Volume Investigations

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This microworld was described in more detail in The Computing Teacher (Conference Issue 1988-1989) article entitled "Investigating Volume with LogoWriter: Building a Bigger Box"

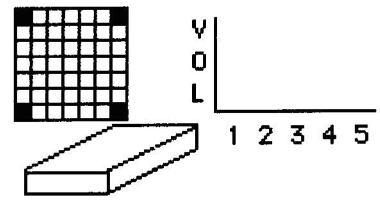
The purpose of this activity is for students to investigate how the volume of a rectangular open top box made from a rectangular piece of paper depends on the size of the clipped out square corners (nibbles).

Useful Procedure:

START prompts the user to enter in the size of the rectangle and the corner nibble size.

The program then draws the grid selected, shades in the nibbles that are cut away, draws a box, calculates the volume, and plots the bar graph of the volume. You are then asked whether you want to try another grid size.

The authors recommend the following higher order questions to be asked:



Why must the corner cuts be squares?
What is the relationship between the size of the corner cut and the height of the box?
In comparing two boxes, will the taller box always have the greater volume?
For a square starting grid with fixed dimensions, what happens to the volume of the boxes as the sizes of the square corner cuts increases?
What happens to the results if you use fractional numbers as well? Can you get a larger volume? Δ

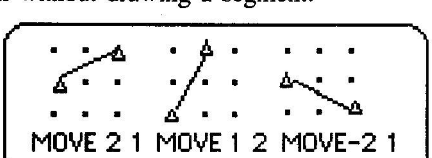
(Editor notes: Though this microworld is more "closed" than the others (just one procedure), it is a useful environment for doing this kind of volume investigation. The authors suggest that students start by doing the experiment with physical objects. Make boxes out of grid paper to see how the volume depends on the corner cuts.)

Euclidean Geometry from the Turtle's Viewpoint

by Peter Pereira

Assume there are two Logo procedures (called MOVE and PUT) which have the effect of moving the turtle around on a rectangular grid. Both procedures take two inputs which relate the turtle's new position to its initial position and heading. The first input determines how far the turtle has been displaced to the right or left; the second determines how far it has been displaced forward or back.

MOVE draws a segment from the turtle's initial position to the new position. PUT simply puts the turtle in the new position without drawing a segment.




```
TO MOVE :S :T
LOCAL "A LOCAL "P LOCAL "Q
MAKE "P :S*10 MAKE "Q T*10
MAKE "A ATAN :P :Q RT :A
FD SQRT (:P*:P + :Q*:Q) LT :A
END
```

Terrapin Logo

After working with these procedures for a while, it becomes tedious to keep typing MOVE (as well as putting parenthesis around negative inputs). It is natural to look for shortcuts, which lead to new procedures and sometimes new mathematical insights. Here is one possible development.

1. A line segment is determined by an ordered pair of numbers (the inputs to MOVE). The location and orientation of this segment is determined by the turtle's initial position and heading, but all segments drawn with a particular pair of numbers will be congruent. Is it possible that segments drawn with different pairs of numbers will be congruent?

2. Any sequence of pairs of numbers (i.e. a sequence of inputs to MOVE) will determine a geometric figure (or turtle path). So instead of writing procedures for the geopieces as was done on the previous page, we could use the following procedure:

```
TO FIGURE :L
IF EMPTY? :L STOP
MOVE (FIRST :L) (FIRST BF :L)
FIGURE BF BF :L
END
```

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