The National LOGO Exchange

ISSN 0734-1717

March 1983 FORWARD 100! Volume 1 Number 7

Burnett's **LOGO** Book is for **Do-ers**

LOGO: An Introduction, by J. Dale Burnett, is a special kind of primer, designed to guide a teacher using LOGO in the classroom. It purports to be neither a text nor a manual, but an introduction to LOGO, and its pedagogy and philosophy.

Throughout the 68-page book, one finds questions such as, "How do you explore a procedure?"; "So what?"; "How much structure do we give to student exercises?"; "What should we as teachers do?"; and "Why do we assume such questions have short answers?" Thus, Burnett brings the reader face to face with important LOGO teaching considerations.

Suggested exercises, powerful ideas, and stimulating operations form an interesting mixture. Turtle graphics explorations make up the bulk of the book, with word and list operations being confined to the last 6 pages. This is appropriate for the scope of the work.

Burnett devotes 12 pages to an exploration of symmetry, and shows clearly how this concept could be explored. Most significantly, he shows how teachers can facilitate this exploration. Obviously, he has spent time in the classroom!

At first, I thought the book might be best suited for elementary teachers. I changed my mind. I believe any teacher could be enriched by a study of this book.

Although possessing minor flaws (don't we all??), such as waiting until page 12 to tell the reader that all LOGO commands in the book are for the MIT version for the Apple, it presents LOGO in an educationally sound manner, consistent with the philosophy advocated by Papert, that the child takes charge of his or her learning.

LOGO: An Introduction, by J. Dale Burnett, Creative Computing Press, 39 East Hanover Ave., Morris Plains NJ 07950, (201) 540-0445, $7.95. ISBN: 0-916688-39-9.

HOW TO MAKE YOUR OWN SPRITE GRAPHICS

by

Jim Fry

You can make sprites come alive on your Apple with MIT LOGO, by using Micromint's E-Z COLOR GRAPHICS SYSTEM board and a set of sprite procedures available from Terrapin, Inc.

It all started for me when I read Steve Ciarcia's Circuit Cellar article in the August 1982 (LOGO) issue of Byte magazine. Entitled "High-Resolution Sprite-Oriented Color Graphics," the article discussed sprites and their uses, and showed how to construct a color graphics interface to enable the Apple to use a sprite generator chip.

I contacted Micromint Inc., 917 Midway, Woodmere, NY 11598, (800-645-3479 to order) and made arrangements to purchase their E-Z Color Graphics System board, on which Ciarcia's article was based. It cost $150.00 for the kit and parts, or $175.00 for the assembled board.

A telephone call to Terrapin (617-492-8816) was all I needed to get a copy of their Terrapin LOGO Sprite Procedures disk ($15.00 plus $2.00 postage). They enclosed a demonstration program and a 5-page manual by Leigh Klotz, in which the procedures were explained. It also showed how to enter user defined shapes, since there was no shape editor.

The sprite commands were similar to those of TI LOGO in that they TELL which sprite to CARRY a shape, and set the x and y coordinates and the color.

However, there were no velocity commands to move the sprites, such as the SETSPEED command from TI LOGO. Instead, I had to write procedures which changed the x and y coordinates continuously within a REPEAT statement.

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Editor.......................Tom Lough

Get Ready!

For many things, growth often occurs in leaps and bounds, rather than by a steady process.

We see evidence of this all around us. For example, an athlete in a vigorous training program will experience periods of "stagnation," with little or no progress toward his or her goal, interspersed with sudden improvements in performance.

A child's intellectual growth may develop this way also, marked by a step-like pattern of progress. During the "non-growth" periods, it is important for teachers to be patient, knowing that processes which cannot be detected are at work.

The rate of LOGO's growth has been a concern to some. After a period of initial activity with the TI and Apple versions, LOGO seemed to settle down upon a plateau. But all has not been dormant.

Digital Research's recent LOGO announcement has far-reaching implications, for example. The indications are present for a LOGO move toward becoming a general use language. If this proves to be true, we are going to see a healthy spurt of growth! The role of LOGO teachers will become significant, to be sure.

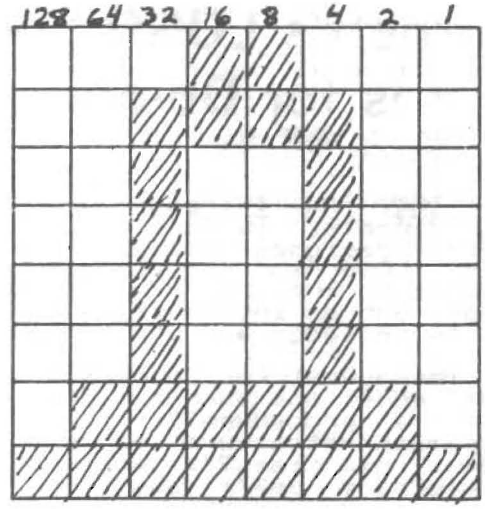
Publications often provide reliable indications of growth. A recent survey of computer books revealed about 10,000 titles in print for BASIC, a dozen or so for Pascal, and only one or two for LOGO! Editors of publishing houses assure me that many LOGO books are in the works. When these become available, we will experience another LOGO step forward.

As LOGO teachers, you are in the right place at the right time! Are you ready for the coming growth? Don't be too smug ... a child is gaining on you while you are reading this!

FORWARD 100! Tom

Sprites Continued

Different shapes can be designed easily and saved on the disk. An 8x8 grid is used, similar to the one below, with numbered columns across the top as shown. The blocks are colored in to show the design, a rocket for example.



In order to tell LOGO the shape, it is necessary to total the column numbers of the blocks in each row. Here, the first row has blocks 16 and 8 colored in, so the total is 24. The second row has blocks 32,16, 8, and 4 colored, making a horizontal total of 60, and so on down the rows. All eight sums are then placed in a list and inserted in the INITNAMES procedure on the Terrapin disk with a command such as the following.

```
MAKE "ROCKET  [ 24 60 36 36 36 36 126
255 ]
```

That's all there is to it! I have found the sprites very enjoyable and exciting to work with. I hope that Terrapin will be offering them as primitives in a newer version of Terrapin LOGO.

If any NLX readers need more information or want to ask any questions, write to Jim Fry, Novi Woods Elementary School, Novi, MI 48050.

(Ed. note: Krell Software Corp., 1320 Stony Brook Road, Stony Brook, NY 11790, offers a complete sprite system ready to go for $325.00. No user modifications are necessary.)

Jim Fry teaches math, reading, and LOGO to elementary school students in Novi, Michigan. He teaches a series of summer computer courses also.

TIPPS for TEACHERS

by

Steve Tipps

Random Thoughts

Introducing PRINT at an early stage in the LOGO classroom is important in overcoming the misconception that LOGO is only turtle graphics. Some interesting projects are possible without reliance on variables or list processing commands. At the same time printing projects can introduce variables and list processing in a natural way.

The INVITATION project from last month's column used a local variable as input which could be changed to personalize the invitation. Children can also write their own arithmetic drills with LOGO and extend problem solving, programming, and procedural skills.

Let me repeat: <u>children should write their own drill procedures</u>. In this way, they learn more about the number system and arithmetic operations by commanding the computer. As the turtle world is a microcosm of geometric rules, working with arithmetic operations in PRINT can help increase their understanding of the operations.

Two new LOGO commands are needed -- RANDOM and SENTENCE. Combined with PRINT, and the MIT LOGO commands of PRINT1 and CURSOR, these commands enable the creation of many new procedures.

A RANDOM PLACE TO START

RANDOM is fundamental to understanding statistics and probability. It expresses the idea that any of a set of events is equally likely to happen. If you flip a coin, either heads or tails will land up. The coin standing on edge is possible, but so unlikely that it is not counted. Therefore, heads and tails are equally likely results of a fair coin flip.

Each coin flip is separate and independent of every other flip. After ten heads in a row, the next flip still has an equal chance of being heads or tails. The common sense law of probability would say that, after 10 heads, the next one should be tails. The common sense law applied to one occurrence is a nonsense law. The coin does not remember or care what has landed before or after. Heads or tails is unpredictable based on prior information. It occurs by chance or randomly.

The same idea applies to the selection of random numbers. If you have a fixed set of numbers (say, 0 to 24), and pick one, any of the 25 numbers has an equal chance of being selected. If you ask the children to guess which one will be drawn, they should be able to pick the correct one only by chance, not with any regularity.

Of course, I've always had students who did not grasp the idea of RANDOM. They took any correct guess by anyone as evidence that the number could be predicted. This is an example of pre-scientific or pre-formal thinking. Teachers can use LOGO to provide experiences with RANDOM. Remember, however, that both maturation and experiences are needed for cognitive development. Dramatizing RANDOM by having the turtle select numbers from a hat may serve as a bridge to understanding RANDOM in LOGO.

Numbered cards from 0 to 9 can be put into a hat or box and drawn out one at at time. Each number has an equal chance of being picked. Be sure to put the card back in the box before choosing again. The child playing turtle can pick, record, and replace. After forty or fifty selections, the tally of each number should be about the same.

The range of numbers can be changed from 0 - 9 to 0 - 24 or 0 - 99. Children would see that, if the range of numbers is bigger, the possibility of guessing what will be drawn is much less. This process is another example of moving from real experiences in the classroom to the abstract level of having the computer perform a function.

RANDOM NUMBERS

Children should be very familiar with the results of PRINT statements such as:

```
PRINT 6
PRINT 6 + 3
PRINT [ 6 + 3 ]
```

The difference between printing the numerals or characters in brackets and the operations and numbers without brackets needs to be well established before introducing RANDOM.

RANDOM can be explained as the turtle pulling a number card from a hat, so that

```
PRINT RANDOM 10
```

means that the turtle has a hat with the first 10 numbers in it: 0,1,2,3, 4,5,6,7,8, and 9. The same statement can be put in a REPEAT statement to verify that only those numbers are in the turtle's hat.

```
REPEAT 10 [ PRINT RANDOM 10 ]
```

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Tipps for Teachers continued

Students can keep track of the range and frequency of the RANDOM numbers picked. If your students have had experience with a printer, this could help record the numbers selected also. They need to see that, in the short run, one number can turn up 3 or 4 times, but, in the long run, all the numbers occur about equally.

RANDOM can also be used in turtle commands to have the turtle perform a curious little squiggle closely related to the "random walk" of statistical physics.

```
FORWARD RANDOM 100
RIGHT RANDOM 30

REPEAT 10 [ FORWARD RANDOM 50
RIGHT RANDOM 20 BACK RANDOM 50 ]
```

PENCOLOR and BACKGROUND can also be set with RANDOM as long as the range is compatible (that is, RANDOM 7 will cover the maximum range of 0 to 6, for example). If an incompatible range is set for PC or BG, LOGO will complain eventually that it does not like a certain large number as input!

Another example of RANDOM use is with CURSOR. This command positions the cursor (the blinking box) on the TEXTSCREEN in any column 0 to 39 left to right, and in any row 0 to 23 top to bottom. To print HI! at random locations on the screen, a short procedure could be defined:

```
TO PRINT.HI!
   REPEAT 10 [ CURSOR RANDOM 39
RANDOM 23 PRINT1 [ HI! ] ]
   END
```

Sometimes this procedure will "knock the word off" if the first CURSOR position is too far to the right. This can be adjusted by changing the range to RANDOM 36.

A lot of exploration of RANDOM should provide a background for some of the future projects using variables. Besides specifying a number of turtle steps, children should be aware that there are other ways to give that information to the turtle. RANDOM can be a bridge to many uses of variables.

A LITTLE DRILL

At the same time RANDOM is being developed, children can be making simple math drills with short procedures of PRINT statements:

```
TO PRACTICE.NINE.TIMES
   PRINT [ 9 X 9 = ]
   PRINT [ 9 X 3 = ]
   PRINT [ 9 X 7 = ]
   PRINT [ 9 X 6 = ]
   END
```

Since the concept of interactive procedures using REQUEST and READCHAR are usually introduced at a later time, the children could work these problems on paper.

The format of these procedures can be changed with CURSOR and with PRINT [ ] to provide blank lines and make them more readable. I also suggest adding a WAIT procedure between PRINT lines. Apple LOGO (by LCSI) has WAIT as a primitive. You will have to define WAIT yourself in MIT LOGO. One which we use a lot is as follows:

```
TO WAIT :TIME
   TEST :TIME < 0
   IFFALSE WAIT :TIME - 1
   END
```

In this WAIT procedure, the larger the number input for the variable TIME, the longer the wait. Thus, WAIT 20 takes longer to execute than WAIT 10. I would be in favor of giving children WAIT as a "primitive" and not belabor its construction. It is a handy idea that facilitates many procedures. A sample procedure for a timed math drill with answers follows:

```
TO PRACTICE.NINE.TIMES.W.ANSWERS
   NODRAW     ; CLEARS TEXTSCREEN
   CURSOR 5 5 PRINT1 [ 9 X 9 = ]
   WAIT 125   ; WAIT FOR ANSWER
   CURSOR 20 5 PRINT 9 * 9
   WAIT 75    ; NEXT PROBLEM
   CURSOR 5 8 PRINT1 [ 9 X 3 = ]
   WAIT 125
   CURSOR 20 8 PRINT 9 * 3
   WAIT 75
   CURSOR 5 11 PRINT1 [ 9 X 7= ]
   ...
   ...
   END
```

The children could try to write their answers on paper before LOGO prints the correct answer on the screen.

Children can move from PRACTICE.NINE.TIMES to this procedure with very little guidance if they understand PRINT1 and CURSOR. They should be able to speed up and slow down the display by changing WAIT. But here, each problem has to be written separately. A more "economical" technique can be used if RANDOM is fully understood.

A LITTLE RANDOM DRILL

RANDOM makes it possible to produce many different problems with a simple single line statement such as:

```
PRINT1 [ 'WHAT IS 8 MINUS  ' ] PRINT
RANDOM 9
```

The apostrophe's are needed in MIT LOGO to preserve the spaces in the brackets. This REPEAT statement can be defined as a single procedure and then used in a REPEAT statement.

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MICROWORLDS

by

Glen Bull

Glen Bull will resume his regular column next month. He and his wife Gina are celebrating the arrival of their first child, Stephen Wesley!

Creating a LOGO Environment

by Tim Riordon

(Editor's note: We believe this LOGO article to be one of the most significant written to date. We are pleased to be able to share it with you. It is presented here in serial form. Copyright 1982 ICCE. Reprinted with the kind permission of The Computing Teacher and the author.)

(Author's note: Perhaps you are a curriculum specialist, school principal or classroom teacher interested in introducing LOGO in your district, school or classroom. You've done some reading and have a grasp of the philosophy. Now, however, it's time to implement your ideas. How do you actually create a LOGO environment? This article bridges the gap between theory and the beginning of actual practice.)

The training in LOGO that many teachers are receiving focuses upon learning the LOGO language. In four hours, a day, or perhaps a week, teachers begin learning to use LOGO commands to write procedures to do wonderful things - graphic designs, music, robot control, random poetry, arcade-like games, etc. This training is necessary but not sufficient for most teachers to use LOGO as it was intended. Most teachers need not only to learn the language but also to learn how to implement LOGO - how to create a LOGO environment in the classroom.

This article examines five questions:

* What is a LOGO environment?
* What are its attributes?
* What things are conspicuously absent in a LOGO environment?
* What are the reasons for creating such an environment?
* How does one begin?

Ideally, a LOGO environment would have a number of computers with many students doing LOGO at the same time. However, such environments will not occur in most schools until school districts begin to pool computer resources and lend individual teachers sets of LOGO machines. Therefore, this article is written for the classroom teacher who has only one computer and wishes to create a LOGO environment.

WHAT IS A LOGO ENVIRONMENT?

It is the entire context, made possible and managed by the teacher, in which students work with LOGO. It is more than a computer learning station. It includes psychological as well as physical space - how students feel, how students and adults interact.

WHAT ARE THE ATTRIBUTES OF A LOGO ENVIRONMENT?

What would an observer see, hear and feel? Suppose an omnipresent observer - perhaps a principal doing an evaluation - were to spend a week in a classroom with 25 students, one computer, and a LOGO environment. What would s/he observe?

It is Monday morning. Teacher and students have not yet arrived. In the front corner of the room, not far from the teacher's desk, is a table with two chairs, a computer with disk drive, a large television monitor and supplies. Supplies include masking tape, rulers, graph paper, pencils, felt tip pens and drawing paper.

There is a box with three disks in it labeled "LOGO STORAGE DISKS." A small weekly schedule shows each day divided into 20-minute periods. The schedule is nearly filled with students' names. The words "Whole Class" appear four times on the weekly schedule. Each student uses the computer 3 times per week while the rest of the class continues with other instructional activities.

On one wall is a chart with student names down one side and several projects listed across the top of the chart. Many students have checked off projects after their names. Above the chart is the sign "TRY TWO OF THESE PROJECTS THIS WEEK," a direction which seems to invite students without commanding or threatening.

On the other wall are some computer printouts of student designs signed by the student programmers. There are also drawings done in felt tip pen - some by students, some by the teacher. These drawings are on a section of the wall labeled "CAN YOU MAKE THE COMPUTER DO THIS?"

This is a problem-solving environment. There appears to be a sharing of authority since both students and the teacher are allowed to contribute to the collection of problems. On the floor are many designs made with masking tape. What purpose do these serve?

The teacher arrives and removes some of the drawings from the walls. Four new problems are posted. Three of them are designs and one is a question: "Can you write a LOGO procedure that will put your name into a code?" The students are evidently using LOGO for more than graphics exploration.

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LOGO Environment continued

School begins and students, sometimes alone and sometimes with a partner, go to the computer at their assigned times. For the most part, transitions are smooth. Kids are eager to get to the computer, reluctant to quit and store their unfinished business.

Once the teacher has to intervene: "Mary, you really must finish now. It's Kevin's turn. There's some open time at lunch recess I'll let you use if you wish."

During the time each student works at the computer the teacher finds a few minutes to watch and sometime, seeing a student encounter an unexpected result, asks quietly, "Do you have a theory about what caused that?" Most interaction with students about their LOGO work, however, occurs at another time.

Occasionally, the teacher will direct something to the entire class, including the student working at the computer. "Kevin, I need to interrupt you so you can hear an announcement for the whole class ..."

Several times throughout the day students are seen leaving the computer, going to another student in the class, interacting and then returning to the computer. Sometimes both students will go to the computer for a short time. Then the student who was doing seatwork will return to his/her seat and continue working.

Listening to these interactions, one hears: "I can't remember how to make the cursor go down." "How do you make the turtle appear randomly at different plaes on the screen?" "SETXY isn't working right." "How do you erase a line you don't want?"

The explanation for this is that each week two students volunteer to be LOGO EXPERTS. Any student experiencing difficulty while working at the comptuer has permission to seek the help of one of these experts. There is one boy and one girl, and it should be noted that the experts are not always the most academically advanced students.

The teacher is sharing authority and at the same time greatly reducing the number of interruptions which would otherwise occur.

About twenty minutes before lunch recess, the teacher ends a language arts lesson and walks over to the computer. The schedule says "Whole Class." A few students sitting in the back move forward in order to see better.

After asking for volunteers to demonstrate some of their work, two students show a procedure that draws a submarine in water. An airplane is then drawn in the sky. A bomb appears beneath the plane and slowly falls toward the sub, causing an explosion when it hits. This demonstration is followed by a student who offers a procedure that draws Garfield the Cat at random places on the screen.

Whenever a student demonstrates a procedure, there follows a discussion, shaped by a questioning strategy composed of four questions:

*(1) Do any class members have questions about the procedure we've watched?

Several students usually want to know how it is done, so the demonstrators show the inner workings of their procedures.

Occasionally, a value-related question arises when a student refuses to show how a procedure works. "I don't want to show it - it's a secret." This leads to a brief discussion about who owns knowledge, and about copyrights and patents. (Usually this motivates one or two other students to discover the secret which is later gleefully published!)

The second and third questions are addressed to the student who demonstrated the program:

*(2) What do you plan to do with your procedure now?

Sometimes the answer is, "Nothing - I'm done with it." Other times elaborate plans are given. Frequently, the student will respond in a sketchy, tentative manner as in these examples: "We'd like to have it so that a person can aim and fire the bomb." "I'd like to have some music go with the drawing." "I'm going to try to figure out how to make each cat a different color."

The tentative nature of these responses tells the teacher that the student has encountered a new problem to be solved but does not yet know the solution. Such responses are always followed up by another question:

*(3) Do you have some ideas to try out or do you need some hints about how to do it?

The teacher is seen making notes for students wanting help. The notes read like this:

Ben - give him music routine
Sarah - have Ann show SETXY and RANDOM
Thane - hint about multiple colors
Keri - tape and walk rainbow starting from center
Raol - no help needed

Several things about this environment are becoming evident. Students decide for themselves whether they need help solving a problem and in so doing they learn to reflect upon, and be responsible for their own learning.

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LOGO in the News

What a month for LOGO! Many new and exciting things are happening! New versions are on the way, lower prices are announced, and a robot turtle from Australia is now making tracks in the USA.

NEW LOGO VERSIONS

Digital Research has recently announced the development of DR LOGO. (trademark Digital Research). It is reported to contain all of the features currently available on the popular LOGO versions, and some very welcome additions. For example, system information and command explanations can be called up on the screen, eliminating searches through reference manuals. Other features include the ability to use indentation, string processing, and several debugging aids.

Comment statements are allowed, but DR LOGO also provides a method to erase all comments, if desired, once a procedure is debugged. The text screen and the editor may be viewed simultaneously. Upper and lower case letters may be used.

From the press releases, one gets the idea that this will be a very powerful version of LOGO, targeted at both the "traditional" LOGO market and the business and professional community. In his article in the March 1982 issue of Microcomputing magazine, Harold Nelson suggested that LOGO had the potential to surpass BASIC as the most widely used general purpose computer language. Gary Kildall, Digital president, supports this by declaring that "LOGO promises to become this decade's most widely accepted computer programming language."

If anyone should know, it would be Kildall. He is the author of the phenomenally successful CP/M system.

DR LOGO will be available initially for the IBM PC and the TI Professional Computer. LOGO on the IBM is exciting to contemplate. With the present versions (Apple, etc.), at best only a few thousand nodes of memory are available for use. DR LOGO will offer nearly 100,000 nodes!!! No more "OUT OF MEMORY" messages!

The only modification necessary for the IBM PC is the installation of a color graphics card.

These versions may be available as early as Fall of 1983. DR LOGO may be the most compelling reason ever to buy a computer!

EVEN MORE VERSIONS

Atari has announced a contract with LCSI to develop LOGO for their 400, 800, and 1200 computers. Atari's LOGO will be a plug-in cartridge with full features. With a price under $100 and a hoped-for availability of this summer, This LOGO version is going to make quite an impact. If your school is one of the thousands with Atari computers, keep your eye out for Atari LOGO!

Michael Burke of San Jose State University (California) reports that LOGO for Mattel's Aquarius computer is being developed, and may be available within the next few months. It will include a full-feature language, with multiple turtles and animation functions. Two types of turtles, toilers (line-drawing) and tilers (graphical shape drawing), will provide many new capabilities. This may be the most powerful inexpensive LOGO version available.

STILL MORE VERSIONS

Available now from Cybertronics International, Inc. is their CyberLOGO for the Apple II 48K. Costing $99.95, this version features turtle graphics, sound, a full screen editor, and the ability to save both procedures and pictures.

A feature I particularly like is its ability to ferret out LOGO primitive commands from keyboard input. For example, if you were to enter WOULD YOU MARCH FORWARD ABOUT 70 STEPS PLEASE, the CyberLOGO turtle executes FD 70. This seems to appeal to younger children, who want the computer to be their friend.

Although limited to integer arithmetic and interrupted by infrequent disk accesses, CyberLOGO is worth investigating, especially if all you really need is turtle graphics.

Don't overlook Radio Shack's Color LOGO! It, too, has been available for some months. A disk version for the TRS-80 Color Computer costs $99.00, and runs on a 32K machine. A cartridge for under $50.00 for the 16K machine will be available soon. The most talked about feature of Color LOGO is its HATCH command, creating up to 255 turtles on the screen, each of which can draw!

KRELL LOGO PRICE SLASHED

As of March 1, Krell LOGO will cost $89.95! Including 4 disks (2 MIT LOGO disks, 1 demo disk, and 1 Krell utility disk), a technical manual, LOGO wall chart, and a premier copy of Krell's LOGO and Educational Computing Journal, this promises to be the best price break around for Apple owners. Krell has also made available a $325.00 sprite board for the Apple II.

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Tipps continued

```
TO EIGHT.MINUS
      PRINT1 [ 'WHAT IS 8 MINUS  ']
PRINT RANDOM 9
      PRINT [ ]
      END
```

```
REPEAT 10 [ EIGHT.MINUS ]
```

This will make ten problems, most of which will be different. However, the same problem can also be written with one PRINT statement, if SENTENCE is used. SENTENCE is a LOGO comand which connects two or more elements.

```
PRINT ( SENTENCE [ WHAT IS  8 MINUS ]
RANDOM 9 [ ? ] )
```

This is a number sentence which has three parts: WHAT IS 8 MINUS, the RANDOM number to be subtracted, and a question mark. SENTENCE connects the three parts into a sentence. Note that no apostrophe was used.

Students can generate different combinations of number drills by varying the operations and the size of numbers.

```
TO RANDOM.ADD
      PRINT  ( SENTENCE RANDOM 1342
[ + ] RANDOM 888 [ = ] )
      END
```

Many different drill programs can be written by children for their own entertainment and learning, or as puzzles for their friends. These RANDOM procedures can be incorporated into more elaborate drill programs, such as in the previous section.

A LITTLE LESS THAN RANDOM

After the children have finished their programs and run them several times, they may notice the same sequence of numbers turning up in the problems. This becomes especially obvious if they have only one math procedure.

The way RANDOM works is not as fair as the turtle pulling numbers from the hat. Actually, RANDOM is a list of numbers which the turtle reads. The turtle starts at the top of the list, unless it is instructed to go somewhere else and begin reading.

The command necessary to start the turtle at a different place in the list is RANDOMIZE. In the early stages of the children's work, this command may not be needed. But, when children complain that the turtle always picks the same numbers, you should then introduce RANDOMIZE as the first line in any procedure which uses RANDOM.

Steve Tipps is a professor at the University of Virginia, and has presented LOGO workshops for teachers throughout the eastern United States.

LOGO Environment continued

Some students who want help are given the complete answer to their problem, sometimes by the teacher and sometimes by another student - authority is distributed. Students often are given hints but not complete answers; when guided discovery is used, students frequently experience the joy of finding the solution by themselves.

The final question raised after each demonstration leads to a short brainstorming session by the class:

*(4) What are some things which could be done to change this program?

Many fascinating LOGO projects result from ideas contributed from several class members. The teacher also contributes ideas - although usually after ideas have emerged from students.

The whole class responds to work demonstrated by class members two other times during the week. And on one other occasion, the teacher demonstrates a new LOGO programming idea to the entire class. (Earlier in the year when LOGO was first being introduced, teacher demonstrations outnumbered student demonstrations. Now the balance has shifted.)

To be continued next issue.

Tim Riordon is a teacher and consultant in Eugene, Oregon, and is a regular contributor to The Computing Teacher magazine.

LOGO in the News continued

TURTLE TRACKS FROM DOWN UNDER

Harvard Associates, Inc., have announced the Tasman Turtle, an easy-to-use programmable robot turtle manufactured by Flexible Systems of Hobart, Australia. The Tasman can operate from an Apple II or other parallel interface computer, as well as from an RS-232 interface. It can move, turn, toot a horn, blink "eyes," draw with a pen, and "feel" with touch sensors. Extra options include a voice capability and an electronic compass. The price is $999.95.

TERRAPIN ANNOUNCES

Terrapin LOGO will run on both the AROS network by SWI and the Corvus Omninet, according to a recent announcement. Further, Terrapin LOGO is reported to run on both the Franklin and the new Apple IIe computers if the commands are typed in upper case letters.