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Java Fundamentals

2-10
Variables

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Objectives

- This lesson covers the following objectives:
  - Understand variables
  - Understand how variables are used in programming
  - Viewing Alice code as Java Code on the side

Variables

- At times, programmers need to store information, and then use that information in animations or in games

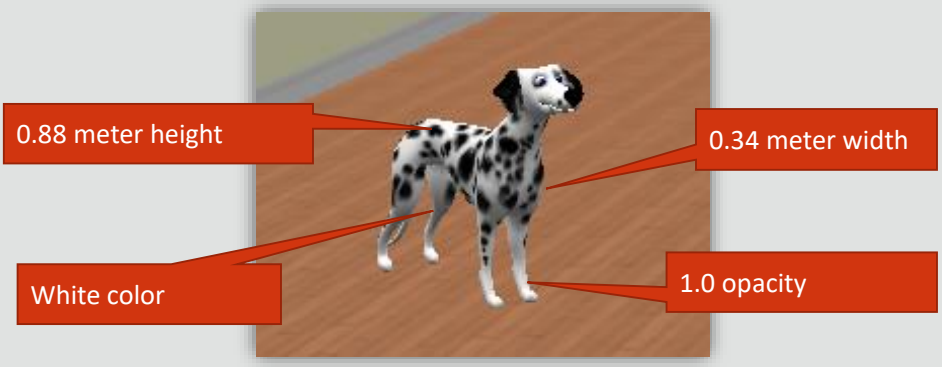
- For example:
  - The number of times a procedure should be executed
  - An object's properties, such as size and color

A variable is a place in memory where data of a specific type can be stored for later retrieval and use by your program. Each variable is given a unique name to make it easy to find and reference. Once a variable is declared it can be used to store and retrieve data.

Variables allow you to store information of a specific type. You then access the information through the variable name.

Variables Example

- Below are the variables and their values for a Dalmatian instance



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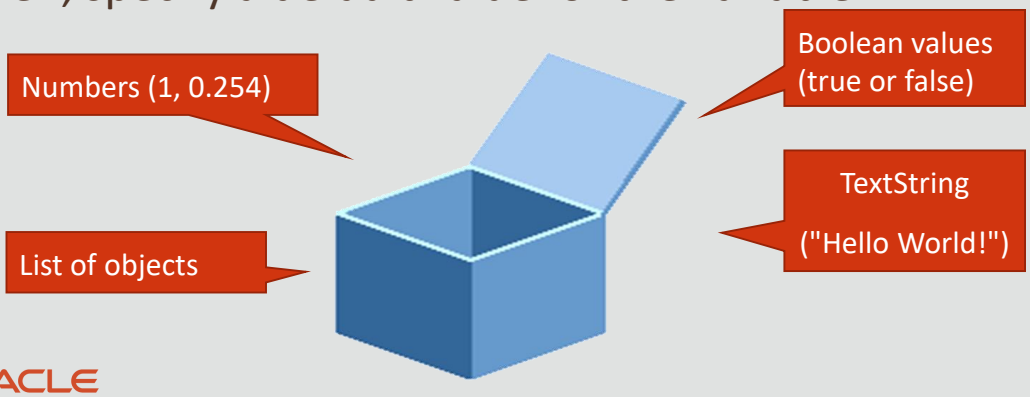
You have already been using variables extensively, probably without even knowing it.

Variables for Data Storage

- A variable is like a container that stores a specific type of data for later retrieval and use by your program
- Declare a variable by naming it and selecting the type of data to store in it
- Then, specify a default value for the variable



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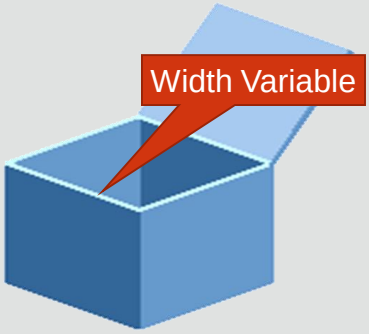
Variables

In Alice 3 you need to give a variable an initial value when you create it.

Object Properties

- Object properties are variables that store information about the object, such as color, width, height, and depth



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Variables are extremely useful in programming as you can change their values at any point in your code allowing you to change their behavior.

Variable Data Types in Alice 3

Data Type	Description
Decimal Number	• Perform arithmetic and set the value of a procedure's arguments • Examples: 0.1, 2.25, 98.6
Whole Number	• Perform arithmetic and set the value of a procedure's arguments • Examples: 1, 459, 30
Boolean	• One of two values: true or false • Usually is the result of tests that compare one thing to another
Classes	• The classes of objects that are available in your animation • Examples: Biped, Scene, Quadruped
TextString	• A String of characters such as "hello" and "goodbye"
Other	• Sounds, colors, shapes, and other special values

The table of data types may seem quite daunting at first but it really just defines the types of data that you store with Alice 3. Each data type stores a unique type of data and trying to use the wrong one will generally result in errors in your code.

Declaring Variables

- To declare (or "create") a variable is to give a variable a name and to define the type of data the variable will contain
- Variables are declared in the Code editor
- They are useful because they allow you to:
  - Assign the same value to multiple procedures, such as a distance to move
  - Simultaneously update the value of all arguments in a program that reference the variable
  - Pass information from one procedure to another
  - Simplify programming statements using many functions and math expressions

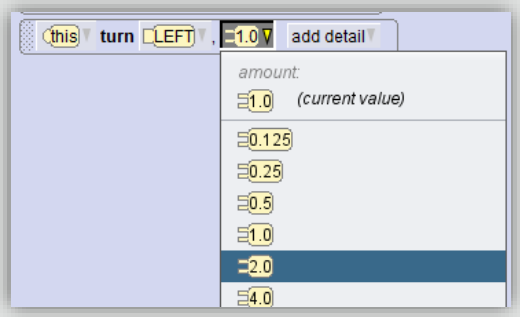
A variable has three parts to it when you declare (create) it, data type, name and initial value.

Initializing Variables

- To initialize a variable is to assign it a value
- Variables are initialized in the Code editor at the same time that they are declared; this is its initial (first assigned) value
- Variable values can be changed as often as you like
- The word "initialize" means "assign a value to"

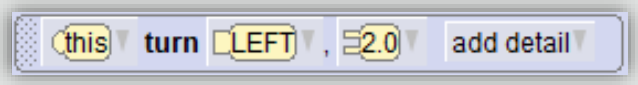
Changing an Initialized Value

- Remember, the initial value you specify for the variable can be considered a placeholder value, and changed at a later time
- You can change the initialized value of a variable using the drop-down list

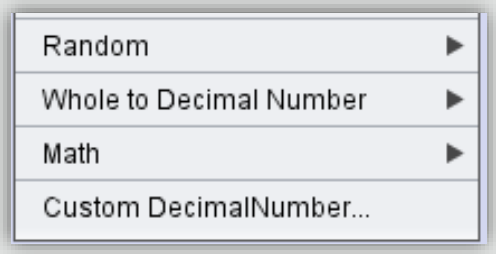


Changing an Initialized Value

- The new value of all arguments using the variable will change when the initialized value is changed

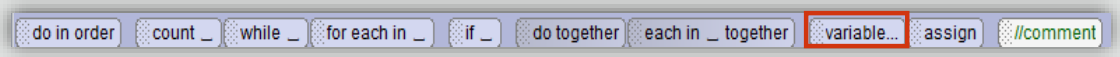


- If one of the default values listed on the drop-down is not what you need, use the Custom options menu to specify another value

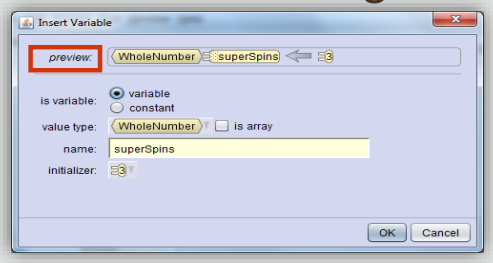


Steps to Declare a Variable

- Drag the variable tile into the Code editor



- Select the value type and name the variable
- Initialize the variable (set the first value that the variable will hold) and click OK
- Note that the preview of the variable, above the thin line, displays the variable settings



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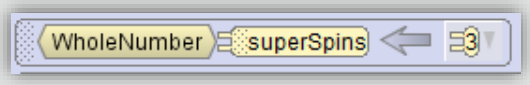
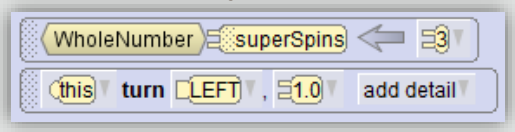
Variable Example

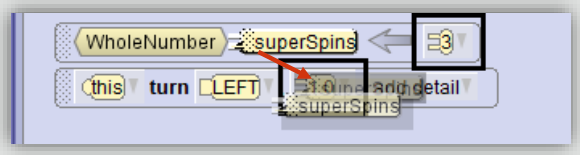
- The "superSpins" variable is declared and initialized to a whole number with an initial value of 3



- Use a turn procedure to spin the character



- This variable is dragged into the distance argument of the turn procedure



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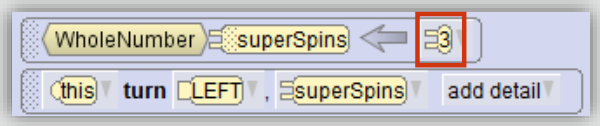
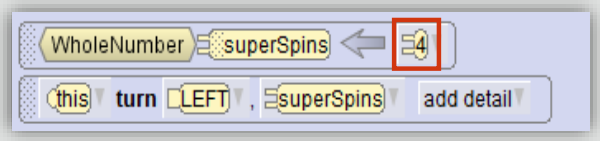
In this example a superSpins variable is created that will make the objects spin 3 times. If we change the value from 3 to anything else then it will change the amount of spins that the characters will do.

Variable Example

- Each character spins three times

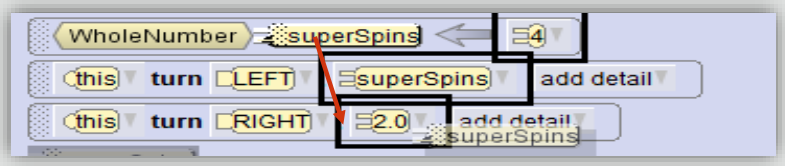


- If the initialized value of "superSpins" is changed to 4, all of the characters will spin based on the value of the variable, which is now 4



Using Variables in Procedures

- To use a variable that has been declared in a procedure, drag the variable name tile onto the procedure's argument value
- The argument is replaced with the variable's initialized value
- Alice 3 helps you visualize the locations you can place a variable by darkening the screen and highlighting the values that can be replaced by the variable



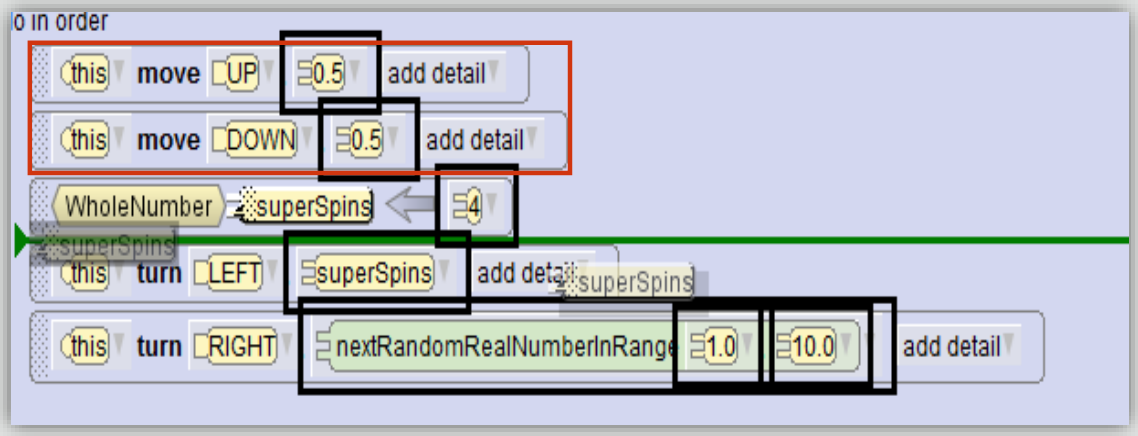
Using Variables in Procedures

- Be aware that a variable must be declared and initialized before it can be referenced by any other statement in your code
- If you try to reference a variable before it exists, your program will encounter an error at run-time

Just like every other walk of life you can't use something that doesn't exist, coding is no different.

Using Variables in Procedures

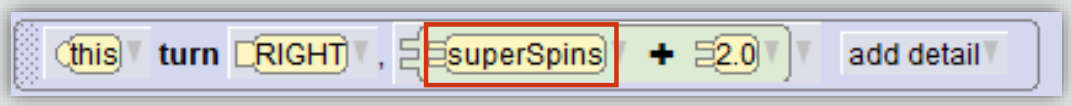
- Caution: Alice highlights all arguments that might potentially reference the selected variable, including those arguments that precede the variable's existence



It is normal practice to declare all of your variables at the beginning of a procedure to ensure that they actually exist when you try to use them.

Using Variables in Math Calculations

- Note that variables can also be used in math calculations
- You can drag a declared variable onto any value within a math expression



This gives your expressions the ability to calculate a range of numbers instead of just static values.

Steps to Randomize an Initialized Value

- Click the down arrow next to the initialized value
- Select Random from the drop-down list
- Choose either the option to randomize using a predefined range or the option to randomize based on values you establish
- If you choose the option to randomize based on values you establish, select the starting and ending values for the range using the cascading menus

Adding random behaviour can add tremendous value to your animations. By creating a slightly different outcome every time it runs it can enhance the experience for your users. It is important to use variables and not static values within your code when using random numbers as each execution of your code will be slightly different.

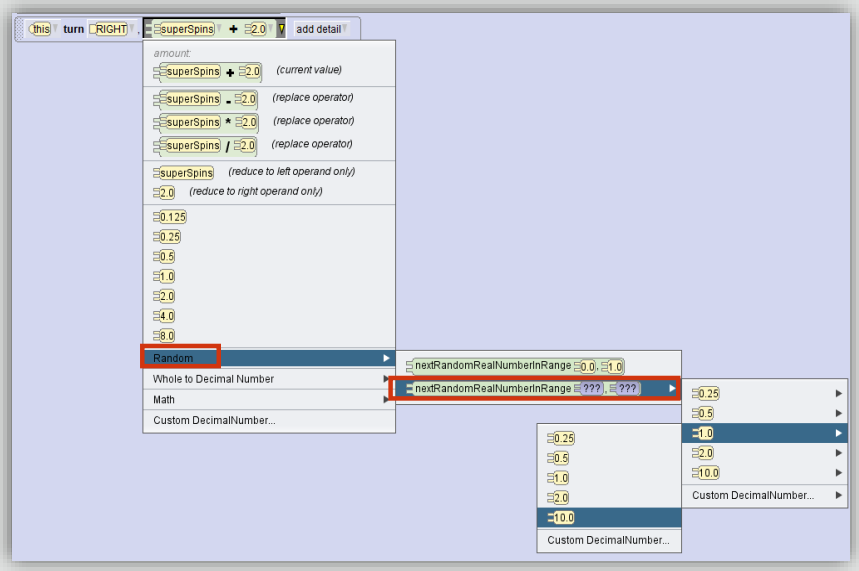
Steps to Randomize an Initialized Value

- Remember, argument values can always be changed
- Randomization of variable values can add value to an animation or game by creating random behavior

Adding random behaviour can add tremendous value to your animations. By creating a slightly different outcome every time it runs it can enhance the experience for your users. It is important to use variables and not static values within your code when using random numbers as each execution of your code will be slightly different.

Randomize an Initialized Value Display

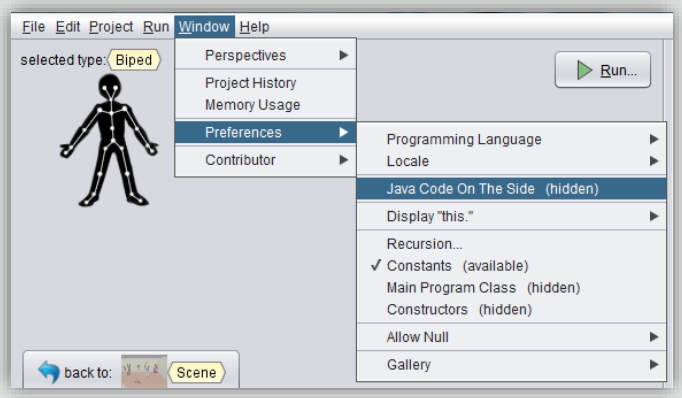
- Below shows how to randomize an initialized value



You can either choose from the given range, from a random number, or specify your own top and bottom range. Random numbers are returned as a decimal value.

Viewing Alice Code as Java

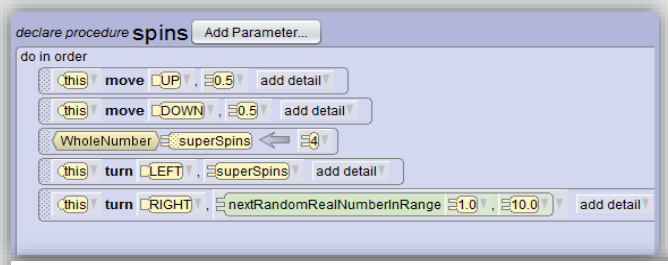
- To see the code that has been produced in a more traditional Java code environment Alice has a Java on the Side option
- Use the Window menu option, then preferences and Java Code to enable the window



This can be very useful to gain an understanding of the code that is being generated in the background of the drag and drop environment.

Viewing Alice Code as Java

- This allows you to see traditional programming structures such as semi-colons(;) to finish statements and curly brackets as begin({) and (}) end statements

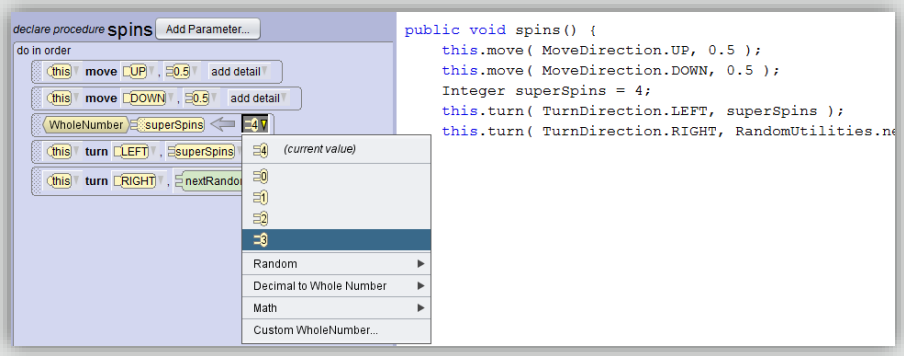



```
public void spins() {
    this.move( MoveDirection.UP, 0.5 );
    this.move( MoveDirection.DOWN, 0.5 );
    Integer superSpins = 4;
    this.turn( TurnDirection.LEFT, superSpins );
    this.turn( TurnDirection.RIGHT, RandomUtilities.nextDoubleInRange( 1.0, 10.0 ) );
}
```


Sometimes what the code actually does can become clearer when read as Java code.

Viewing Alice Code as Java

- Changes made in the Alice code are reflected in the java code

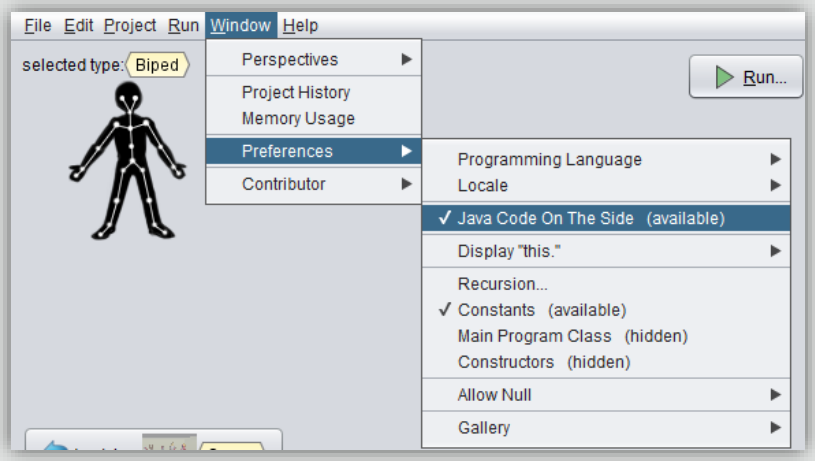


- You cannot change the java code directly it is just a representation of the Alice code

If you change the value of an argument/variable in the Alice window you will see that being updated in the Java window. This is a one way operation you cannot change the Java code directly.

Viewing Alice Code as Java

- To turn off the Java Code on the side option and return to only the Alice interface go to the window menu, preferences and then un-tick the Java Code on the side option



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Although it is a useful tool to view the code it can be distracting when coding in Alice 3 so most people tend to turn it off during normal coding conditions.

Terminology

- Key terms used in this lesson included:
  - Variable
  - Object properties
  - Declaring variables
  - Initializing variables
  - Java Code on the side

Summary

- In this lesson, you should have learned how to:
  - Understand variables
  - Understand how variables are used in programming
  - Viewing Alice code as Java Code on the side


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