



## LESSON 1

Vocabulary: ask [ ] and wait, answer, change [x] by 1, change [t] by [x], make a variable, point in direction [ ], set x to 0, set [variable] to answer, show [x], when GREEN FLAG clicked

Assignment 2A: Read this handout

Assignment 2B: Watch these videos which I am putting on [summercore.com/videos](http://summercore.com/videos) for redundancy since the **YELLOW** links do not work for everyone

- [Arrow and Variable](#) • 9 minutes

<http://www.youtube.com/watch?v=YhzaZrO84oo&feature=youtu.be>

- [Change Cat to Arrow](#) • 6 minutes

<http://www.youtube.com/watch?v=JT2qnciGVJc&feature=youtu.be>

Assignment 2C: Schedule a 30 minute phone call or skype with me

Assignment 2D: Please continue to contribute several entries to our WIKI which is located at the [tinyurl.com/sconlinec](http://tinyurl.com/sconlinec) webpage.

Assignment 2E: I would like you to introduce yourself to the other 6 people in this course and send a picture of yourself to the other 6 people in the course. Many of you are contemplating some type of Programming/Coding course in your lower school and I believe you will be resources to each other. I will kick this off with an email to the group of 7 of you and ask you to REPLY ALL and attach a picture. Thanks!

Assignment 2F: Programs to Write (final page)

## Lesson 2 is about Variables

A variable is an important part of programming. It is also an important part of pre-algebra, algebra and math in general. Math people like to call variables X, Y, Z, T, and C which occasionally the letter stands for a word, e.g. T for Total or C for counter. Computer people like to use actual short words for variables such as COUNTER or TOTAL or HOWMANY. Different strokes for different folks; we all have our preferences!

Here is the first sample program that uses a variable to draw a square of variable size. I am calling this program Lesson 2.1 using a suggestion from Matt M who is in our course from Florida who teaches computers to lower school kids.

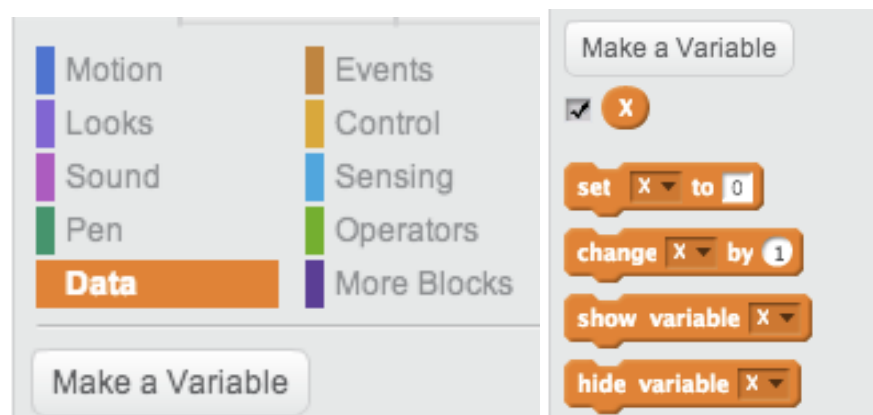
You will learn from one of the videos how to access programs that have been shared by the person who created them. My scratch account is SBERGEN33 and starting with Lesson 2, I will use Matt's system with programs named 2.1 and 2.2 and 2.3 etc. Each time you access one of my programs, you can either RUN it or you can REMIX it. If you REMIX it, you can save it in your library and modify it.

To access any of the programs from my library, you look at the TOP LINE on SCRATCH where it says SEARCH and you type in SBergen33 (my username)



You then get to see any of the programs that I have chosen to share and make public. You can do the same if you like and within a few days, you will have the usernames of the other 6 people in our course. By sharing our user names with each other, we will move into a next phase of this course in weeks 4-5 and beyond of collaboration.

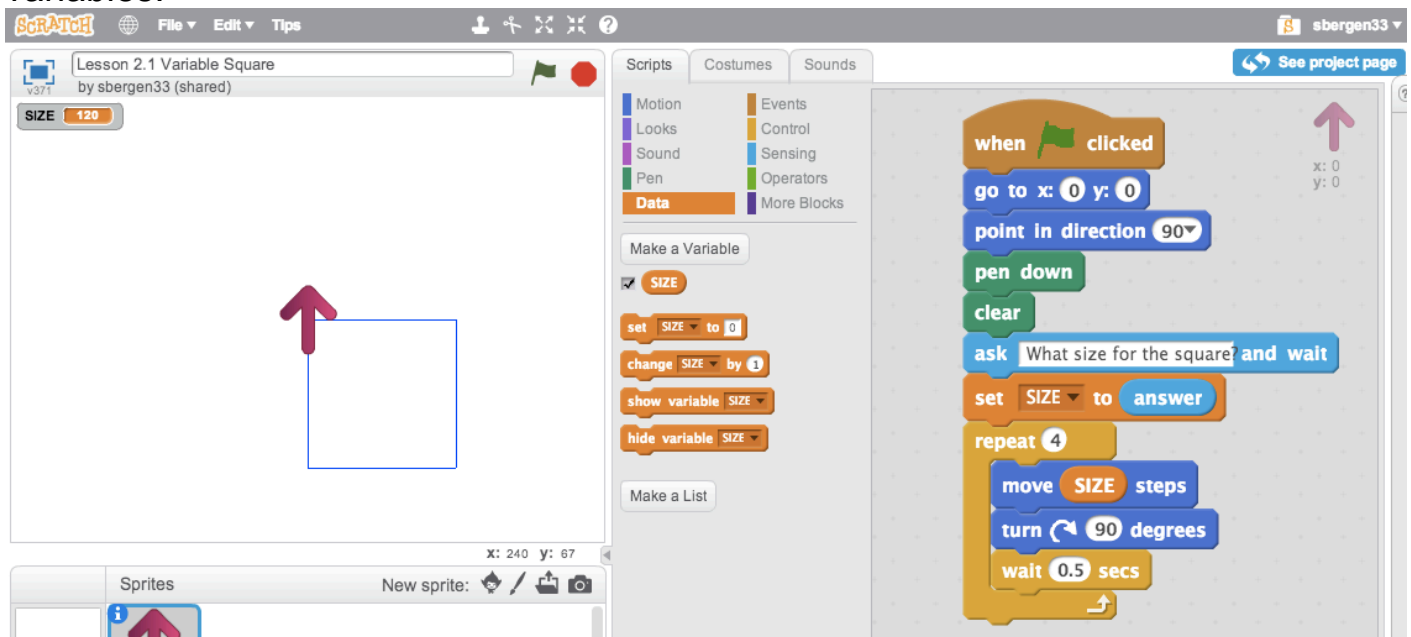
Here are the new ORANGE commands under DATA



When you make a variable, you get this new set of 4 commands that you see on the right. The important ones are the SET command and the CHANGE command.

Below you can see that I am adding the starter command with the green flag so that my program runs when you click the green flag. The first and only use of a variable in this program occurs when you see the ORANGE DATA command called SET SIZE TO ANSWER. Using the DATA option, I created a variable called SIZE. This automatically displays at the top left of the screen where your program is executed.

Now here is the important thing. When you use the BLUE ASK command, the result always goes into the BLUE temporary variable called ANSWER. So as a programmer, the standard thing to do is to use the SET command to move ANSWER into a more permanent variable, in this case SIZE. Got it? I hope so, but like anything else, you need to do it yourself from scratch and then repeat it a few times to practice. Think BLUE and ORANGE. The blue command called ASK allows the human to interact with the program and puts the result into the ANSWER variable which you will see right below ASK in the blue SENSING set of commands. Meanwhile the ORANGE DATA section is where you make or rename your variables.



Please notice that I have changed the CAT to a RED arrow pointer which I find much more useful in terms of the themes of directionality. I will show you below and also video how to do this using COSTUMES. Also notice my personal preference of using WAIT to slow down the action a bit so you can see each side being drawn. And yes, you can use decimals like .5 to wait half of a second.



This program below **Lesson 2.2** is the exact same program using the variable X instead of the variable SIZE. The ability to rename the variable in DATA is wonderful. I want you to see both styles (math teacher and computer teacher) so you can decide what your own personal preference is when using variables. It is great that you can RENAME a variable and it renames it everywhere!

```

when green flag clicked
  go to x: 0 y: 0
  point in direction 90
  pen down
  clear
  ask "What size for the square?" and wait
  set X to answer
  repeat 4
    move X steps
    turn 90 degrees
    wait 0.5 secs
  
```

```

when green flag clicked
  ask "Add from 1 to what number?" and wait
  set HOW MANY to answer
  set C to 0
  set T to 0
  repeat HOW MANY
    change C by 1
    change T by C
    say T
    wait 0.2 secs
  say "Got it! I used my RAM CHIP to add." for 4 secs
  say T
  
```

On the right above is our next program, **Lesson 2.3 Add from 1 to Specified Number** this time with two variables C and T that show you how to add up the numbers from 1 to any specified number. C is the counter and T is the running total. The third variable called HOW MANY is assigned by the user from the ASK command using the same technique as before with the important temporary transfer variable called "answer" in lowercase which is created by the system (not us).

The important two new steps involve the word CHANGE. When we say CHANGE C BY 1, we are using a classic programming technique to COUNT. When we say CHANGE T BY C, we are using a classic programming technique to SUBTOTAL. Believe it or not, I have told hundreds of students and adults to memorize these two techniques, study them and make them yours ever since 1974 when I started teaching programming in BASIC in Charlottesville Virginia. I was a math teacher and graduated college in 1973. In my first year, the computer teacher told me that he was going to take kids on the Wilderness Survival elective in the Blue Ridge mountains and that he asked me to teach the course!

First challenge: Lesson 2.4: Add from 1 to X with Visual  
 Here is the program on the left. If the user enters 10, what will be drawn on the screen? Please try to figure it out before you get it from my shared library (SBergren33) and run it.

```

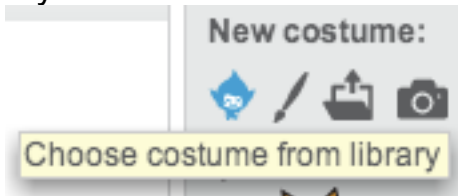
when clicked
  go to x: 0 y: 0
  point in direction 90
  clear
  pen down
  set pen color to blue
  ask "Add from 1 to what number?" and wait
  set HOW MANY to answer
  set X to 0
  set T to 0
  repeat HOW MANY
    change X by 1
    change T by X
    show variable T
    wait 0.5 secs
    move T steps
    turn 90 degrees
  think "The total is " for 2 secs
  say T
  
```

```

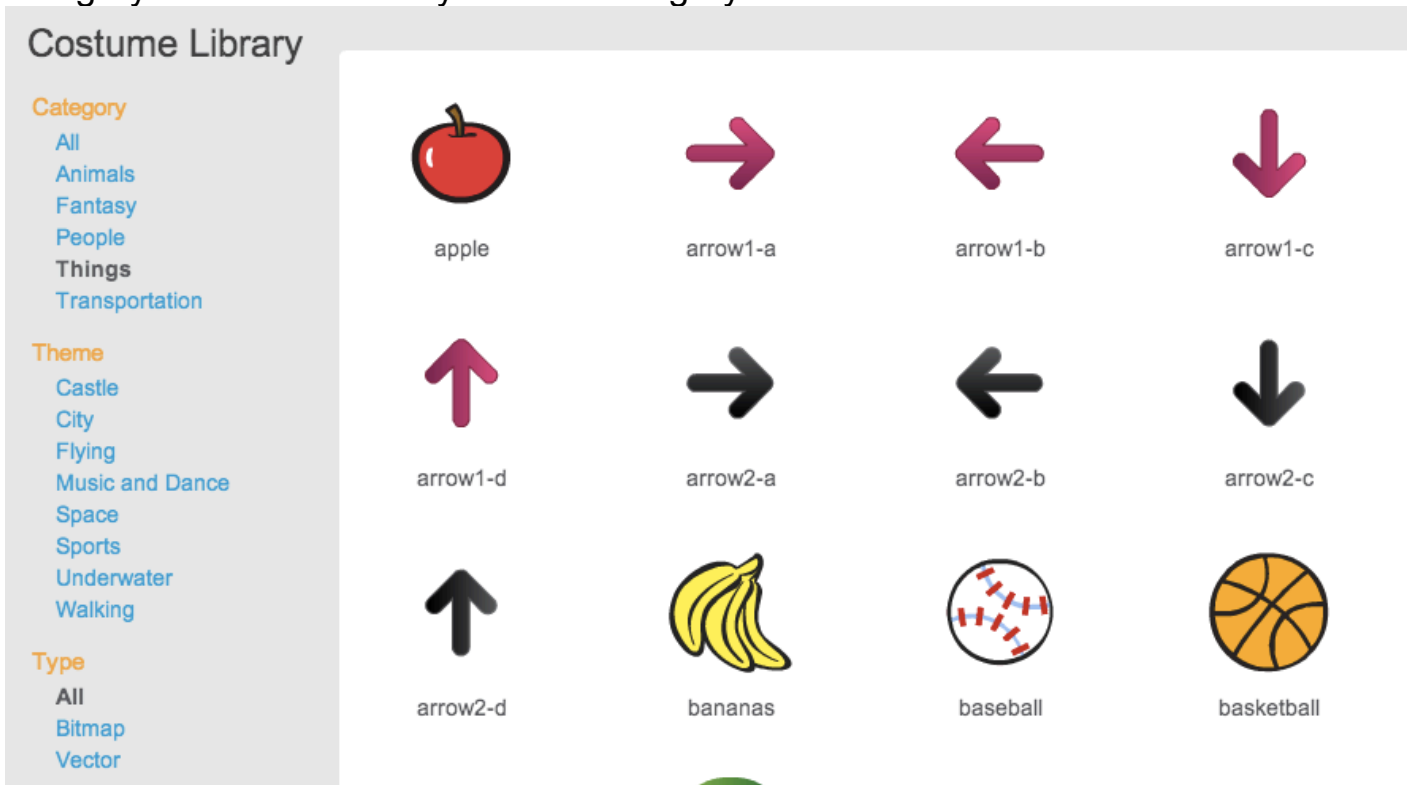
when clicked
  ask "What size? Please keep under 33!" and wait
  set X to answer
  go to x: -100 y: 100
  point in direction 0
  clear
  pen down
  repeat 4
    repeat 8
      move X steps
      turn 45 degrees
      wait 0.2 secs
    turn 135 degrees
    repeat 9
      move X steps
      turn 45 degrees
      wait .2 secs
    move X steps
    turn 90 degrees
    move X steps
    turn 90 degrees
  
```

Second challenge is on the right and is called Lesson 2.5 Bathroom Tiles. The task is the same. See if you can figure out what the drawing will be before you run the program. Hint #1: Escher • Hint #2: Bathroom Tiles

Let's talk about changing the CAT to my new favorite icon, the arrow.  
If you click on the blue icon below called CHOOSE COSTUME FROM LIBRARY



you get access to dozens of replacements for the CAT. They are organized by category on the left and my favorite category is THINGS.



The arrow pointing to the RIGHT is the one you want, either arrow1-a or 2-a. This is the arrow for which the ink that comes out matches your intuition. I may have messed up earlier and told some of you to choose the UP arrow, but I was confused because Scratch begins in its default state with the cat drawing to the right.

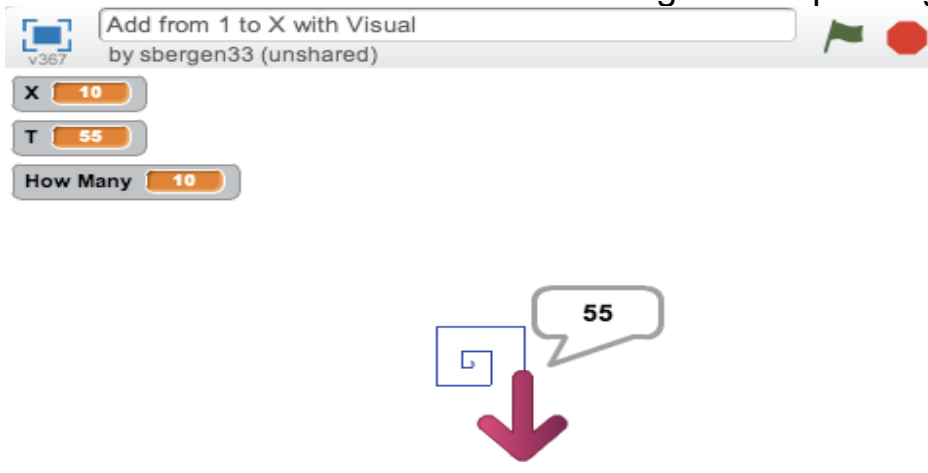
Hope this is clear!

In this next example, I decided to use variables and create a shape using the algorithm of adding up numbers. When you run the program, you see




showing you my new favorite arrow facing the way I prefer. Do you recognize that I used the ASK command to find out from the user what to add up to? Do you recognize that I must have used the command POINT IN DIRECTION 90 before the ASK command? That explains why the arrow is facing up, because facing right means 0 degrees and facing up means 90 degrees.

Here is what the user sees after entering 10 and pushing return or enter.



Notice that 3 variables are in the upper left with their final value after the arrow drew 10 line segments. The ten line segments correspond to the partial sums  $1+2$  or  $1+2+3$  or  $1+2+3+4$  etc. Basically, I just wrote the program to add up the numbers from 1 to 10 and each time I got a new value of T, I turned 90 degrees and moved forward that value. That is why the segments get bigger from inside out.

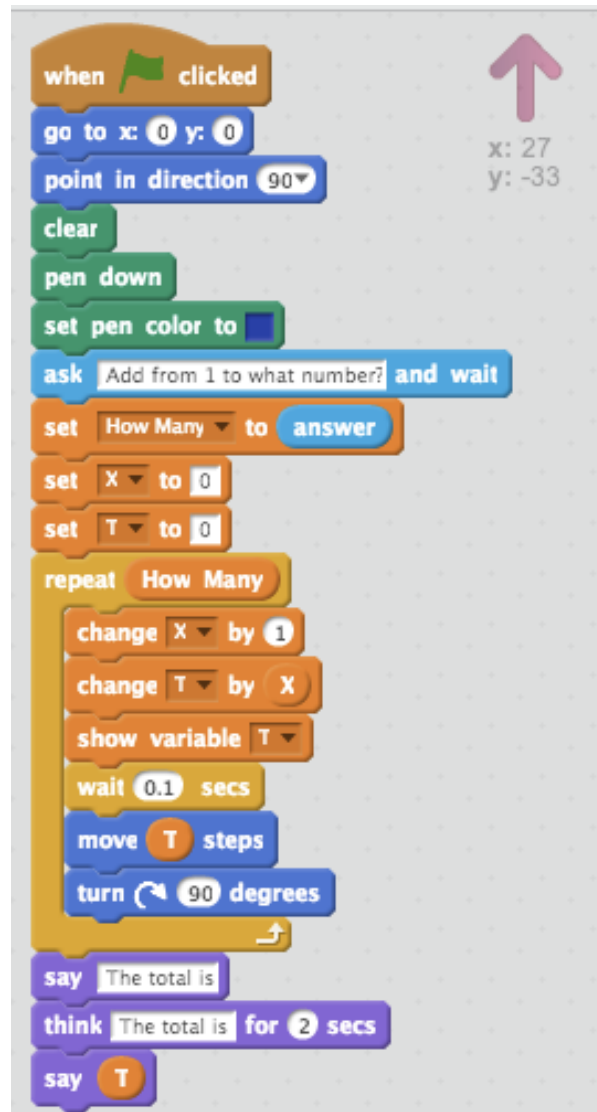
The program appears below but let me first comment that in my language of "I turned 90 degrees" you see an example of what Seymour Papert (creator of Logo in the 1970s and 1980s and author of *MindStorms*) called the "ego-syntonic and body-syntonic" nature of programming shapes and graphics. He said the "child identifies





with the cat or the arrow" and it is both a physical thing ("body-syntonic") and a psychological things ("ego-syntonic"). If you google Seymour Papert, you can watch videos from this incredible educator/computer scientist who was a very important figure in the educational tech world of the 1980s.

As I have told a few of you on the phone or skype, I quit my job in the summer of 1982 as a computer programmer in Cambridge MA after reading *Mindstorms* to start this company to do teacher training. The company was initially called The Teaching Company but we then changed to Summercore in 1985. I told friends I would be out of business by 1989 since I predicted that schools by then would have geared up to fully incorporate technology into their curriculums and provide professional development for their own teachers. I now realize how young and naive I was then!





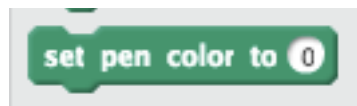
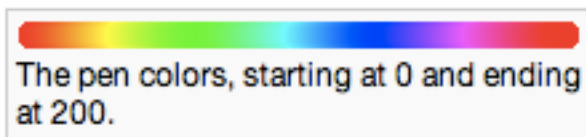
Time to share the homework problems.

I have ranked them from EASY to HARD and encourage you to do any 2 you like. If you are a bit obsessive (like me) and do more, violating the 2 hour rule I said would be the maximum weekly time for busy teachers and professionals, then that is your problem and you cannot blame me!

HW Assignments (do any 3)


1) Draw a triangle of varying size. The computer asks the human "how big for each side" and the computer then draws the triangle. I will call this **HW 2.1**

2) Draw a line segment of varying color. The computer asks the human the number for color from 0 to 200 and then draws a line of length 100 in that color. I will call this **HW 2.2**



You will need the command.

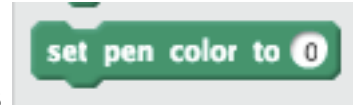
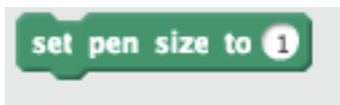
3) Ask the human for 2 numbers and then have the computer give the answer. I will call this **HW 2.3**

Hint: you will need to explore and use one of the commands  in the green OPERATORS section.

4) Draw a triangle of varying size and varying color. The computer asks the human "how big for each side" and "what color" and then the computer then draws the triangle in that color. I will call this **HW 2.4**



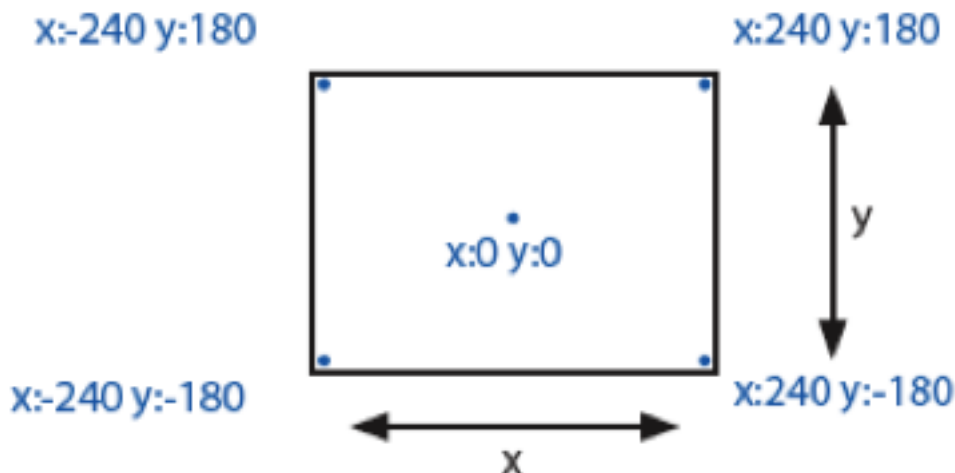
5) Draw a line segment of varying color, varying thickness and varying length. The computer asks the human the number for color from 0 to 200, the thickness from 1 to 256 and then draws a line of specified length in that color and size. I will call this **HW 2.5**



You will need as well as

6) Make the computer add up all the numbers from 1 to 100. The answer is 5050 and was once figured out by Gauss when he was seven years old. His teacher was punishing all the kids for bad behavior and made them sit with their chalk boards for an hour to add up all those numbers. Young Gauss finished in a few minutes much to the chagrin of the teacher. He came up with the formula of taking the biggest number 100 and multiplying it by the next consecutive number then dividing by 2. You get  $100 * 101 / 2$  or 5050

7) Make a large uppercase T or uppercase H that will fit comfortably on the screen which is 480 pixels across. Our goal is to get the seven letter word SCRATCH on the screen in variable size but that will take us weeks! I think the T and the H are the easiest letters so we will start with them. Choose either T or H and make it fit into a rectangle approximately 50 pixels wide and 100 pixels tall. This will allow for all seven letters of SCRATCH to fit on the screen when done. Got it? The height of your T or your H is to be 100 and the width is to be 50. Good luck. This is harder than you think.



8) Use the variable sized hexagon to make a tessellation of hexagons (another popular pattern of bathroom tiles)

9) Compute interest on \$100 at 7% interest for 13 years

10) If you did problem 7 and created the H or T, make it be of variable size so that the human can say "how big" and the computer responds with an H or T that is either bigger or smaller but is based on the variable size.

Have a good week. I have really enjoyed our phone calls/skypes and hope you have as well!

Steve

p.s. Later in the course we will encounter HopScotch for the iPad since Scratch does not yet work on the iPad. This is a dedicated company (see blog at [blog.gethopscotch.com](http://blog.gethopscotch.com)) and interestingly, they just announced that they have added VARIABLES to their programming language!

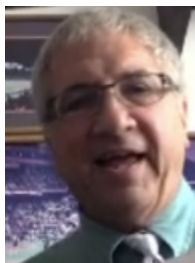


**Hopscotch**  
@hopscotch



Following

We're in the office, working on adding variables. Wheeeee!



Steve

phone = 781-953-9699

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