Logo Primer or What's With The Turtle?

The most popular Logo environment has involved the Turtle, originally a robotic creature that moved around on the floor.

It can be directed by typing commands at the computer. The command forward 100 causes the turtle to move forward in a straight line 100 "turtle steps". Right 45 rotates the turtle 45 degrees clockwise while leaving it in the same place on the floor. Then forward 50 causes it to go forward 50 steps in the new direction.

With just the two commands forward and right, the turtle can be moved in any path across the floor. The turtle also had a pen which may be lowered to the floor so that a trace is left of where it has traveled. With the pen down, the turtle can draw geometric shapes, and pictures, and designs of all sorts.

Off the Floor and Onto the Screen

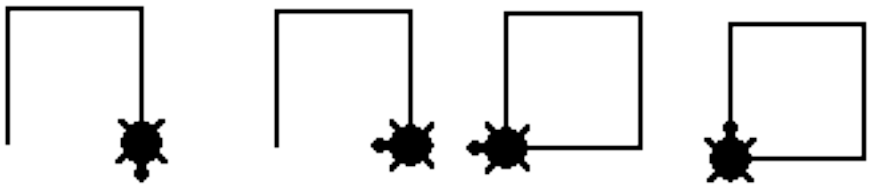
The turtle migrated to the computer screen where it lives as a graphics object. Viewing the screen is like looking down on the mechanical turtle from above.

The screen turtle also understands forward and right.

forward 50 right 45 forward 25

Following some exploratory messing around, a common first Turtle activity is to draw a geometric shape. How about a square?

forward 50 right 90 forward 50 right 90



forward 50 right 90 forward 50 right 90

There's also a repeat command so that

```
repeat 4 [forward 50 right 90]
```

also draws a square.

How about a triangle?

```
repeat 3 [forward 50 right 60]
```

Oops! That's fine. Debugging is part of working in Logo.

Another important aspect of Logo is defining new procedures. We drew a square using the instruction

```
repeat 4 [forward 50 right 90]
```

But if we tell Logo

```
square
```

Logo responds with the message:

I don't know how to square

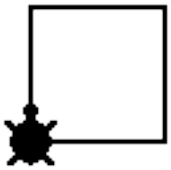
So we teach Logo a new word.

```
to square
```

```
repeat 4 [forward 50 right 90]
end
```

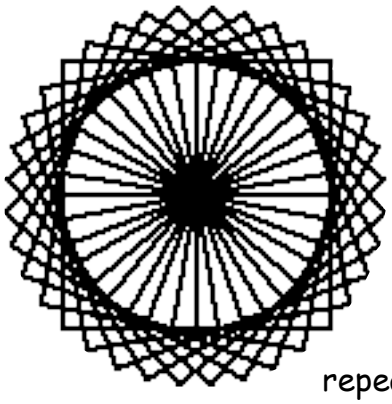
Now if we type square, Logo draws a square just as if we had typed repeat 4 [forward 50 right 90]. Logo has learned a new word.

forward 50



square

Now that square is in Logo's vocabulary, the new word may be used as part of another instruction. For example



repeat 36 [right 10 square]

We can give this a name also.

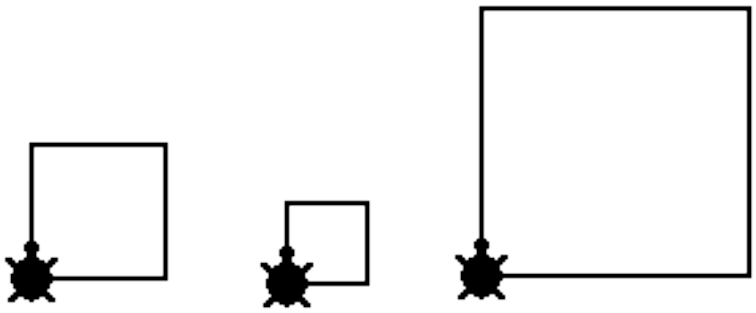
```
to flower
 repeat 36 [right 10 square]
 end
```

In Logo, programming is done by adding new words to the existing vocabulary. It's like learning a spoken language. New words are defined using words you already know.

Things can get more complex. Procedures can take "inputs" so that the information they use varies. We could write a square procedure like this:

```
to square :size
repeat 4 [forward :size right 90]
end
```

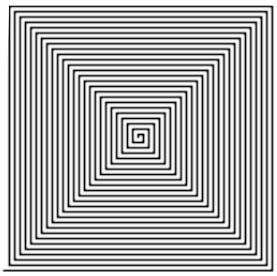
Instead of always having a square of 50 units on a side we can tell it how big to be:



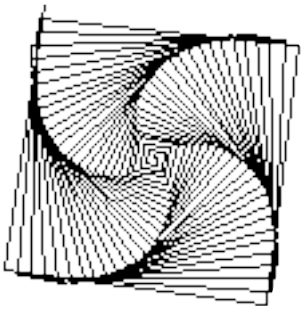
square 50 square 30 square 100

There's more:

```
to spiral :size :angle
if :size > 100 [stop]
forward :size
right :angle
spiral :size + 2 :angle
end
```



spiral 0 90



spiral 0 91

The traditional Euclidean geometry is built on abstractions: a point that has no size; a line that has length but no thickness. The turtle is a real concrete object that may be seen and manipulated. Analytic geometry rests on an outside frame of reference -- the coordinate system. In contrast, turtle geometry is "body syntonic". The turtle moves around as you do. You can identify with it and understand what it is doing.

Turtle geometry was not intended to be a replacement for traditional geometry but rather, as an alternative entry point into geometry and mathematics in general. It is appropriate for young children as well as adults.

The rationale behind turtle geometry is thoroughly explained by Seymour Papert in Mindstorms. Many versions of Logo come with tutorials and guide books about turtle

geometry.

While it is easy to get started with turtle geometry, it can also get quite complex. The book, **Turtle Geometry**, by Hal Abelson and Adrea diSessa includes many advanced explorations with the turtle.

Up and Away

Another species of Logo turtle emerged in the early 1980s. Dynamic turtles, or "sprites" as they were often called, lived in computers like the Texas Instruments TI99/4 and the Atari 800. The video game hardware in these machines allowed for software with numerous high speed multi-colored objects.

The versions of Logo created for these machines includes many turtles, which could take on a variety of shapes becoming birds, trees, dogs, or spaceships. Although the early video game computers disappeared, sprite capability has been included in most modern versions of Logo.

Here's an example of how an animation may be created with a dynamic turtle:

We start by assigning a shape to the turtle with a command such as setshape "bird1

We also have a second shape of a bird in a different position which we see by typing setshape "bird2

Then we can write a procedure

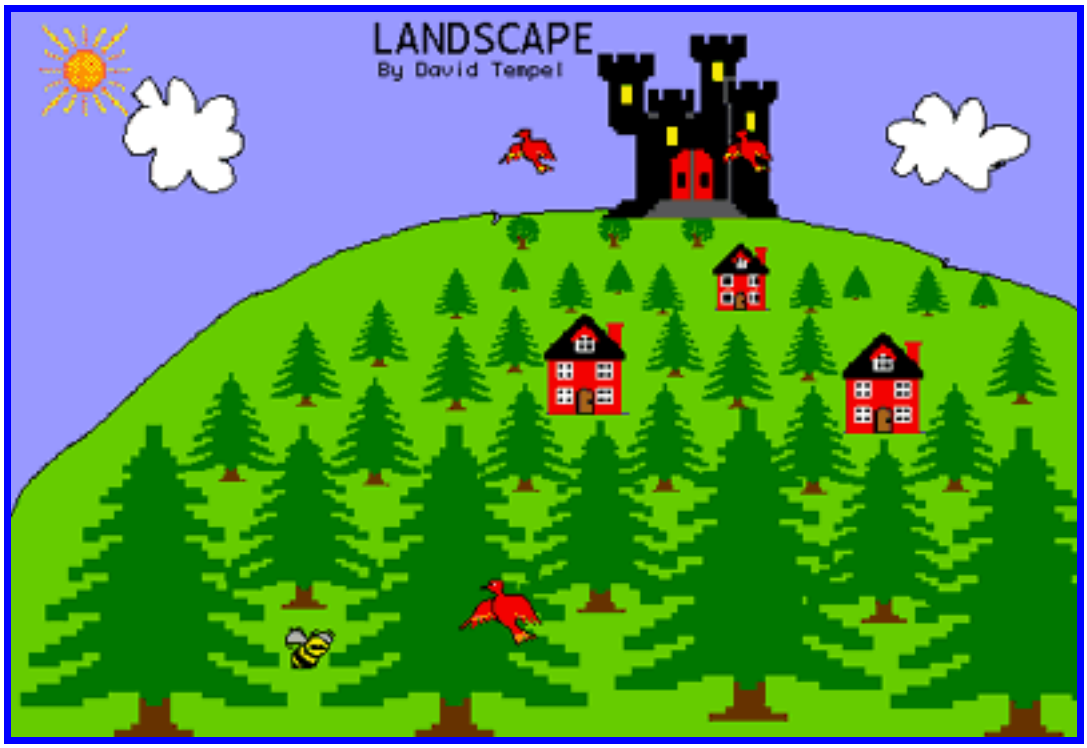
```
to fly
setshape "bird1
setshape "bird2
end
```

The instruction fly gets the bird to flap its wings once. Repeat 9999 [fly] causes it to flap continuously but it hovers in one spot. We can make it move forward also by changing the procedure:

```
to fly
setshape "bird1
forward 2
setshape "bird2
forward 2
end
```

In MicroWorlds we can say forever [fly] to send the bird on its way, or we can program the bird-turtle itself with the instruction fly. Then clicking on the bird-turtle with the mouse sets it in motion.

These Logo environments also allow us to have several of these processes active at the same time. This "multi-tasking" capability is particularly important when creating animations. Each character in the show can be programmed and activated independently. In this MicroWorlds project three birds and a bee are flying around at the same time.



Thanks to the Logo Foundation: http://el.media.mit.edu/logo-foundation/logo/turtle.html