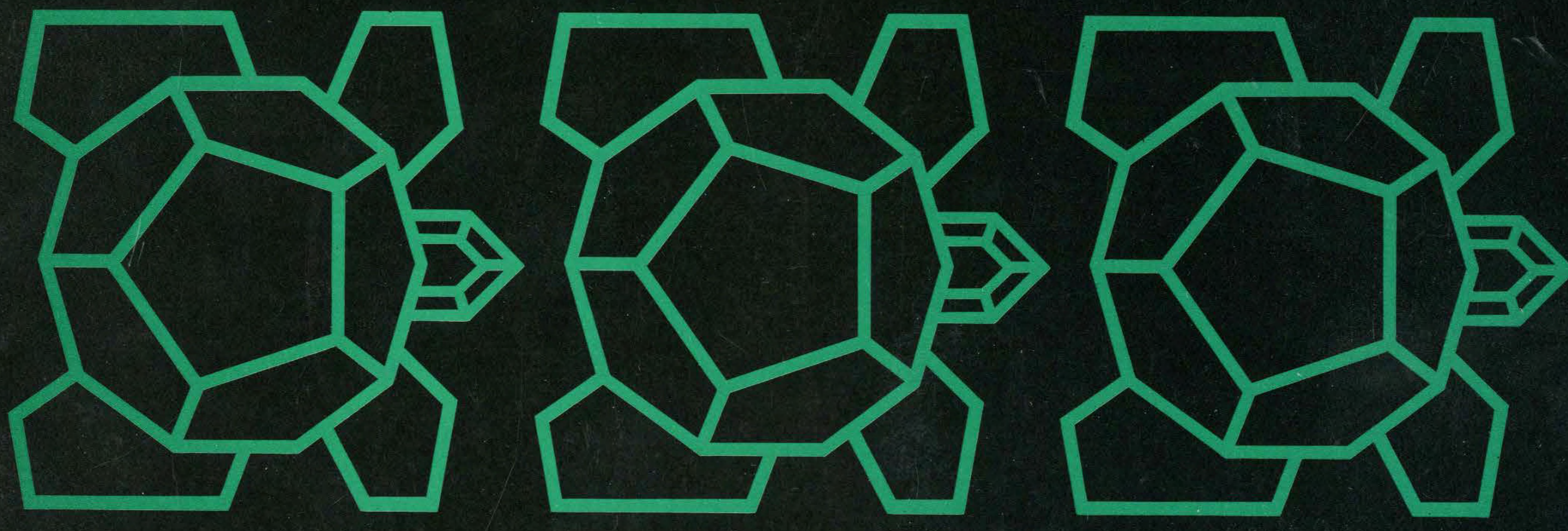
...PENUP



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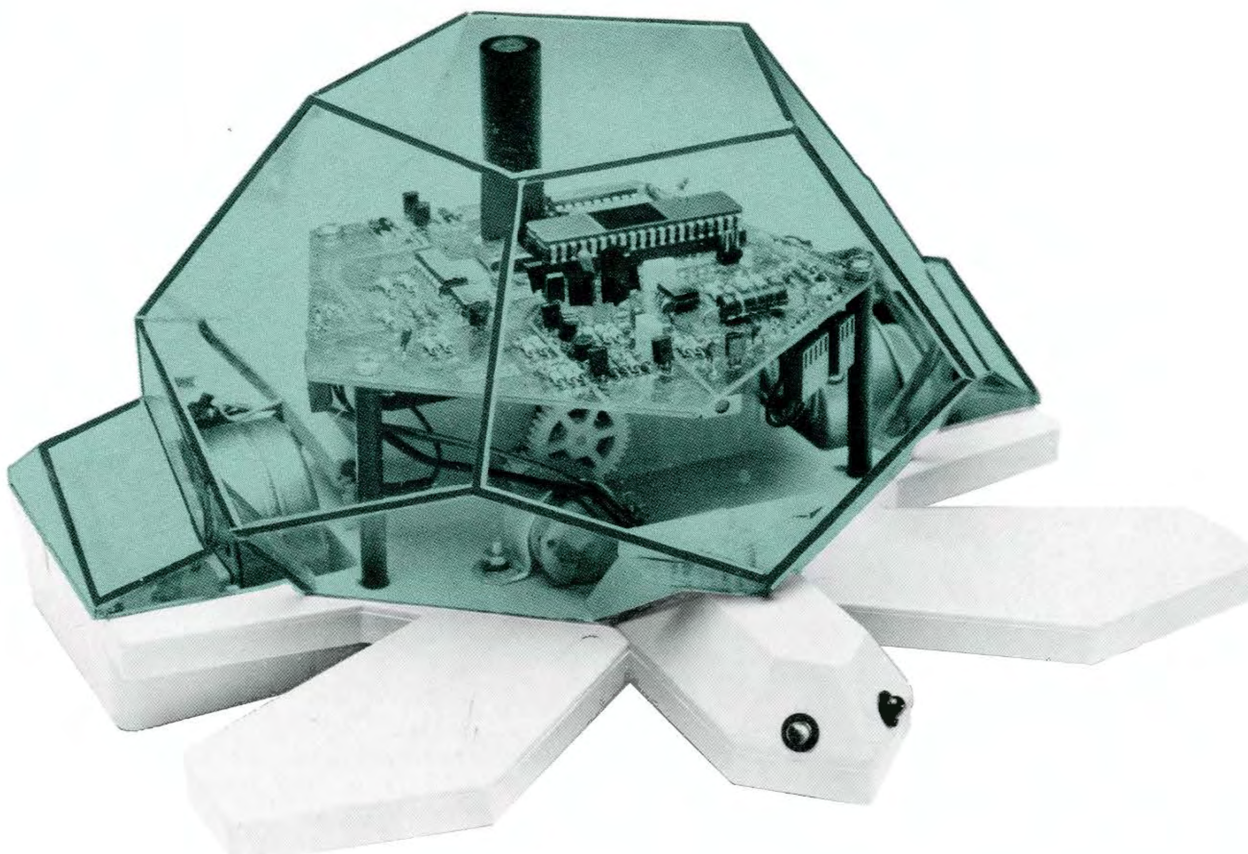

Penup was produced by Valiant's Educational Research Group. It contains a collection of articles for parents, teachers and children. The contents introduce LOGO and give you some practical ideas for activities at school and home with the Valiant Turtle. It also contains a children's section.

The articles in "Penup" are only intended as a starting point. We will be developing these activities and ideas in a book due to be published in Autumn 1984. This will be available at a discount to Valiant Turtle owners. Send a s.a.e. for details of the offer to: Valiant Book Offer, c/o Valiant Designs Ltd., Park House, 140 Battersea Park Rd, London SW11 4NB.

"Penup" was edited by Anthony Ginn. Thanks to Tom Stonier, Derek Radburn and Marcus Topham for their valuable contributions.

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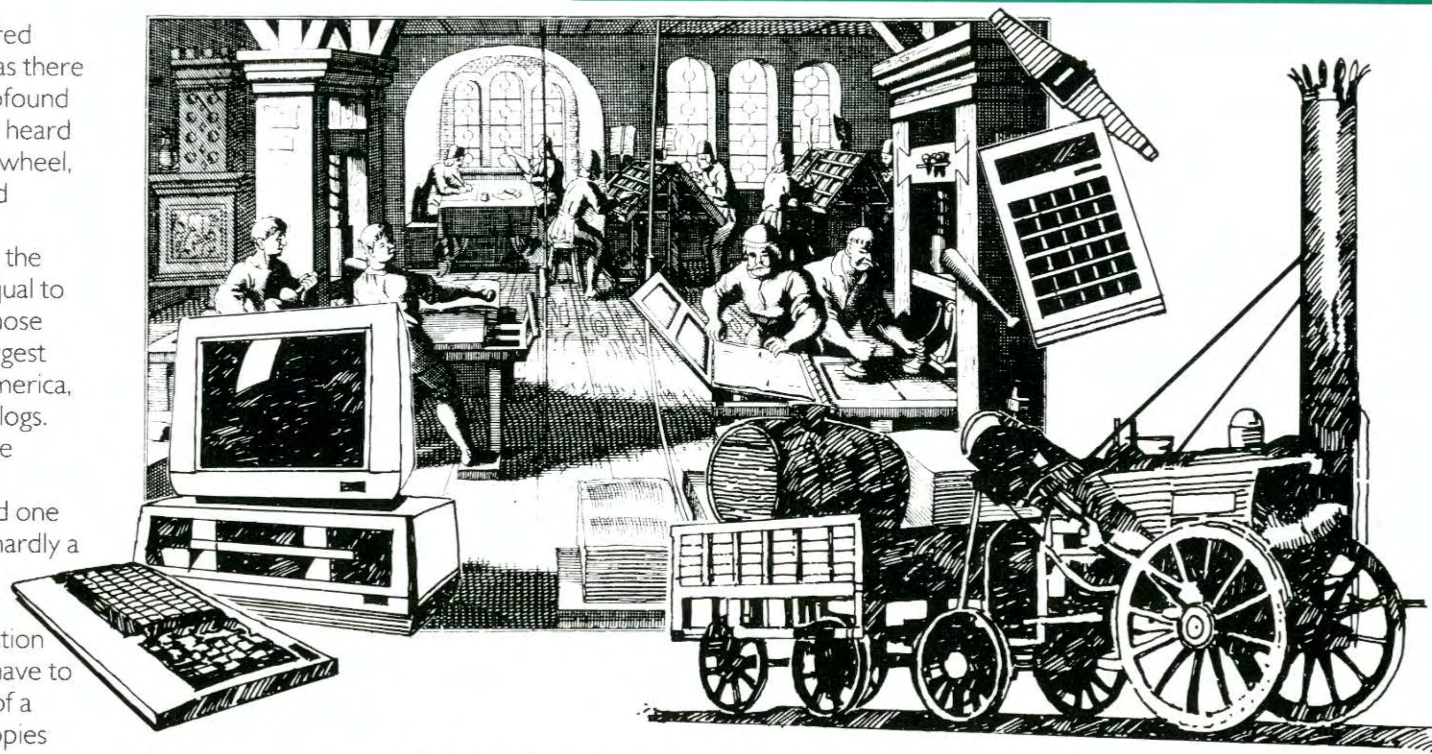
Patent Application Pending
Design Regd. in UK, Europe, USA, Japan and other countries

CONGRATULATIONS...

YOU BOUGHT A TURTLE!...

Not since human beings mastered fire and developed speech has there appeared an invention as profound as the computer. We have all heard about the importance of the wheel, and perhaps the compass and gunpowder – certainly we all know about the historical importance of the printing press and the steam engine. None of these, however, are equal to the computer. The wheel was useful only to those civilisations which had draught animals. The largest pyramids in the world are found in Central America, built by rolling enormous chunks of stones on logs. Polynesian mariners have navigated all over the Pacific without a compass for generations; and gunpowder was largely a device which allowed one nation to prey on another more effectively – hardly a great contribution to the human welfare.



The printing press is much closer to the computer. It also represents a form of information technology. No longer did a dedicated monk have to labour for decades to produce another copy of a book. Instead, hundreds, even thousands of copies could be produced in a matter of weeks. That was important. However, the printing press was, so to speak, merely an extension of the monk's hand. It was a mechanical device used for furthering intellectual effort.

The steam engine, we all know, was the foundation of the industrial revolution. The steam engine found its way into mines and factories. Later, steam locomotives, steam ships, and steam tractors became important for transportation and farms. It was a sort of super machine which could be coupled to all sorts of mechanical devices: coupling steam power to a pump, emptied the mines of water much more efficiently than anything before. Coupling the steam engine to a loom, created a power loom. Coupling it to the wheels of a wagon which ran on rails, produced a locomotive. For well over a century, human ingenuity became preoccupied with coupling the steam engine to virtually every mechanical device known. It was indeed a super-technology.

Today's super-technology is the computer. Like the steam engine, it is being coupled to every imaginable device in sight. Coupling a computer to a lathe, converts it to a numerically-controlled lathe. Coupling a computer to a moving arm, produces a robot. The spread of computers into the factories is now happening at such a rate that there is a great loss of jobs, including many skilled jobs. Furthermore, this technology is now invading the offices and other commercial areas. For example, a computer coupled to a typewriter, creates a word-processor – one secretary can do the work of four or five. A computer coupled to a money-counting machine, creates an automatic teller machine which displaces people working in banks. Computers are now used widely in all areas of commerce including insurance, real estate, and finance. Computers are having a substantially more dramatic impact on the world of work than did the steam engine over a century ago.

The idea that people might be carrying steam engines around in their pockets, or wearing them on their wrists, was preposterous. In contrast, the chances are that the reader owns a pocket calculator or a digital wrist-watch. Computers can be found everywhere. Around 1980, it was a rare automobile coming off the assembly line that had a computer in it. By 1984, it was a rare automobile that didn't. The computer has entered the home. It is found in washing machines, stereo sets and television, and increasingly in regulating heat and lighting. Among the more recent additions to many households is the home computer, and now, of course, the appearance of education games and robot toys.

Computers are also entering the schools at an amazingly rapid rate. The presence of computers in school, in the home, in commerce and industry, in transport and recreation shows how widespread this technology is, and how the younger generation must learn to live with it. With computers everywhere, children need to become computerate.

Education is undergoing a revolution. The ability of children to learn in the privacy of their own home using computers and sophisticated computer toys such as the TURTLE, means that a part of formal education will begin to return to the home. The present system which relies on the home only for doing homework, but looks to the school as the basis of the education system, is likely to disappear over the next few decades.

Using a TURTLE for introducing the child to the computer, not only provides the child with an exciting toy, but turtle graphics is the best method devised so far for introducing children to the potential of the computer and computer programming. In addition, while working with a computer, children learn important concepts in areas of mathematics and logic. Children working with the TURTLE will develop new intellectual skills including a systematic way of approaching problems. It took years of research, on both sides of the Atlantic to develop the system.

Most of the work in the U.S. was done at the Massachusetts Institute of Technology, and in the U.K. at Edinburgh University. A basic philosophy of the system, as Seymour Papert, the originator of the idea of using the LOGO TURTLE has stressed, is that it is important for the child to program the computer, rather than the opposite.

The TURTLE allows the child to explore concepts by using the child's own body to work out problems. This use of "body geometry" makes that branch of mathematics much more real to the child and represents one of the important principles in education: You learn by adding to what you already know rather than starting at some completely abstract point that you don't understand. Mathematics becomes a sort of language to describe how your body, then the TURTLE, moves. It is not merely a series of formulae and rules to be learned by rote.

To develop a complex program with the TURTLE, you first work out simpler programs. You never begin with a level of complexity and confusion which a person cannot handle. You engage in, what Papert calls "mind-sized bytes". The child, thus, automatically learns to break up a big problem into smaller problems, which is the chief method of analysis. The child has a sense of controlling the environment. It has fun while doing so.

Equally important is the attitude to errors. Mistakes are no longer a source of embarrassment. Everybody makes mistakes; grown-ups working with the TURTLE, also make mistakes. Very quickly a child approaches mistakes with a view to "de-bugging" the system. It is a way of experimenting with reality when the TURTLE doesn't do what you thought it ought to be doing.

An excellent example of this de-bugging routine is to build up the command 'TO HOUSE'. You begin by teaching the TURTLE 'TO SQUARE', which is, of course, to turn at a right angle four times and draw four lines of the same length. The next step involves drawing a triangle, and again, the command 'TO TRIANGLE' is based on turning 120° three times and producing three lines of equal length. When the TURTLE has learned the two commands, 'TO SQUARE' and 'TO TRIANGLE', the idea of the command 'TO HOUSE' is to put a triangle on top of the square. This, however, turns out to be more complicated than one might think: You might not get a triangle tight against a square; or it is to the side of the square, or inside the square. It is only by having the procedure worked out clearly in your own mind, then giving crystal-clear instructions, that the TURTLE will learn how to draw a house. That is what you have "taught" it, and that is the command which you can then use.

The child is thus encouraged to engage in habits of clear thinking and precision. The idea is to go from simple commands like LEFT and RIGHT, FORWARD, etc. to more complex patterns like squares and triangles, and then a third level of commands such as TO HOUSE, which is a mix of second level complex commands. You could then build a series of houses and trees and so forth, to come up with a fourth level command: TO STREET. The young mind begins to engage in various levels of analysis and synthesis. It engages mind play – one of the most important things anyone can teach a child.

The TURTLE is also an excellent introduction to the whole question of robotics and production control. A child with imagination will also quickly use it as a new art form, designing patterns of flowers and suns. A bright child will create whole micro-worlds of its own.

It is only recently that a proper remotely-controlled TURTLE has appeared on the scene. The VALIANT TURTLE is a high-precision instrument, yet it is rugged as well. David Catlin and his colleagues are to be congratulated for what amounts to a brilliant engineering job. The availability of the VALIANT TURTLE with cheap home computers, now opens up the vistas first envisioned by that brilliant educator, Seymour Papert.

Have fun!

Tom Stonier
Professor


commodore

GETTING STARTED WITH LOGO...

You've got your turtle up and running and you're ready to learn LOGO. Where do you begin? If you've got a full implementation of LOGO for your micro, then to start with the accompanying manual. The starting point is turtle graphics. The instructions that send your robotic turtle drawing pictures on your Axminster carpet also command a screen turtle to draw pictures on the T.V. screen.

Dialects

In New York it's quite acceptable to visit friends in your vest and pants. In America vest means waistcoat and pants are trousers. They speak a different dialect of English from the British. In Britain your vest and pants are your underwear, so your visit would finish in the police station. LOGO, like English, has different dialects. One version needs BD to send the turtle backwards, and another requires BK. In this article I'm going to use the most common versions of the commands. Consult your manual for your own LOGOs idiosyncracies.

How to confuse the computer.

We instruct the turtle through the keyboard. To get the turtle to move we type FD for forwards, BK for backwards, RT for right turn, LT for left turn. The turtle needs to know how far to move and how much to turn, and it won't do anything until we tell it. We must put a space between the instruction and the quantity. To do that we press the space bar at the bottom of the keyboard. If we forget to do this the computer will get confused and say something like, "I DONT KNOW HOW TO FD50". It will also get confused if you use the letter O instead of the zero next to 9 at the top of the keyboard. Try telling the turtle to do something obscene and see what the computer's reply is.

Return

When we've finished typing an instruction we have to press a key marked RETURN (on some computers ENTER) before the turtle takes any notice of us. The RETURN key is descended from the carriage return key on the typewriter, hence it's name. It's function on a computer is quite different. It's a switch that tells the computer to "DO IT". Everyone forgets to use it when they start out. You can type a list of instructions, but the turtle won't follow them until you press RETURN.

Spulling mistukes

If you make a spelling mistake, forget to put in a space, or change your mind in the middle of a line you don't have to type out the whole line again. There is an electronic eraser you can use. It's a key, usually on the top right of the keyboard, marked with something like DEL, DELETE or DELETE BACK SPACE. Pressing it will send the cursor backwards, deleting what you've just written one symbol at a time.

CONTROL and SHIFT

If you press the keys marked CONTROL (sometimes CTRL) or SHIFT on their own nothing will happen. They are used to change the function of the other keys. Holding down SHIFT and pressing a key with two characters on it, such as "9" with "(" over it, will produce the top character on the screen, i.e. the "(" instead of the "9". The CONTROL key changes some character keys into "action" keys in the same way. Consult your LOGO manual to find out what happens with your particular version.

Teaching the turtle to draw things

If we want the turtle to draw we type PD (for Pendown) which lowers the pen. PU (for Penup) raises the pen. We may discover that

FD 100 RT 120 FD 100 RT 120 FD 100 RT 120

or REPEAT 3 [FD 100 RT 120]

produces a triangle. We can teach the turtle to draw that triangle by typing:

```
TO TRIANGLE
REPEAT 3 [FD 100 RT 120]
END
```

Whenever we type TRIANGLE the turtle will draw a triangle, side 100.

TRIANGLE can then be used in other procedures, for example:

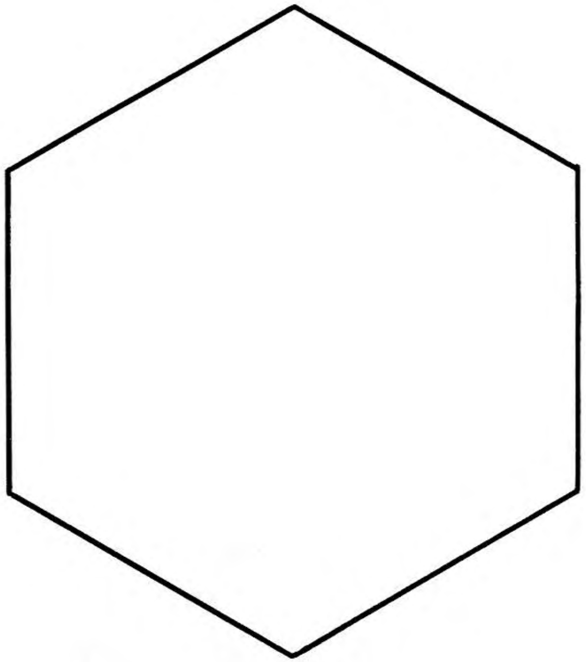
```
TO WHEEL
REPEAT 10 [TRIANGLE RT 36]
END
```

Two WHEELs could then be used in a procedure called BICYCLE. Small procedures are used to build larger procedures.

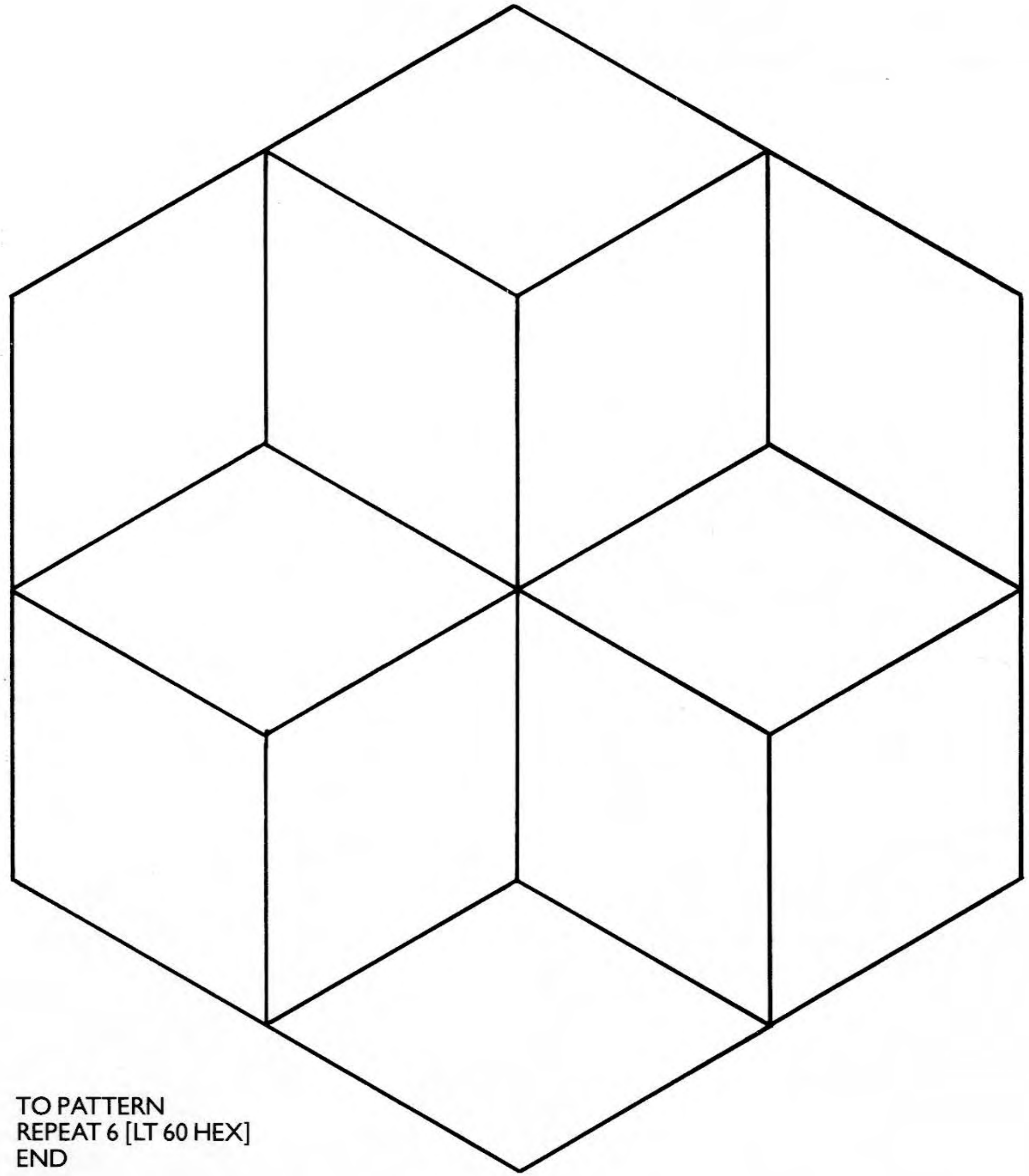
If you are using LOGO with children it's best not to rush them into defining procedures. Let them explore each level of LOGO fully before moving on to the next. There are several examples of "pre-procedure activity" elsewhere in Penup, which they should be given a chance to explore.

It's very rare that the turtle draws what we want the first time. More often than not there's a "bug" in our program and we need to change something in a procedure. To do this we go into the EDIT mode. Different machines have different editorial instructions, so consult your manual for the details.

Have fun.



```
TO HEX
REPEAT 6 [FD 5 RT 60]
END
```



```
TO PATTERN
REPEAT 6 [LT 60 HEX]
END
```

A TURTLE IN THE HOUSE...

To some parents the arrival of computers and robots heralds the dehumanisation of our society. Children will sit in front of a screen all day being programmed by a machine. They will stop learning the basics of mathematics, reading and writing, and will become computer conditioned zombies, unable to think for themselves.

Teachers and parents who have worked with LOGO and turtles will tell you that in practice the opposite is true. In learning to control a computer with LOGO a child learns to organise his thoughts to express himself creatively. The turtle makes difficult geometry accessible to young children in an enjoyable way. By "playing turtle" a six year old will be learning mathematics that a ten year old would find difficult if it were taught formally.

The computer is a tool, like a paintbrush, video recorder or camera. These, like the computer, can be used to stimulate or bore. There are computer programs, programming languages and video tapes of dubious quality. This isn't the fault of the computer or the video recorder.

Children accept the computer for what it is and are keen to get at the keyboard. It's the adults who suffer from "computer-phobia" and are nervous about touching the buttons.

A turtle and LOGO are the ideal tools with which to learn how to control a computer. In the unrestricted environment of the home children are free to learn and experiment in their own way and at their own pace.

Children do their best learning before they get to school.

Professor Hawkins, of the University of Colorado, who studied children learning science said, "When we narrow the scope of education to what goes on in schools, we throw out the method of that early and spectacular progress at our peril ...".

Children are not empty jugs waiting to be filled up with knowledge. They need the opportunity to experience and discover things for themselves. The result of "cramming knowledge into children" is adults who "hate maths", "can't draw" and are "no good at languages".

When learning is fun everyone wants to do it.

John Holt, author of several books on how children learn, says, "What teachers and learners need to know is what we have known for some time: first that vivid, vital, pleasurable experiences are the easiest to remember, and secondly, that memory works best when unforced, that it is not a mule that can be made to walk by beating it."

The last few years has seen an avalanche of computer technology upon our lives. It is important not to make the computer into another "boring difficult subject" for children to struggle through. Destroying their initial enthusiasm is a crime, yet this has already happened to many youngsters who believe that computer programming means the complicated abstract mathematical syntaxes of BASIC. Little wonder they prefer playing Pac-Man. Because of it's limitations, BASIC programming is for "mathematically inclined". The difficulties of learning this cumbersome language are accepted as the

difficulties of computer programming.

With LOGO and turtle these obstacles are bypassed. Your child can enjoy learning a high level, friendly programming language.

Given the opportunity, guidance and encouragement children will master the new technology just as they mastered Rubik's cube.

The younger they have access to computer power the easier they control it. The turtle is the key.

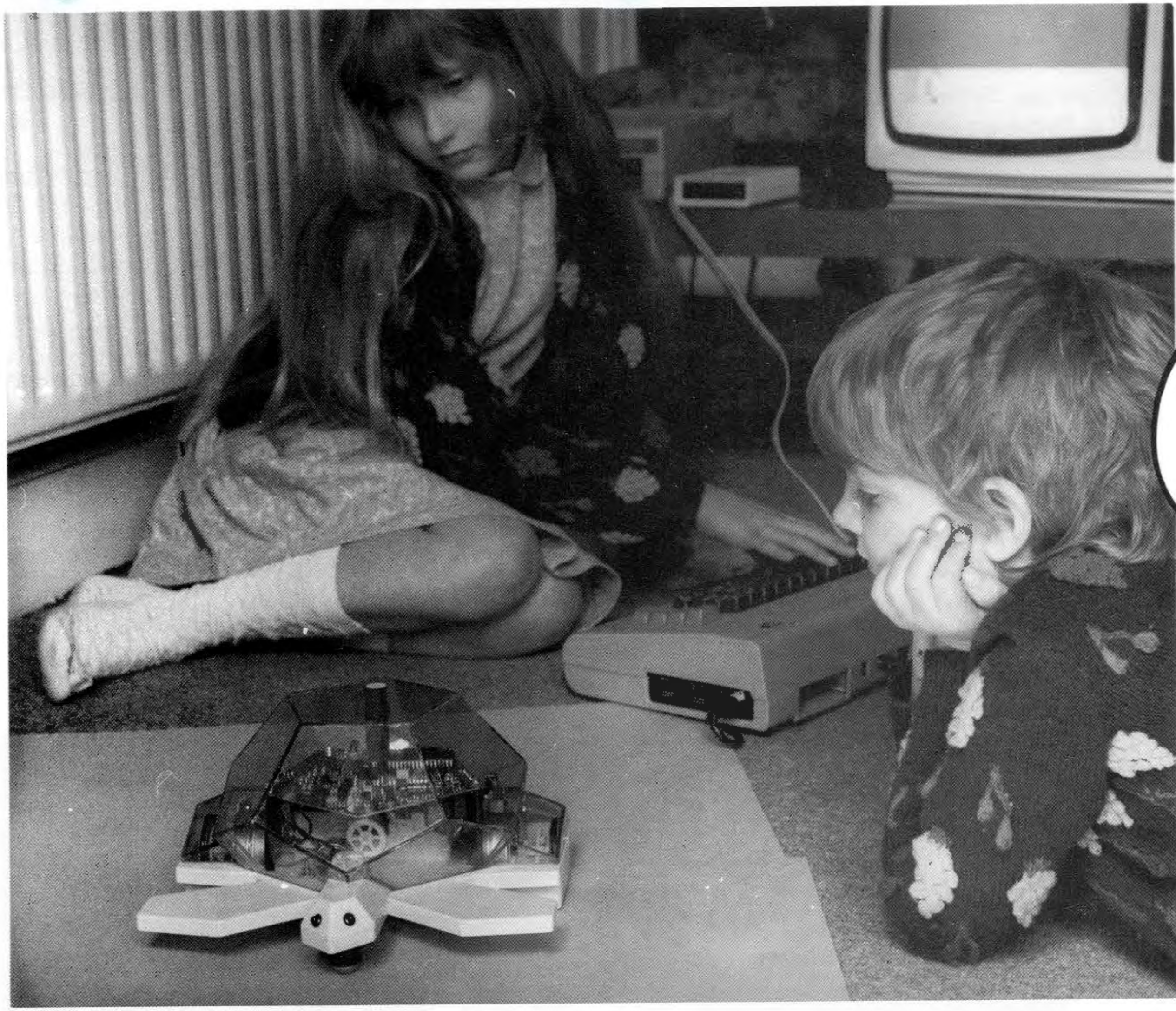
How do we introduce it to children? Do we show them a protractor, explain precisely what RT 90 means and give them a set of problems to work out; or do we leave them in a room with the computer and a turtle for a few months and expect them to "discover it all for themselves"? Clearly neither of these methods is satisfactory. The solution lies somewhere between the two.

We should give our children every opportunity and all the time they need, to play freely with the turtle in their own way. Let them discover and experiment for themselves. We should be aware that to get the full benefit of LOGO and the turtle, "free play" isn't enough. To appreciate the full capabilities there are certain things that have to be learnt. Often children will ask for this information as a part of their play, "Is there a way I can make the pen go up?" or "Is there a way I can get it to do it over again without typing the same line out eight times?".

Children develop their own "computer culture". If they use LOGO at school or have friends with LOGOs or turtles, then they exchange information, ideas and programs almost clandestinely.

There are times, particularly when starting out, when a child will need guidance and assistance from a parent.

You will need to explain and/or demonstrate that to make the turtle move forwards you type FD SPACE, a number and RETURN. Let them try it out. You could play a little game, trying to get the turtle to stop at a certain point on the carpet, or stop as near as possible to a wooden brick without knocking it over.



Perhaps you'll be all ready with your "one step at a time" approach and the first thing your daughter will say is "I want to write a procedure to draw a rhombus with 450 angles". All we can do is keep an open mind and be ready to help. The first problem most children experience using the turtle is that their parents are so busy playing with it, they can't get a go themselves.

When you sense they've fully explored FD, then introduce them to RT and LT. Combining FD and a turn introduces a whole range of new possibilities. The games described in "The Turtle goes to School" can all be played at home.

The games should begin simply, and gradually build up to the more complicated and difficult. When they are used to putting together lists of commands it's only a small step to go on to defining procedures.

We often want to dump as much knowledge onto children as fast as we can, "getting them defining procedures as soon as possible". It's much better to guide them into the knowledge one step at a time, and allow them plenty of opportunity to explore each stage letting their own interest and imagination lead them where ever it will.

Maybe they'll want to build a house for the turtle, or convert it into a battle cruiser or furry animal.

THE TURTLE GOES TO SCHOOL...

"In most contemporary situations where children come into contact with computers the computer is used to put children through their paces, to provide exercises of an appropriate level of difficulty, to provide feedback, and to dispense information. The computer programming the child. In the LOGO environment the relationship is reversed: The child, even at preschool ages, is in control: The child programs the computer. And in teaching the computer how to think, children embark on an exploration about how they themselves think. The experience can be heady: thinking about thinking turns the child into an epistemologist, an experience not even shared by most adults." Seymour Papert writing in his book Mindstorms.

The turtle is the doorway into LOGO, a powerful programming language, capable of handling words and lists, mathematical functions, music, and intricate graphics. The basic principles learnt "playing turtle" are used in the other areas of LOGO.

The turtle provides stimulation for work in other areas of the curriculum, maths, english, art and craft, music and even dance. A turtle is an ideal tool with which to choreograph a piece of movement. The Valiant Turtle has the facility to run more than one turtle from the same computer simultaneously. Dances for several children can be choreographed using "multiple turtles". The accompanying music can also be written with LOGO.

The first activity for children to explore is controlling the turtle with the "move" and "turn" commands. RT 40 turns the turtle 40 degrees to the right, FD 27 sends it forwards 27cm. It is much more beneficial for the children to discover what these values mean for themselves, by playing with the turtle, rather than give them a theoretical explanation of what degrees are, using the turtle to support the theory. Learning by doing is better than learning by listening.

The following games are all introductory, to get children used to moving and turning the turtle. Games dealing with more complex activities, such as defining procedures, will feature in a forthcoming book, produced by Valiant's Educational Research Group.

For the best results, the games should be played on a smooth level surface, such as plastic floor tiles. The game "boards" may be drawn on the floor itself, large sheets of pliable plastic or paper.

I. Shove Turtle

The board is shown on figure I. and the four numbers at the end represent scores.

Place the turtle behind the start line facing the scoring strips. Each player types FD and a quantity, aiming to finish with the turtle's head on the highest score.

The exercise could be repeated a number of times and a running total of the scores recorded. The game can be played by an individual to assess accuracy in driving the turtle or competitively between individuals or teams.

When the children have mastered the game the START line can be removed. The turtle is positioned by the opposition before each turn.

Because FD 50 can send the turtle forward 50cm, "shove turtle" is an excellent way to get children to estimate distances.

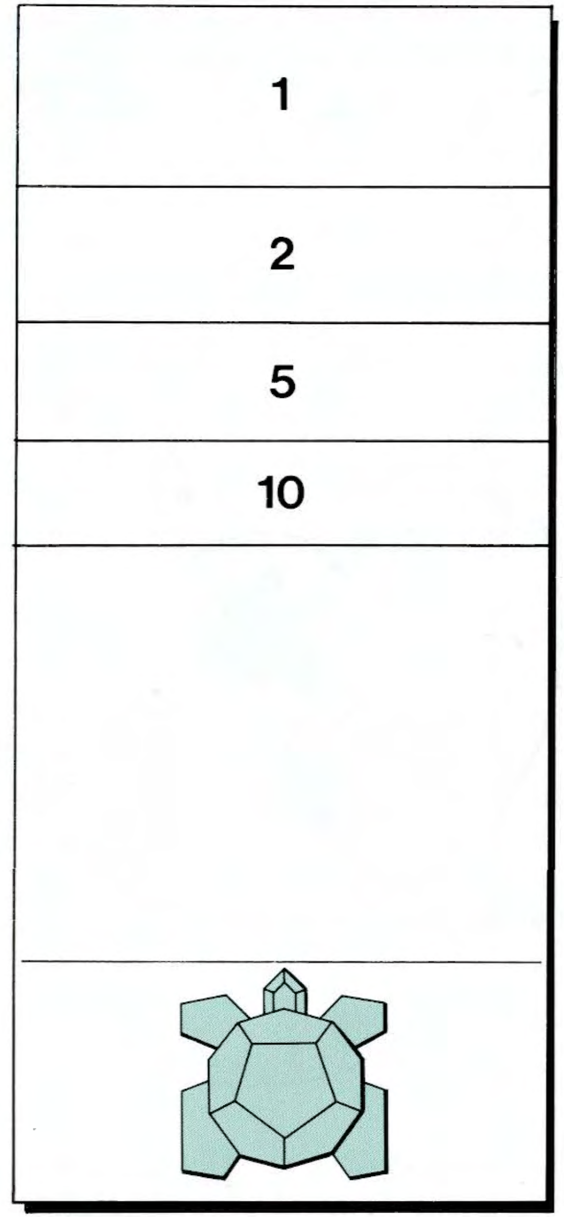


FIGURE I

2. Turn Turtle

The shaded areas of the board, shown in figure 2, represent the scoring zones.

Place the turtle in the inner circle. The object is to turn the turtle, using LT or RT and a quantity so that it's head points to a scoring zone. If the game is played competitively the player using the lowest number of commands to succeed is the winner.

Extensions

A particular scoring zone may be designated beforehand.

The direction of turn may be designated.

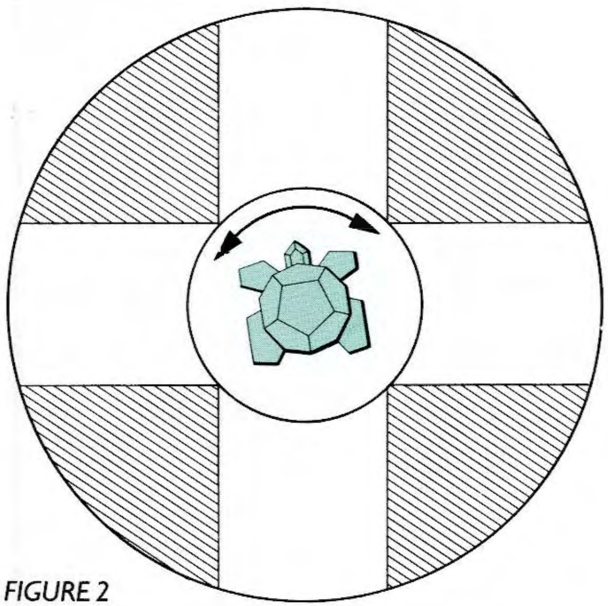


FIGURE 2

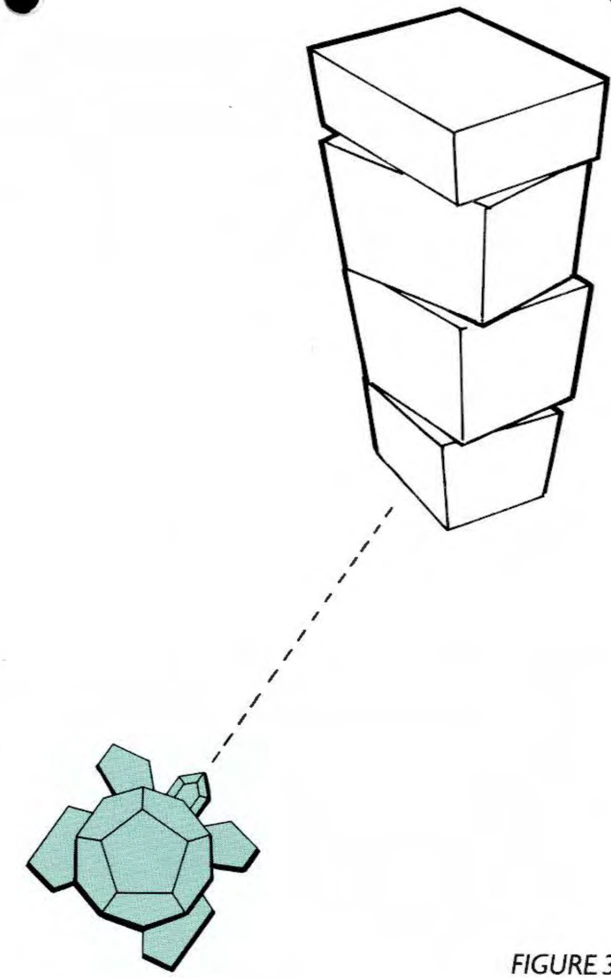


FIGURE 3

3. Demolition Turtle

Build a tower of small blocks of light material, e.g. balsa wood or polystyrene.

Point the turtle at the tower and try to knock it down using the FD command. (figure 3.)

Extensions

Choose an arbitrary starting position for the turtle so that a combination of FD and TURN commands are required to demolish the tower. the turtle must reach the tower avoiding the obstacles, (figure 4.)

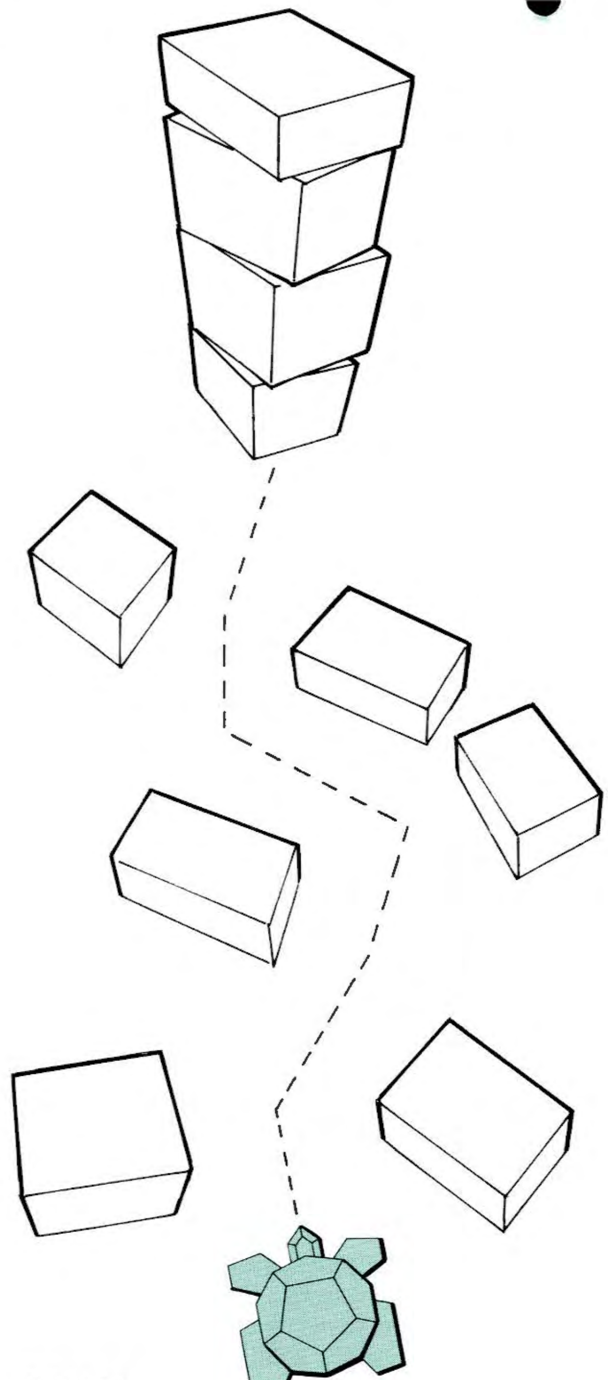


FIGURE 4

4. Racetrack

A large amount of floor space is needed for this game, (figure 5), alternatively run the track around existing furniture.

Position the turtle on the START line. Using FORWARD, LEFT and RIGHT commands steer the turtle around the track.

Performances can be timed or measured by the amount of commands required for a circuit.

Linear or more complicated circuits may be laid out as alternatives to the square track, (figures 6 & 7.)

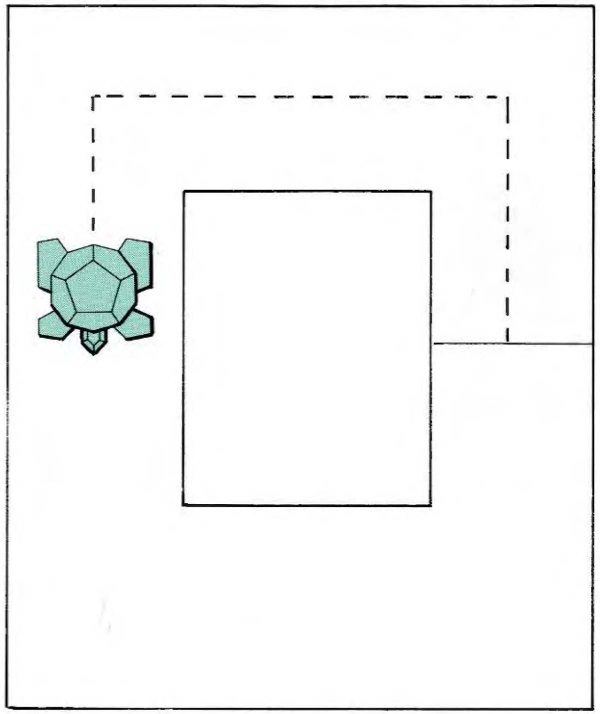


FIGURE 5

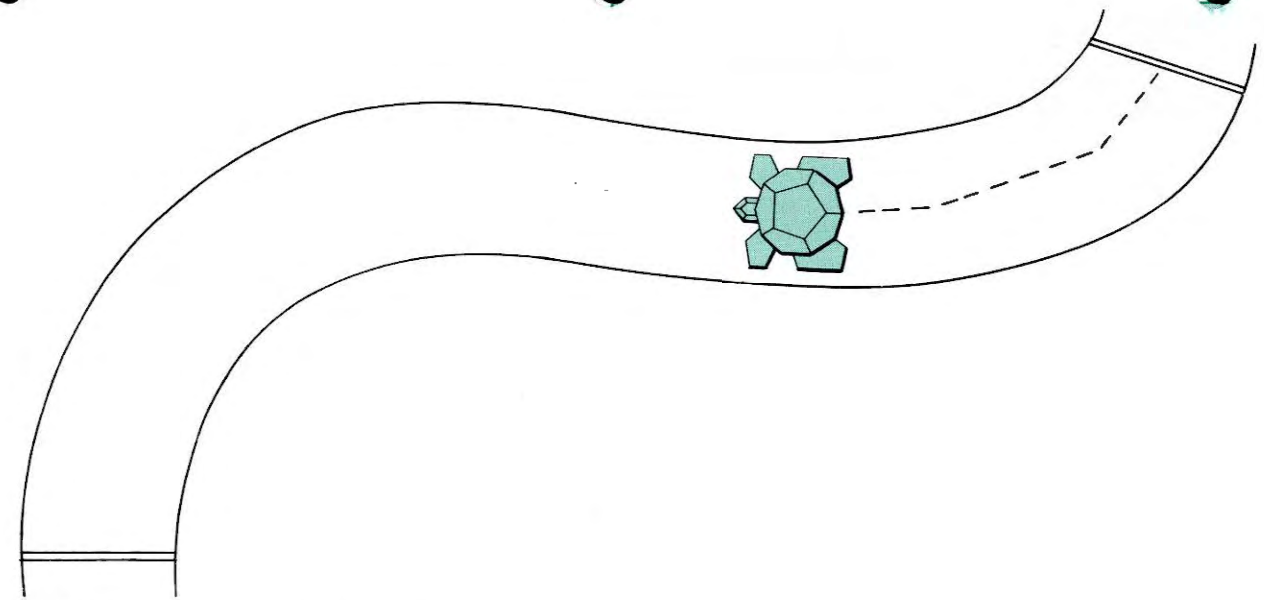


FIGURE 6

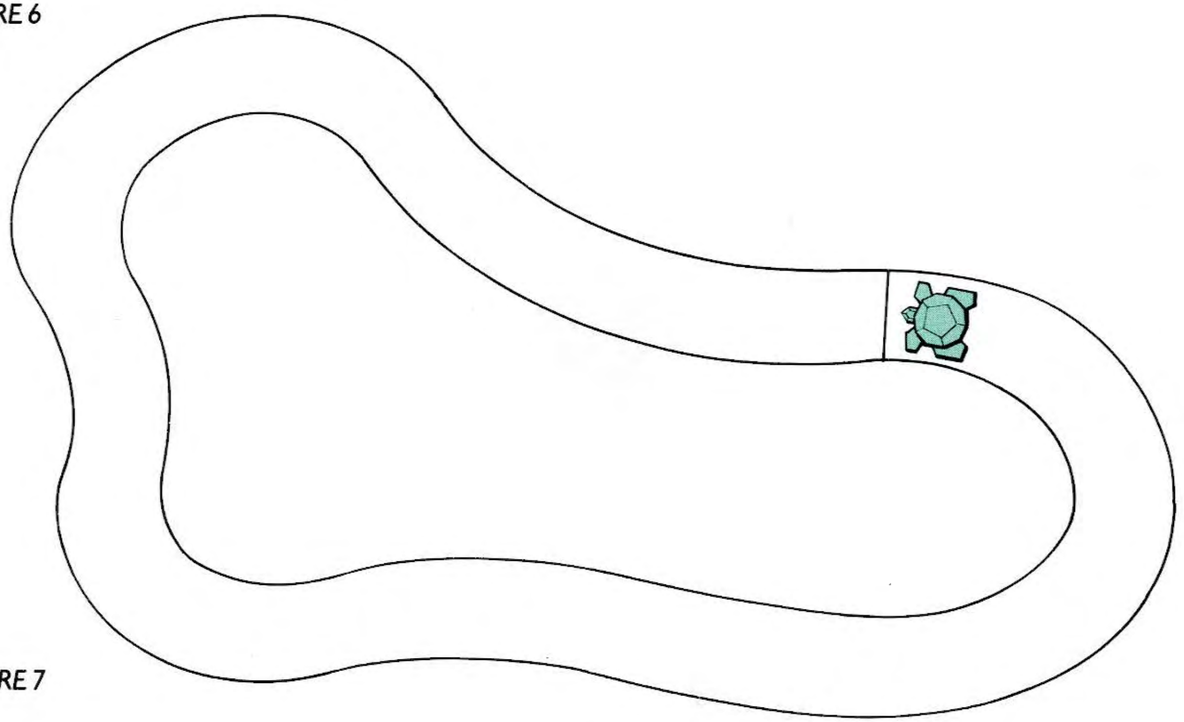


FIGURE 7

5. Postman

A group of children sit in a circle on the floor, (figure 8.) The turtle is inside the circle. One child has the computer and asks who wants to send a message. The child sends the turtle to the correspondent. A written message is placed on the turtle and the author indicates who it's for. The child with the computer programs the turtle to deliver the letter in as straight a line as possible.

To continue the game the children stand up and move around one place.

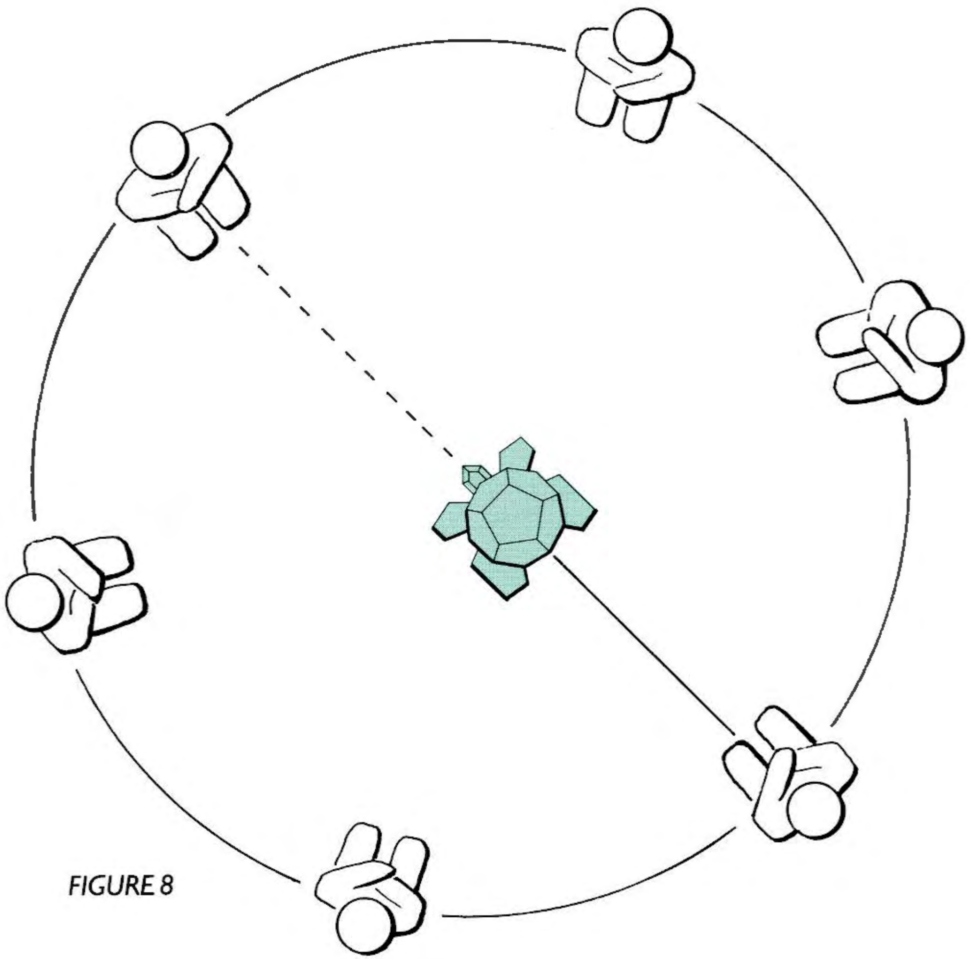
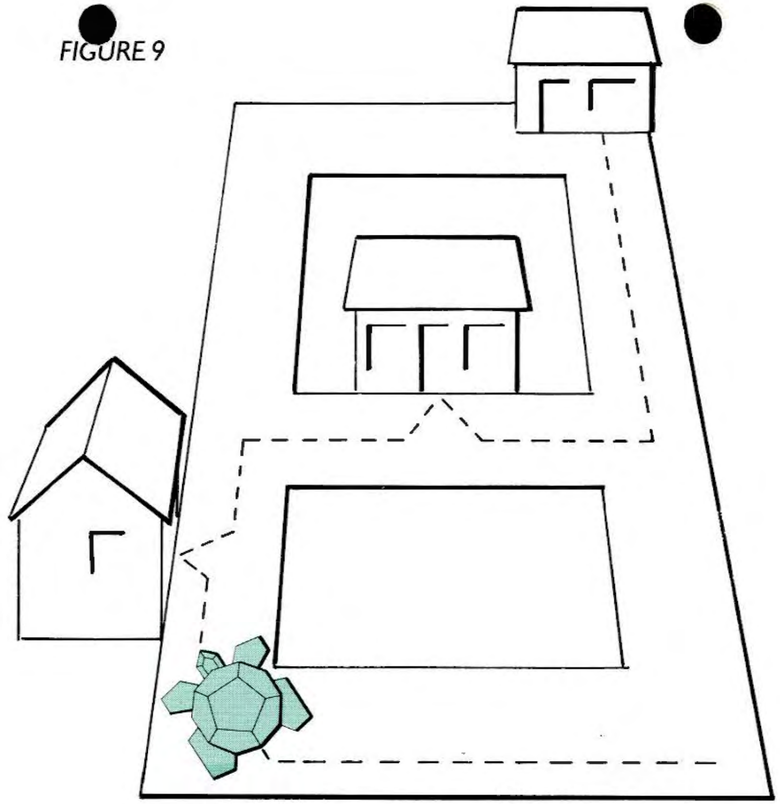


FIGURE 8

FIGURE 9



6. Shopping

A model town is needed for this game, (figure 9.) The size of the town, and variety of shops can be varied. The shops could be constructed in art and craft lessons.

A child is given a shopping list and asked to design a route around the town, visiting the shops and returning to the start.

Extensions

The journey must be completed within a time limit, to ensure catching the bus home.

The layout can be made more complex, involving more careful control of inputs.

There are many possibilities for developing the above games and activities. The children themselves are a great source of ideas. With a little imagination the turtle can support and inspire work across the curriculum.

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