA, HA, HO, HO, HO";
30 GOTO 10
```

The GOTO statement in line 30 in this program had the computer "going around in circles". This is an "infinite" or never-ending loop. It will never stop until a human presses BREAK or until there's a power failure. The idea of a loop or a process that repeats itself can be very handy in writing a program. It is even more useful when we can write a loop that we are able to control and start or stop without hitting BREAK. We can do that by using a limited loop.

Before we "loop-a-long" to the next program, what about that strange word in line 10? REM represents the first three letters of the word remark. A REMark is a way to make a comment or a note inside a program to yourself or to another person who may be reading your program. The computer will ignore the REM and go on to line 20 because REM is a note to a person only. The only time a REM shows is when you or someone else has the computer LIST the program. Good programs have lots of REMarks to help people review the organization of the program. That means, of course, that you will want to include *REM*arks in your programs.

FOR-NEXT Loops

To write a program to have the computer count to ten you *could* use this program:

```
1Ø REM COUNTING THE HARD WAY
2Ø PRINT "1"
3Ø PRINT "2"
4Ø PRINT "3"
5Ø PRINT "4"
6Ø PRINT "5"
7Ø PRINT "6"
8Ø PRINT "7"
9Ø PRINT "8"
1ØØ PRINT "9"
11Ø PRINT "10"
12Ø END
```

To see the program, type the letters

```
RUN
```

and press RETURN. It would take you a lot longer to type that program than for the computer to follow it.

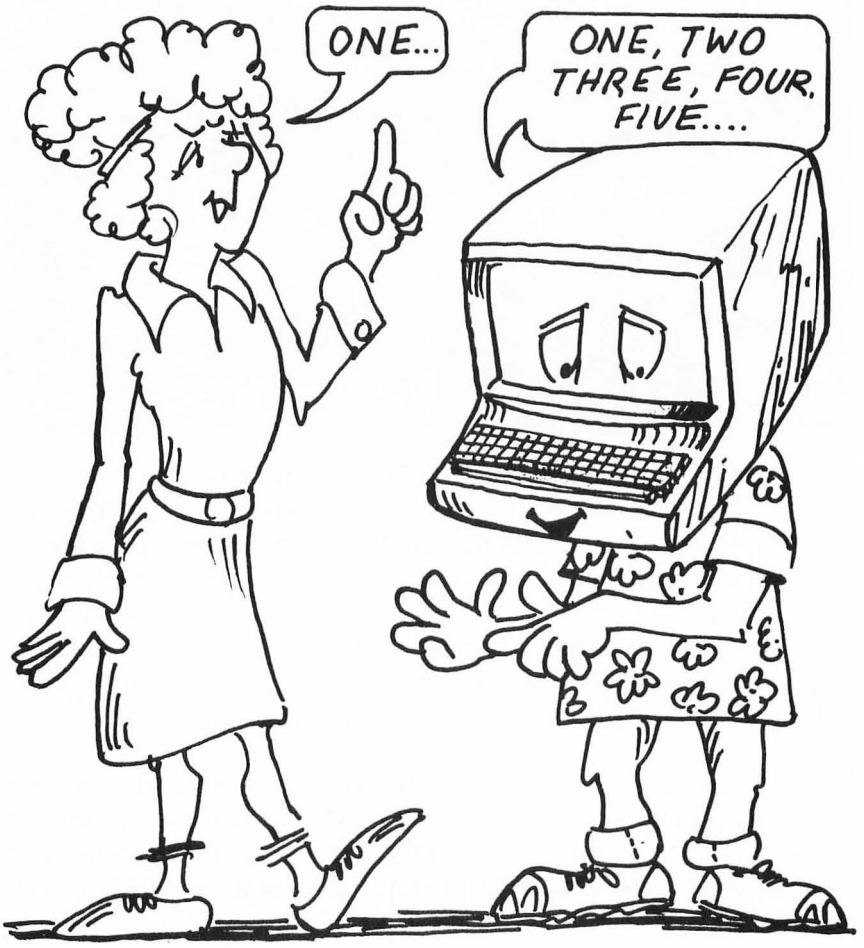
You probably noticed the "could" before the program was italicized. Did you think, "Ah, there's a shortcut coming!" You are right; a FOR-NEXT loop will do the job in short order. Try this:

```
NEW
1Ø REM COUNTING SHORTCUT
2Ø FOR N = 1 TO 1Ø
3Ø PRINT N
4Ø NEXT N
5Ø END
```

If you think you can count quickly, the computer challenges you to a race. Type the letters

RUN

and when you press RETURN ,start counting out loud as fast as you can! Ready, set, go! Did you make it to three or four by the time the computer got to 10? That's about right for a human.



Now let's see how this FOR-NEXT loop works. LIST the program.

1Ø REM COUNTING SHORTCUT	Line 10 is a REMark and is skipped over by the computer.
2Ø FOR N = 1 TO 1Ø	Line 20 is the FOR part of the loop. It sets the range, telling the computer where to start and where to stop. In this case you are telling the computer to start at one and stop at ten.
3Ø PRINT N	Line 30 tells the computer to print the numbers (N) on the screen. Without this line the computer could count just as quickly, but you would not see the results. The first time the computer prints "1".
4Ø NEXT N	Line 40 says to the computer, "After you have printed the first N (number), go on to the next N." The computer loops back to line 20, picks "2", and goes on to line 30 again. The computer prints "2" and comes again to line 40. Once again line 40 sends the computer back to line 20. This continues until the computer prints "10" and all the N's are "used up".
5Ø END	Line 50 is finally reached; it tells the computer that it can stop.

Of course, the N doesn't have to start with one. The computer will start wherever the program tells it to begin. If we enter a new line 20, it will take the place of the old one. Type this:

2Ø FOR N = 1ØØ TO 2ØØ [RETURN]

Now clear your screen by holding down the SHIFT key and pressing [CLEAR], and list your program again. Your new line 20 in the program has been substituted for the old one. RUN this program with the change to see it work.

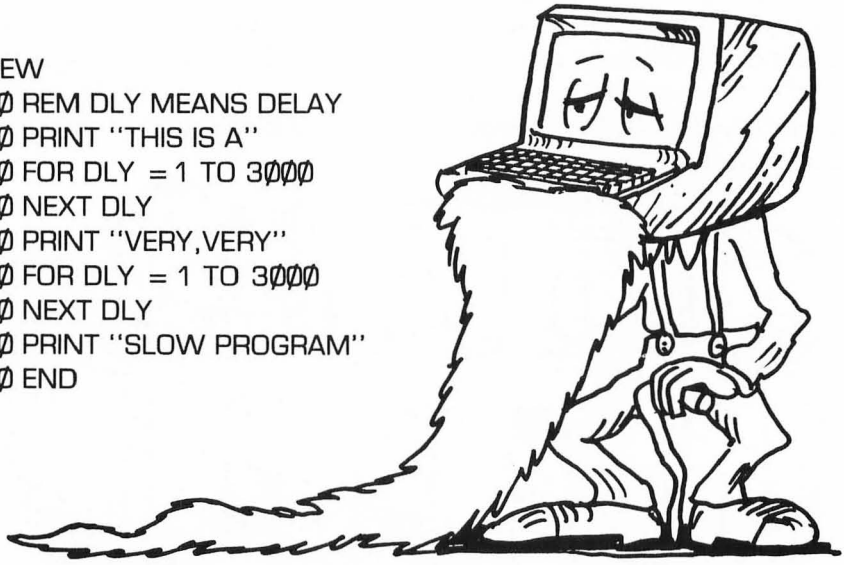
Kind of reminds you of how fast a gas pump adds up the bill while it is pumping fuel into a car, doesn't it?

Delays

How can we use this FOR-NEXT idea? Clear your screen again by holding down the SHIFT key and pressing CLEAR (<). Now type the following.

Remember to press RETURN after each line.

```
NEW
1Ø REM DLY MEANS DELAY
2Ø PRINT "THIS IS A"
3Ø FOR DLY = 1 TO 3ØØØ
4Ø NEXT DLY
5Ø PRINT "VERY,VERY"
6Ø FOR DLY = 1 TO 3ØØØ
7Ø NEXT DLY
8Ø PRINT "SLOW PROGRAM"
9Ø END
```



How does this work? The FOR-NEXT loops on lines 30, 40 and lines 60, 70 cause the computer to stop and count to 3000 before going on to the next lines. The result is a delay while the computer follows its master's orders to count as high as asked.

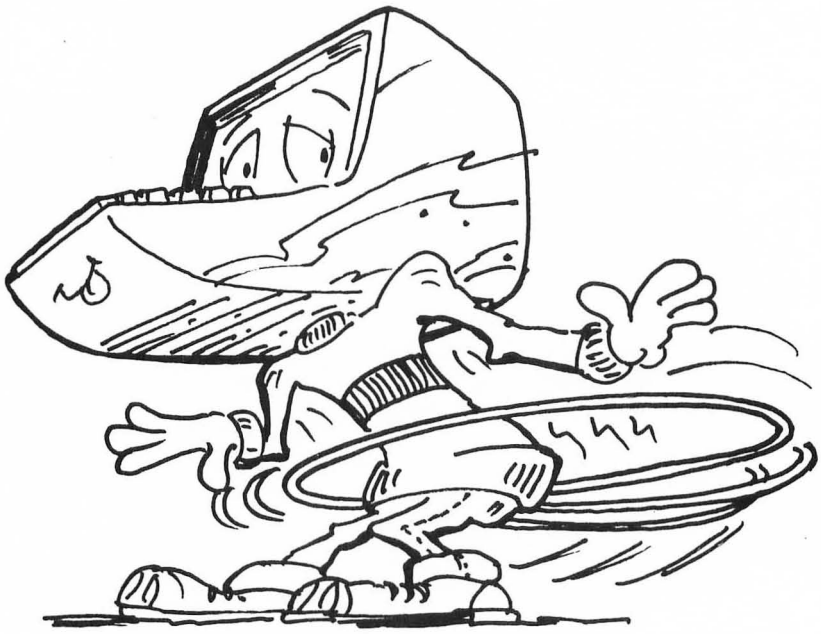
FOR and NEXT must always be used together in a program. Neither statement will work without the other somewhere in the program. FOR and NEXT are often on different lines. The letter or letters used following a FOR must also be used following the NEXT. For example a FOR *N* = 1 TO 100 must have a NEXT *N* somewhere in the program. In other words, FOR and NEXT must name the same thing.

Sometimes a program uses two loops, one inside the other. Try this one. You may want to first clear your screen again.

```
NEW
10 REM NESTED LOOPS
20 FOR ROWS = 1 TO 10
30 FOR COL = 1 TO 25
40 PRINT " * ";
50 NEXT COL
60 PRINT
70 NEXT ROWS
80 END
RUN
```

(Use the space bar to leave a space on either side of the asterisk)

Do you see stars? In this program lines 30 and 50 are a loop for columns of stars "inside" the loop in lines 20 and 70 that count the rows.



Graphics Loops

Can you, the ATARI Computer Master, use the loop idea in a graphics or drawing mode? Yep! Try this:

```
NEW
10 REM VACATION COTTAGE
20 GRAPHICS 3
30 COLOR 1:SETCOLOR 0,0,6
40 FOR D = 1 TO 1000:NEXT D
50 PLOT 10,18:DRAWTO 24,18
60 FOR D = 1 TO 500:NEXT D
70 FOR P = 10 TO 18
80 PLOT 25,P:DRAWTO 30,P
90 NEXT P
100 PLOT 27,9:DRAWTO 28,9:PLOT 27,8:DRAWTO 28,8
110 FOR D = 1 TO 500:NEXT D
120 COLOR 2:SETCOLOR 1,12,8
130 FOR H = 16 TO 17
140 PLOT 10,H:DRAWTO 20,H:PLOT 24,H
150 NEXT H
160 FOR X = 13 TO 15
170 PLOT 10,X:DRAWTO 12,X:PLOT 15,X:DRAWTO 20,X:
    PLOT 24,X
180 NEXT X
190 PLOT 10,12:DRAWTO 24,12
200 FOR D = 1 TO 500:NEXT D
210 COLOR 3:SETCOLOR 2,15,2
220 PLOT 9,11:DRAWTO 24,11:PLOT 31,11
230 PLOT 11,10:DRAWTO 24,10
240 PLOT 13,9:DRAWTO 26,9
250 PRINT
260 PRINT "(9 spaces) MY VACATION COTTAGE"
270 GOTO 270
RUN
```

Press SYSTEM RESET to stop the program, as it ends with a continuous loop at line 270. This will also put the computer back into text mode.

GRAPHICS 3 allows you to use 3 different colors. Can you find the three lines in the program that chose the 3 colors in the cottage? That's right, lines 30, 120 and 210.

Our cottage, like any building, is built in stages. First the foundation, then the chimney, then the walls, and finally the roof is built. This is written into the program by using "delay" statements between each stage of construction. Locate the four delay statements.

Good! You found them on lines 40, 60, 110, and 200. How far did the computer have to count before it could go on to each delay? You are right if you said 1000 for the first delay and 500 for the last three.

The key to this program is the use of FOR-NEXT loops. Without them, the program would be almost twice as long because every single line of construction would be a line in the program. The fireplace alone would need 11 lines of instruction. Can you find all seven FOR-NEXt loops? Remember, each "delay" statement is a FOR-NEXT loop. There are three more of them.

Aren't you impressed by how fast the computer built your "vacation cottage"? You provided it with all the materials of a program and the computer didn't have to hire any help. If you were to build a real cottage, you would be sure to run into many more "delays".

Now You Know

Remember the program that mixed wild sounds and colors? That program works because it contains a FOR-NEXT loop. Here it is again:

```
NEW
10 FOR X = 0 TO 255
20 POKE 710,X
30 SOUND 1,X,10,15
40 NEXT X
50 GOTO 10
```

To stop this program press the SYSTEM RESET key.

You can see that the program works because of the FOR-NEXT loop in lines 10 and 40. The family dog may not like loop programs after that one! Now is the time for you to try using the FOR-NEXT loop. Try some programs of your own using the ones given here as a guide. Some suggestions follow. Loop back this way when you are ready to go on.

- Write a program that will tell the computer to print your first name, wait a few seconds, and then print your last name.
- Write a program that instructs the computer to print READY - SET - GO with short delays between each word, and then count to ten very slowly.
- Write a graphics program where the computer is instructed to draw a geometric figure like a square or rectangle with built-in delays between each line of construction.

If The Conditions Are Right

Many activities in our lives are influenced by other things. *If* there is snow, *then* we'll go skiing. *If* we can get tickets, *then* we'll go to the game. *If* you pay your income tax, *then* you won't go to jail! A computer program can be written to do something if the conditions are right by the use of another type of loop called an IF-THEN statement. Try this program. Clear the screen first.

```
NEW
10 REM IF-THEN TWINS
20 N = 1
30 PRINT N
40 N = N + 1
50 IF N<11 THEN GOTO 30
60 END
RUN
```

Let's follow the computer step by step to see how this works.

Line 10: A remark to humans; the computer goes on to 20.

Line 20: Tells the computer that the number (N) is equal to one. (Any letter can be used here as long as the same letter is used all through the program.)

Line 30: Says to print the number on the screen; the computer dutifully prints 1.

Line 40: Changes the value of N; this time it adds 1 to 1 to make 2.

Line 50: It's decision time; Line 50 tells the computer "*IF* your number is less than 11, *THEN* go back to line 30." The computer can't think, but it knows its numbers; two is less than 11 and so it returns to line 30, as its Master wishes.

At this point the computer recycles or "loops" again and again. At line 30 it prints; at line 40 it adds one; at line 50 it "tests" each new number to see if it is less than eleven. This looping continues until N (the number) is 11. Eleven is *not* smaller than 11 and so the computer can go on to line 60 (or the next line in the program).

Line 60: Tells the computer that the program is finished.

All this happens very quickly, of course, because the computer hurries to do as its Master bids. If you want to slow down you program, you can enter a "delay" statement.

More IF-THENS

You can use this idea in other interesting ways. Try this program. Remember to type NEW first to wipe out the old program.

```
NEW
1Ø REM COIN FLIPPER
2Ø FOR N = 1 TO 5
3Ø A = INT(2*RND(1))
4Ø IF A = Ø THEN PRINT "HEADS":GOTO 3Ø
5Ø IF A = 1 THEN PRINT "TAILS"
6Ø NEXT N
7Ø END
RUN
```

You can see a FOR-NEXT loop allows the computer to "toss a coin" in lines 20 and 60. Line 30 is a formula that tells the computer to pick either the number zero or the number one. Lines 40 and 50 tell it what to do if it picks a zero and what to do if it picks a one. The computer keeps "flipping" until it has picked "tails" five times. Then the program ENDS happily. Run this program several times and you will find that the computer is randomly selecting HEADS and TAILS.

A Computer Game To Play

Let's try a program where you can play too. Enter this program by typing each line including the line number. Remember to press RETURN after each line, but only when each line is complete. If a line is too long, just keep typing and the ATARI will move the cursor to the next line.

```
NEW
10 REM NUMBER GUESSING GAME
20 X = INT(100*RND(1)) + 1
30 PRINT
40 PRINT "I'M THINKING OF A NUMBER FROM 1 TO 100"
50 PRINT
60 PRINT "TRY TO GUESS MY NUMBER!"
70 PRINT
80 PRINT "WHAT'S YOUR GUESS?"
90 PRINT
100 INPUT G
110 PRINT
120 IF G < X THEN PRINT "TOO SMALL. TRY A BIGGER NUMBER"
    :GOTO 100
130 IF G > X THEN PRINT "TOO BIG. TRY A SMALLER NUMBER"
    :GOTO 100
140 IF G = X THEN PRINT "RIGHT ON! YOU GUESSED MY
    NUMBER."
150 END
RUN
```

If the program does not work, type LIST and list your program on the screen. Now compare it to the program given above to see if you made any errors or forgot anything.

The screen below shows an example of the above program. The numbers following the question marks (?) are guesses input into the program.

```
I'M THINKING OF A NUMBER FROM 1 TO 1ØØ.

TRY TO GUESS MY NUMBER!

WHAT'S YOUR GUESS?

?75

TOO BIG: TRY A SMALLER NUMBER

?37

RIGHT ON!  YOU GUESSED MY NUMBER.
```

Try playing this number guessing game a few times, and then let's see how the master's instructions work.

Line 10 is a remark to yourself.

Line 20 is a formula that tells the computer to choose a random number between 1 and 100.

Lines 30, 50, 70, 90, and 110 put in blank lines.

Lines 40, 60 and 80 each print a message on the screen.

You will notice that line 100 is a new statement. The INPUT statement tells the computer to wait right here until the person playing the game enters some information, in this case a number guess. The screen shows a question mark followed by the cursor. The computer will wait patiently for as long as necessary for the player to enter his guess.

Lines 120, 130, and 140 compare the player's guess (G) to the number chosen by the computer (X) at line 20. The symbol < means smaller than, and > means larger than. Lines 120 and 130 end with a GOTO statment that sends the program back for another guess after first giving a clue. If the guess and the number chosen by the computer are the same, then the computer prints "Right on! You guessed my number".

The program then ends at line 150.

If you wanted to change the program so that a person could play the game over and over, you could add this statement:

```
15Ø GOTO 2Ø
```

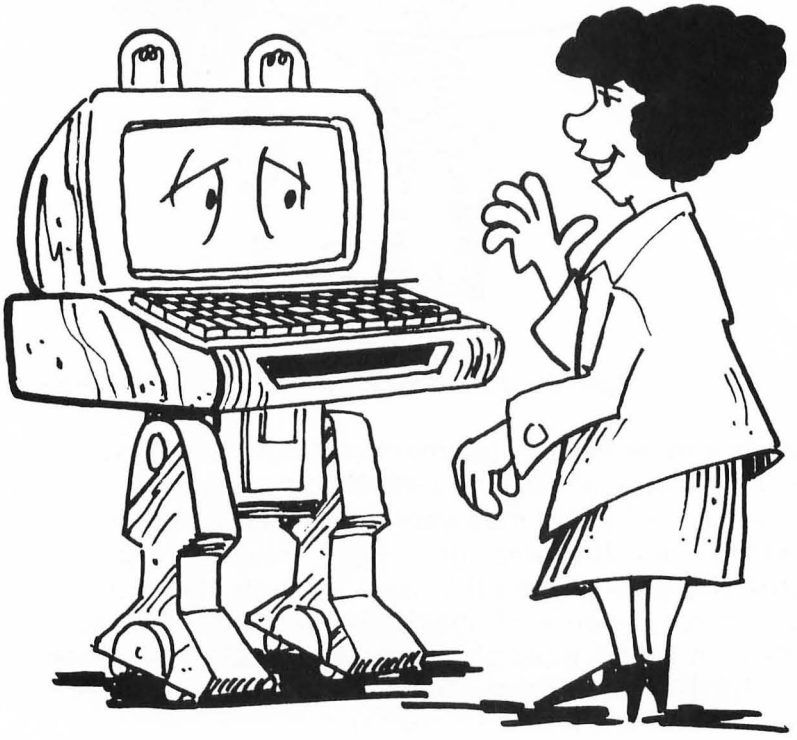
This would tell the computer to go back to line 20, pick a new number, and play again. This might be a program that

you would like to SAVE so that you can play it another day. Look back to page 75 in Chapter Four for how to SAVE a program.

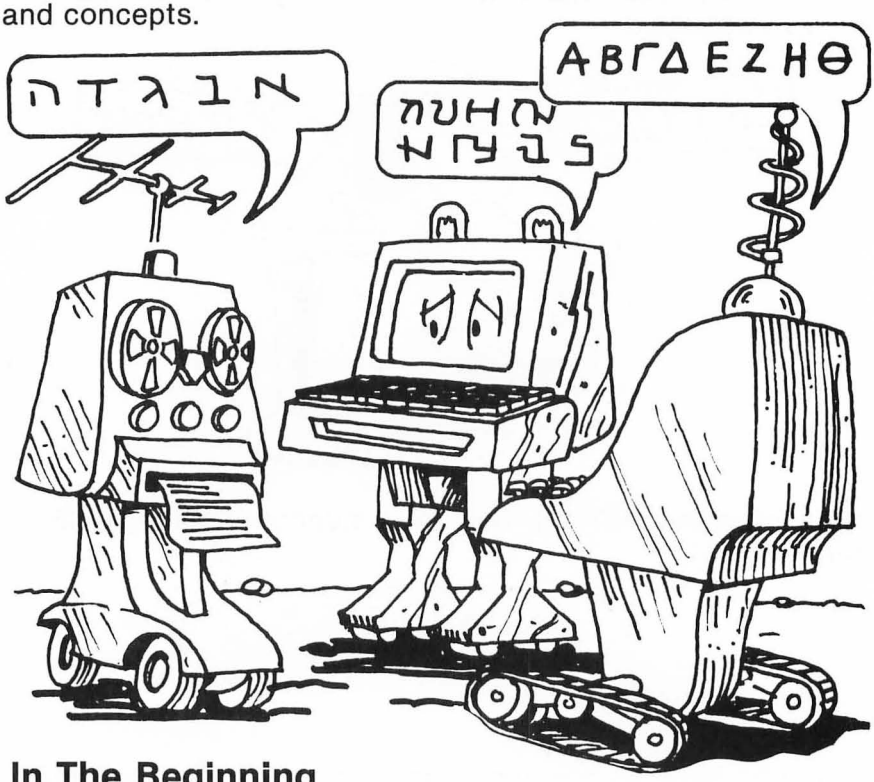
IF you like loops, THEN you loved this chapter. As ATARI "Master", you can now put your computer through the "loops".

COMPUTER LANGUAGES

You have discovered, ATARI Master, that computers are not able to function unless a person provides the directions. Computers need instructions in the form of programs for every task. Some of these programs are built into the computer when you buy it and are stored in the computer's memory (in the ROM) ready to use. These instructions tell the computer how to respond to your commands, perform all arithmetic operations and perform other fundamental tasks that you might take for granted. These built-in programs also include instructions which allow you to communicate with the computer in an English-like language.



There are many different languages with which people can communicate with their computers, just as there are many different languages used by people from different parts of the world. These languages developed because people wanted to convey different ideas that involved a unique variety of terms and concepts.



In The Beginning

The very first computers were programmed simply by the way the various parts were connected. A new idea was communicated to the computer simply by changing some of the connections. Information was held in vacuum tubes and later in transistors by a simple code based on whether the vacuum tube was turned on or off. Thus everything in the computer had to be written in a code that had only two symbols such as + and - or ∅ and 1. Can you imagine trying to write a message to a friend in a secret code with only two symbols?

Assembly Language

The computer itself still understands only the two symbols, Ø and 1, called BInary digiTS or BITS. People don't think in a language like that, and writing a coded page filled with zeros and ones without making a mistake is difficult, so easier ways to "talk" to the computer were invented. Assembly language code is easier for people because it uses more symbols, letters and numbers. The computer translates this code into zeros and ones and follows the instructions. This code works very well for people who program computers regularly. For beginning computer users this code appears strange, secret and difficult tc use.

Typical code in assembly language looks like this:

```
ØØ3B1   F6   EF   F4   LDB
ØØ3B4   C5   Ø2        BITB
ØØ3B6   27   F9        BEQ
ØØ3B8   84   7F        ANDA
ØØ3BA   B7   EF   F5   STA
ØØ3BD   39             RTS
```

This particular routine checks whether a character has been typed on the keyboard, waits until one is typed and then puts that letter or number on the screen. If you type this program into the ATARI Computer, you will get an ERROR message because it does not understand.

Computer languages that use familiar words and symbols are known as high level languages. They were developed beginning in the 1960's. In these high level languages, every word represents an entire series of instructions for the computer. Each word entered into the computer refers to a sequence of instructions already stored in the ROM as "low level" computer code similar to the assembly language routine already described.

FORTRAN

The very first high level language, FORTRAN, remains one of the more popular computer languages and is now available on some microcomputers. FORTRAN means FORmula TRANslation because everything in this language is based on the use of mathematical formulas. FORTRAN is primarily used by scientists and mathematicians. A strength of the FORTRAN language is that the computer can run a FORTRAN program very quickly.

Here is a sample of a FORTRAN program designed to analyze a True-False questionnaire of 50 questions.

```
      LOGICAL ANS (5Ø)
      READ (5,1ØØ) ANS
      KOUNT = Ø
      DO 1Ø I=1, 5Ø
      IF (ANS (I) ) KOUNT = KOUNT + 1
   1Ø CONTINUE
      WRITE (6,2ØØ) KOUNT
      STOP
  1ØØ FORMAT (5Ø L1)
  2ØØ FORMAT (1X, I3)
      END
```

BASIC

As you already know, the language you used is BASIC. BASIC stands for Beginner's All-purpose Symbolic Instruction Code. Most microcomputers use the BASIC language,but it was not originally intended to be a programming language. In 1963 a group at Dartmouth College wrote BASIC as a program to help non-mathematics students learn about the computer. BASIC was so successful that it grew into a language of its own. BASIC is easy to learn and convenient for programmers to write,but it's not as fast for the computer to use as some other languages.

Here is a sample of a BASIC program.

```
NEW
1Ø PRINT "HI,WHAT IS YOUR NAME?"
2Ø INPUT N$
3Ø PRINT "DO YOU HAVE A FRIEND WITH YOU?"
4Ø INPUT A$
5Ø IF A$ = "YES" THEN 1Ø
6Ø PRINT "TOO BAD, GOOD-BYE ";N$
7Ø END
```

Try this on the ATARI Computer now. It will work for you because the ATARI Computer speaks BASIC with the BASIC LANGUAGE CARTRIDGE in the left hand slot. Press RETURN at the end of each line. Type RUN and press RETURN to see it work.

There are other languages available for microcomputers and someday you may want to learn another one. Each computer language has its own characteristics and specific strengths.

PILOT

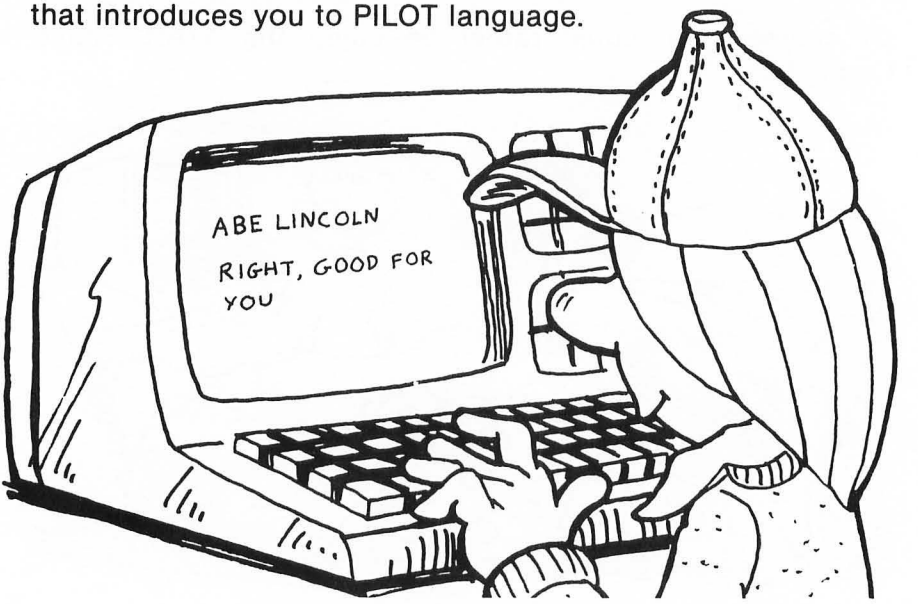
PILOT was originally designed for teachers to write instructional material. The name itself stands for Programmed Inquiry Learning Or Teaching. With the PILOT language a teacher can easily ask questions, receive and check answers, and give varied responses. The language also includes ways of presenting material on the screen in an interesting way. There are several versions of PILOT available for microcomputers. Since the commands in PILOT are one or two letters only, it is an ideal language for beginners. Some simplified versions of PILOT are designed to be an introductory language for beginners. When programming in PILOT, you can do graphics by the use of an imaginary turtle on your screen that follows your directions to draw.

A program written in PILOT looks like this:

```
1Ø R: CONDITIONAL MATCH PROGRAM
2Ø T: WHO WAS THE 16TH PRESIDENT OF THE UNITED STATES?
3Ø A: $P
4Ø M: ABRAHAM LINCOLN, LINCOLN, ABE LINCOLN
5Ø TY: RIGHT! GOOD FOR YOU.
6Ø TN: NO, THE ANSWER IS ABRAHAM LINCOLN.
7Ø T: COME BACK LATER FOR ANOTHER PRESIDENT QUESTION.
8Ø E:
```

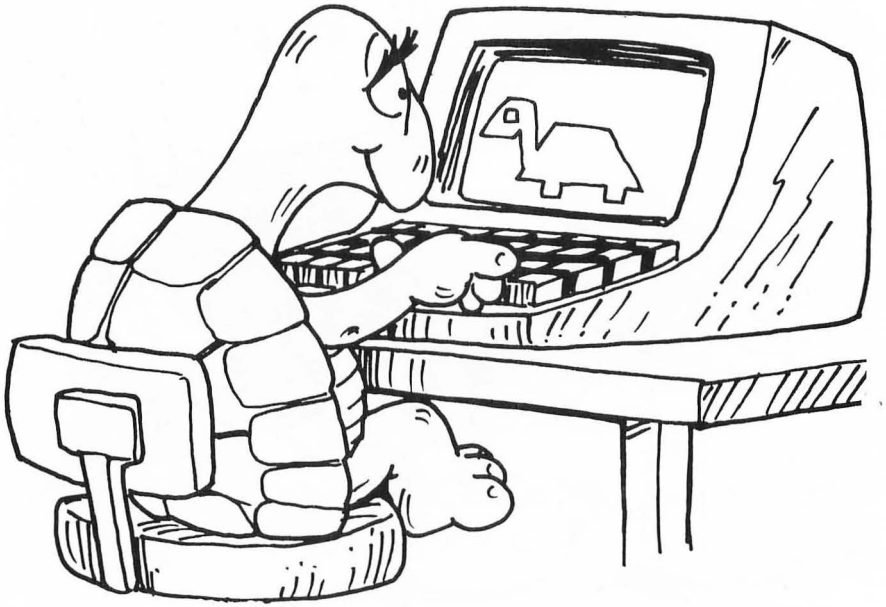
This program prints the question on the screen and waits for an answer. When the answer is given, the program checks to see if it matches the correct answer. The response to the student depends on whether the answer is a match or not a match.

The PILOT language is available for the ATARI Computer in a cartridge. The cartridge is packed with an instruction book that introduces you to PILOT language.



LOGO

LOGO is another language available on many microcomputers. A special part of LOGO called Turtle Graphics has been included in other languages and is available on even more computers. LOGO is quite different from PILOT and BASIC. You can write routines in LOGO with just a few commands and then build the language to fit your ideas by defining your own terms. You begin to "teach" the computer the language you want it to know.



A procedure written in LOGO looks like this:

```
TO SQUARE :SIDE
REPEAT 4 (FORWARD :SIDE RIGHT 90)
END
```

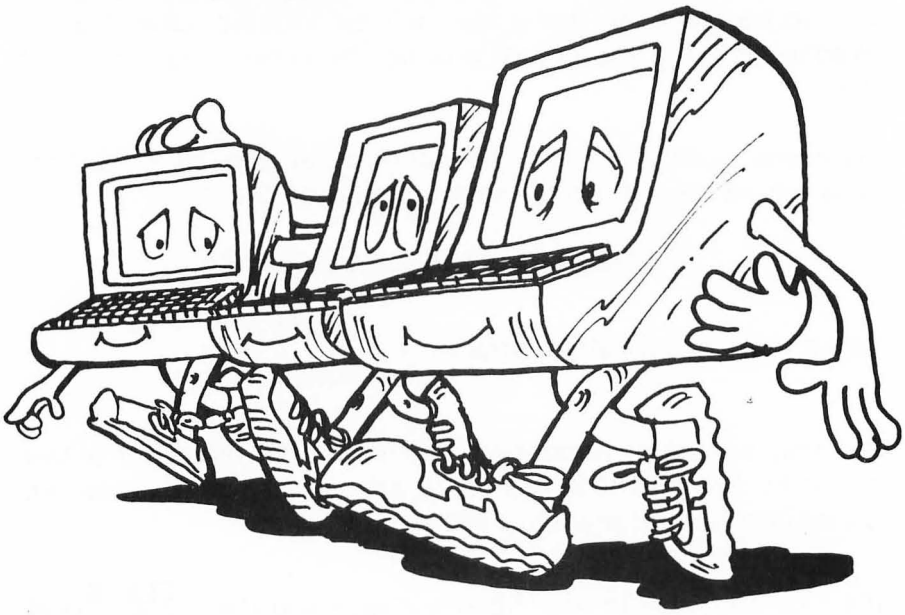
This program will draw a square of any size you choose on the screen. For example, the command SQUARE 10 will make a square with 10 units on a side.

LISP

LOGO was derived from the language called LISP, which is very different in appearance from most of the other languages. For example, (Times 9 3) would put 27 on the screen. After entering

(SET'FRIENDS' (DICK JANE SALLY))

into the computer, [DICK JANE SALLY] would appear on the screen when you typed FRIENDS!



PASCAL

Another language that is commonly used with microcomputers is PASCAL. This is a relatively new language compared to BASIC and FORTRAN. You may want to learn PASCAL and become a programmer. PASCAL was named for Blaise Pascal, the French mathematician who designed the first mechanical adding machine while he was still a teenager.

PASCAL is called a structured language and looks quite different from the other languages discussed previously. Once you're familiar with PASCAL, however, it is very easy to read. PASCAL was designed to write very large programs and for teams of programmers working together on a large project. One of the advantages of PASCAL is that it runs more quickly in the computer than BASIC. You can do many things more easily with PASCAL than with BASIC, but it is a more complicated language to learn.

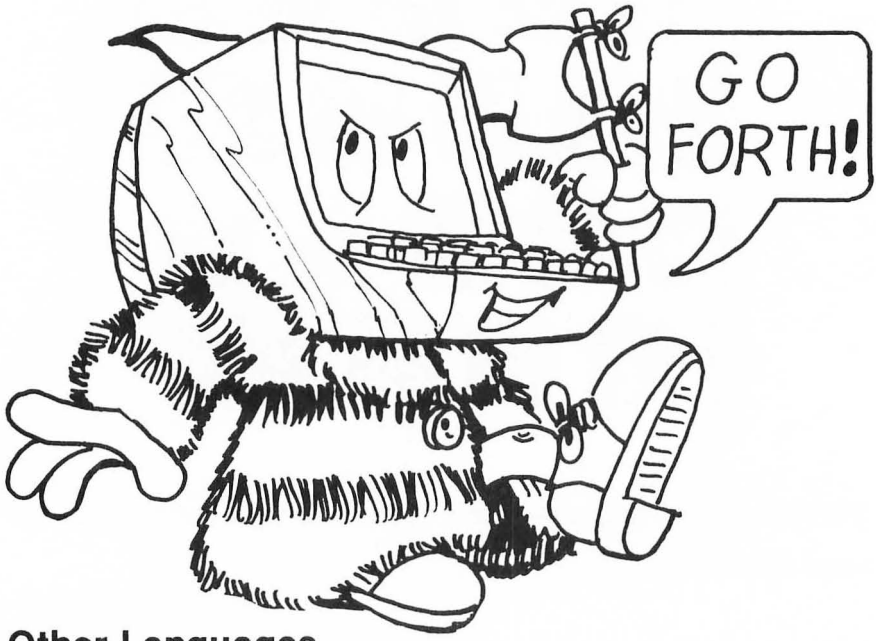
A PASCAL program that instructs the computer to print the squares of the numbers from 1 to 1Ø would look like this:

```
PROGRAM SquareNumber (output);
  VAR number:integer;

BEGIN
FOR number := 1 to 1Ø DO
    Writeln (number * number);

END.
```

FORTH

Another language used to write many commercial microcomputer programs is FORTH. It resembles assembly language more than the other high level languages and, as a result, programs written in FORTH run very quickly. It differs from assembly language, however, because you may create new words that the language can understand—words that perform whatever you tell them to.Here is a sample FORTH program that would print HI on the screen five times when you run it.

```
: PRINTHI ." HI" ;
: 5HI 5 Ø DO PRINTHI LOOP ;
```



Other Languages

Some of the other languages you may hear about are mentioned below. Most of these languages are available on the big main frame computers, but may be rewritten for microcomputers in the future.

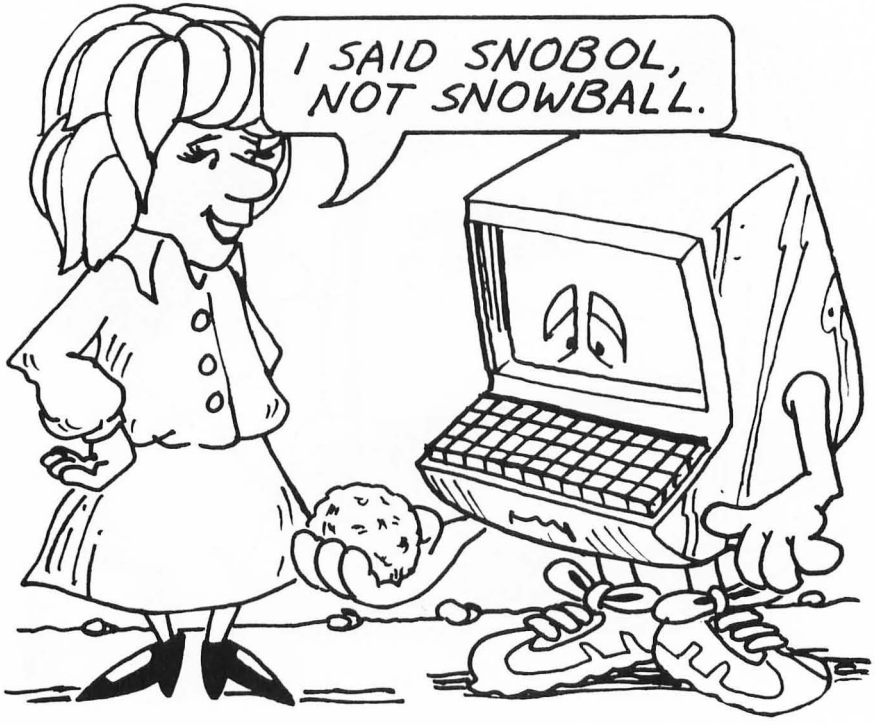
ALGOL, stands for ALGOrithmic Language. It is one of the first high level languages and is rather mathematical. It has many similarities to FORTRAN.

COBOL, COmmon Business Oriented Language, was written for business applications.

ADA is a new language used by the U.S. Department of Defense. It was named after Ada Lovelace, who was a pioneer computer programmer.

PL/1,(Programming Language#1) is an early computer language still used in scientific and engineering problems.

SNOBOL, StriNg-Oriented symBOlic Language, was written especially to handle words—"strings". It is used in artificial intelligence.



LISP is an acronym for LISt Processing and is very different from the others. LISP is the language from which LOGO was derived.

C is the language used to write the popular and powerful UNIX operating system.

Any computer language is just a set of rules for the computer to follow. Each language has its own distinctive style and philosophy. Each has a special purpose and an application for which it is best suited. Many languages were written by individual companies or for particular computers. FORTRAN and PL/1 were written by IBM, while SNOBOL was written at Bell Telephone Labs.

Any computer language is a powerful tool when you learn to use it. Practicing with the language most suited to your needs on the ATARI Computer will increase your enjoyment of this exciting machine. The ATARI Computer will do what you ask when you "speak" a language it understands for *you are its Master!*

APPENDIX

The ATARI Computer has nine graphics modes. The programs that were created in chapters four and five were written in Graphics 3, Graphics 5, and Graphics 7. A grid for planning your plots in Graphics 3 is included in chapter three. On the following pages you will find charts with the grid arrangements for Graphics 1, 2, 4 and 5.

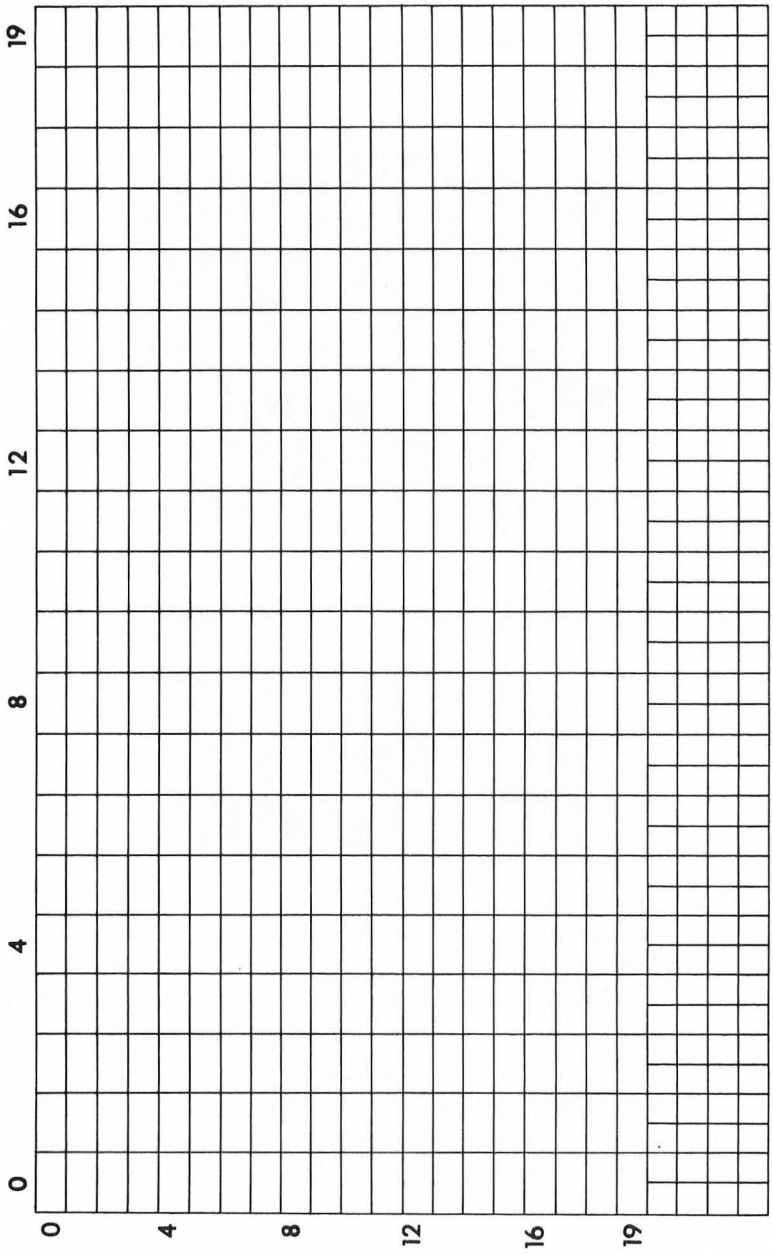
Graphics modes 1 and 2 allow you, ATARI Master, to print large letters on the screen instead of the standard size. Characters printed in Graphics mode 1 are twice the width of regular letters, but are the same height. Characters printed in Graphics mode 2 are twice the width *and* twice the height of regular letters.

Graphics modes 1 and 2 use a PRINT statement followed by a number sign and the number 6 (#6). For some BIG letter fun try the following program. Be certain to have the BASIC cartridge in place before you begin.

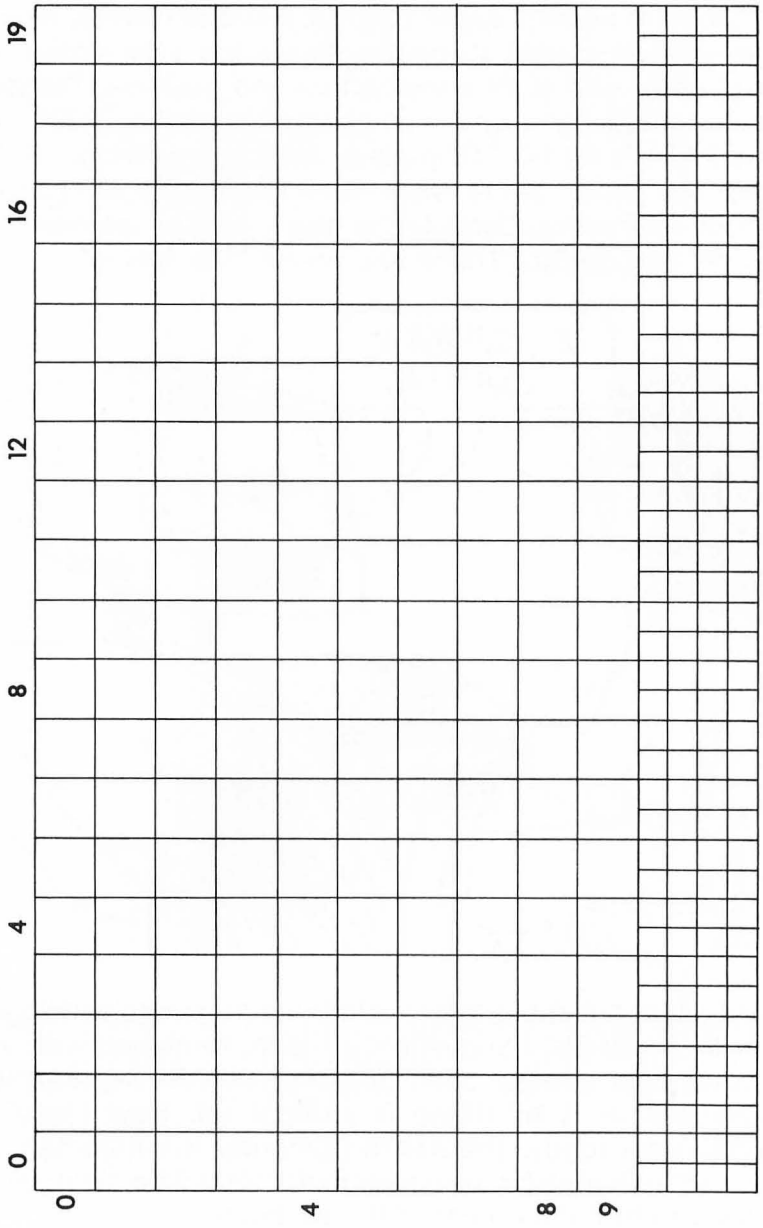
```
1Ø REM LARGE LETTER PROGRAM
2Ø GR.2
3Ø POSITION 1Ø,2
4Ø PRINT #6;"I"
5Ø FOR P= 1 TO 5ØØ: NEXT P
6Ø POSITION 9,5
7Ø PRINT #6;"AM"
8Ø FOR P= 1 TO 8ØØ: NEXT P
9Ø POSITION 4,8
1ØØ PRINT #6;"ATARI MASTER!"
2ØØ END

RUN
```

Type GR.0 [RETURN] to LIST the program. Try the program *without* 30, 60, and 90. Do you see the difference? Lines 30, 60, and 90 place the letters on the screen at specified position. You can move the letters around by changing the position numbers.

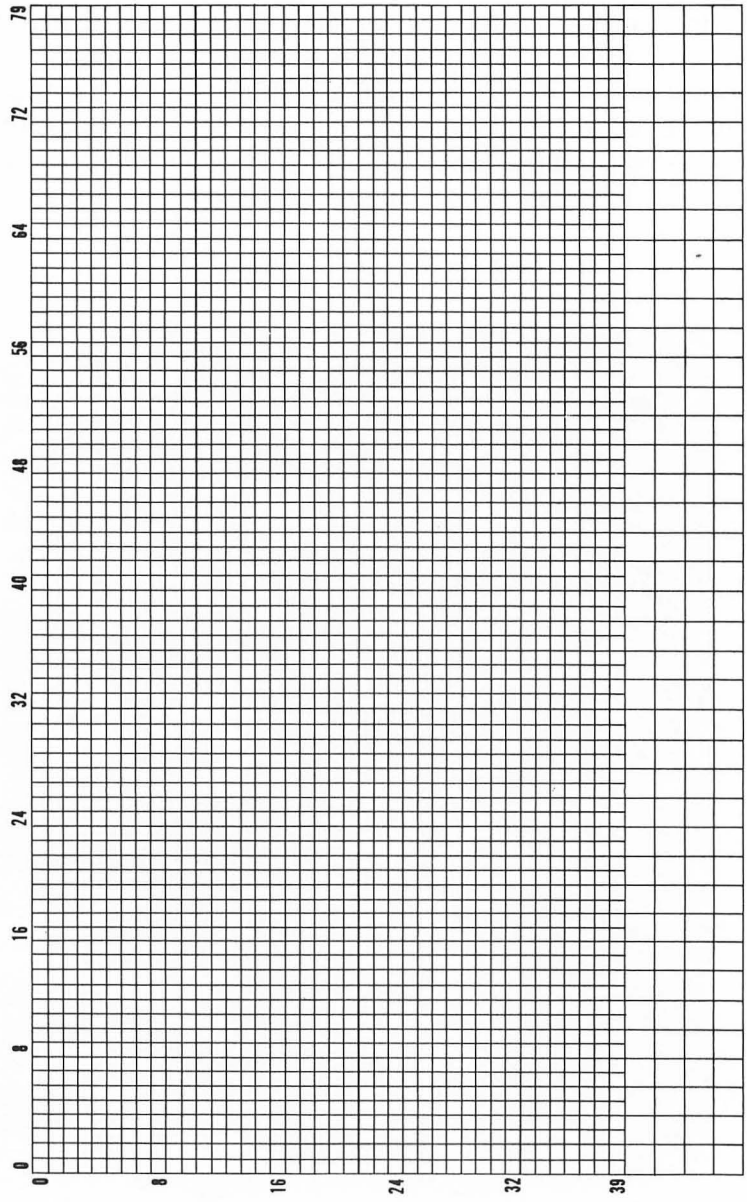
Graphics Mode 1 with Text Window



Graphics Mode 2 with Text Window



Graphics Mode 4 or 5 with Text Window



GLOSSARY

algorithm A procedure for solving a problem or making a decision.

Arithmetic Logic Unit (ALU) The part of the computer that does all the math in the computer.

assignment The storing of a value in the variable using the assignment instruction (variable name = value).

BASIC (Beginner's All Purpose Instruction Code) A programming language.

bug A programming term for an error or mistake.

Cathode Ray Tube (CRT) A picture tube used to show information. One kind of output equipment.

Central Processing Unit (CPU) The part of the computer that interprets instructions and carries them out; the "core" chip of the computer.

character A letter, digit, or other symbol used to represent information (data) for the computer. All symbols that appear on a computer keyboard are characters.

control unit The part of the computer that directs the flow of data or information through the computer.

cursor A square symbol that tells where on the video screen the next character will appear; the "place keeper".

data The information that is put into the computer to be processed by a program or that results when the program is RUN.

debugging The process of finding and correcting the mistakes in a computer program.

disk drive A machine that plays and records on disks and diskettes; one kind of input or output equipment.

diskette A storage material about 5¼" (13.34 cm) or 8" (20.32 cm) across with a magnetic surface for recording. Enclosed in a square, plastic, protective covering.

Disk Operating System (DOS) A set of computer programs that control other programs and allow for the transfer of information from and to a diskette.

editing The process of changing or correcting a program line.

execute To perform or carry out, as to execute (or RUN) a computer program.

flowchart A picture or little map using symbols to show the steps of a program.

graphics Pictures; a way of showing information by pictures rather than by words.

hardware The computer and its parts, as opposed to *software.*

incrementing Increasing the current value of a numeric variable (usually by one).

infinite loop A loop that has no way of ending.

information Organized data used in a computer program.

input Information put into the computer.

input equipment Any of the pieces of equipment used to put information into the computer such as a keyboard, disk drive, program recorder or modem.

instructions Directions for the computer to follow.

keyboard The part of the computer that operates like a typewriter to give input to the computer.

language A set of words and other symbols used to give instructions to a computer.

line number The number in front of program instructions. The computer will normally follow instructions in order of line numbers.

LIST The command to the computer to give a listing of the program in use.

LOAD The command to the computer to take information into the memory unit.

logic The process of breaking down a problem in step-by-step order.

loop A set of instructions that repeats.

loop index The variable used in a loop that stores the number of times the loop has already been executed.

magnetic tape A plastic ribbon that has a chemical coating that can be magnetized. Information can be recorded on magnetic tape and "fed" into the computer's memory.

memory The part of the computer that stores information.

menu A list of options, choices, from which the user may choose.

microchip A tiny circuit etched onto silicon crystal.

mode An operating state of a computer; a method of working.

modem A machine used to allow a computer to receive or send information over a telephone line.

nesting (loop nesting) The method of placing one program loop inside another.

operation One of the basic functions (jobs) a computer can do, such as addition, subtraction, and movement of data.

output The information or results coming out of the computer.

precedence In a computer language, refers to the performance of one type of arithmetic or logical operation before others within the same statement. Among arithmetic operations, exponentiation has the highest precedence, followed by multiplication and division (same precedence), and finally, addition and subtraction (same precedence).

PRINT A statement to the computer to put something on the video screen.

program The set of instructions that tell the computer what to do step by step; to write the instructions that tell the computer what to do.

programmer A person who writes a program, instructions, for a computer to follow.

Random Access Memory (RAM) The part of the computer's memory that stores information temporarily. The computer user puts information into this memory.

Read Only Memory (ROM) The part of the computer's memory that contains built-in instructions. It cannot be used for storage of programs by the person using the computer.

REM A program statement short for remark.

RUN The command to the computer to start or begin.

SAVE The command to the computer to record information to use another time.

software The programs and instructions that go into a computer.

string A series of characters. A string may contain any combination of letters, numbers or punctuation.

subroutine A self-contained set of instructions used outside (after the end) the main program.

syntax error An error caused by a mistake in the way a command or information is given to the computer.

text The writing in a program, as opposed to the graphics.

variable A part of the program that is changeable or may have different values.

video monitor A machine with a CRT screen for showing information; one kind of output equipment.

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