CHAPTER 15

Apples and Oranges

There's an old saying, "That's like comparing apples to oranges." What it means is that it's sometimes unfair to compare dissimilar objects. I said "sometimes," because at other times it's completely fair. Suppose I hand you one apple and one orange. Which one is heavier? Which one has a larger diameter? These aren't unfair questions, are they?

So sometimes you *can* compare apples to oranges! And when it comes to your robots, there's a way for your robots to compare things, too—not apples and oranges but numbers.

The COMPARE Block

Remember that we discussed the concept of Logic back in Chapter 8? True or False? (If you said False, you need to go back and read Chapter 8 again!)

Well, NXT-G comes with a programming block called the COMPARE block that relies on your understanding of Logic.

Suppose I ask you, "Is 5 greater than 3?" Your answer would be, "Yes." When you program, the same question is given to a computer or robot in the form of a statement, "5 is greater than 3." This statement, to your robot, is either True or False.

Similarly, if I ask you, "Is the Earth square-shaped?" you would answer, "No." A robot would not be asked this question, but instead told, "The Earth is square-shaped." And it would respond with False.

So, here's an important item to remember: robots respond to statements with True or False.

Before I show you the COMPARE block, let's create a test program for SPOT using pseudo-code:

> **Me**: SPOT, I want you to create two random numbers between 1 and 9 (number A and number B), show them on the LCD screen, and tell me if A is greater than B.

To do this, we'll start by dropping two RANDOM blocks (see Chapter 14) on to the beam, as shown in Figure 15-1. I've configured both RANDOM blocks with identical settings, as shown in the configuration panel.

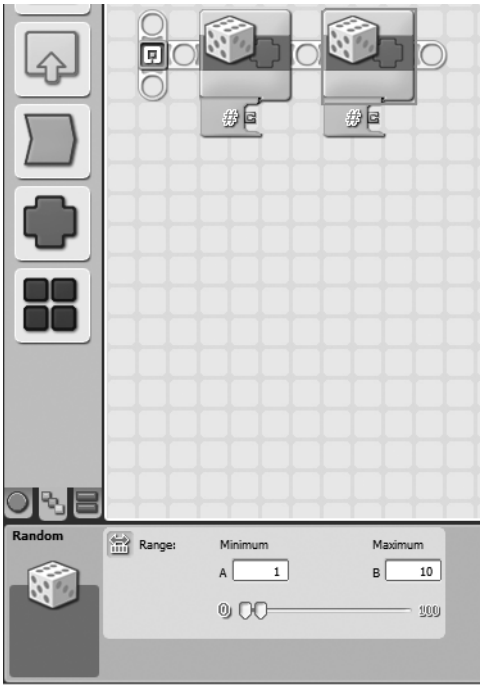

Figure 15-1. *Two RANDOM blocks will generate numbers for comparison.*

Next, I'll convert them to text using two `NUMBER TO TEXT` blocks (see Figure 15-2). Review Chapter 14 for information on the `NUMBER TO TEXT` block.

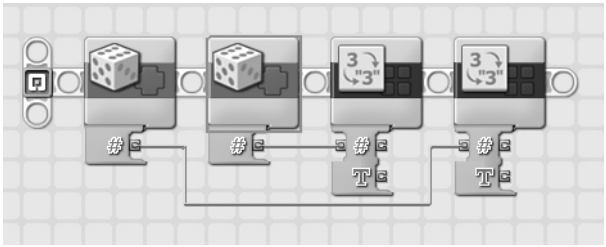

Figure 15-2. *Convert the random numbers to Text.*

And before we get to the Compare block, I'll use a `TEXT` block to create a statement in the form of "A greater than B," as shown in Figure 15-3.

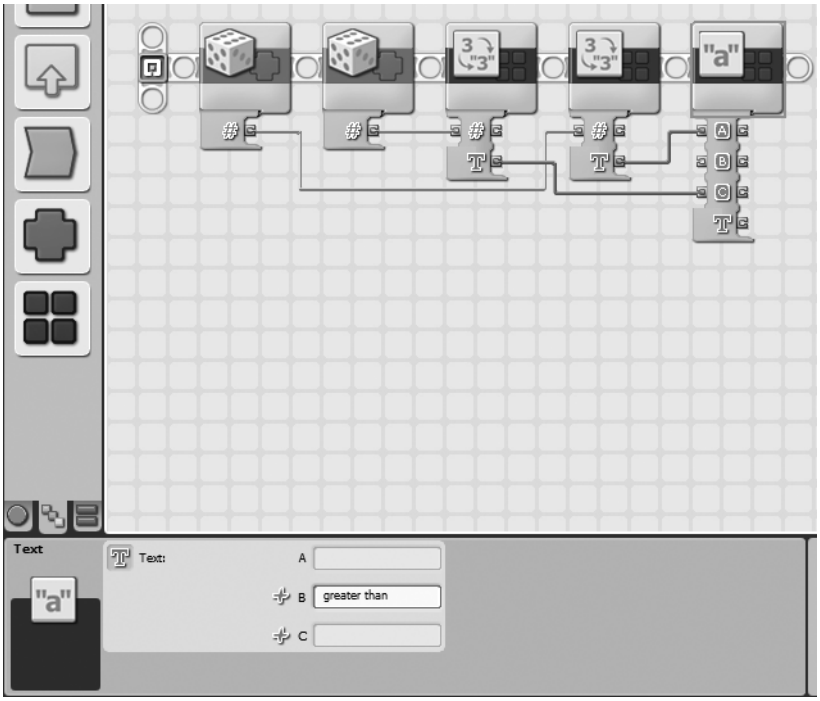

Figure 15-3. *Create a text statement to be displayed on the LCD screen.*

As you can see from Figure 15-3, the first RANDOM block number is used as input in the second NUMBER TO TEXT block (the fourth block from the left). The second RANDOM block number is used as input in the first NUMBER TO TEXT block (the third block from the left).

For the TEXT block, I have taken the first number (now converted to text) and used it as input to the A data plug. Also, I have taken the second number (now converted to text) and used it as input to the C data plug. I enter the words "greater than" in the B text box. This will create a single sentence (also called a *statement*): A greater than C (where A and C will be numbers between 1 and 9).

I now send the combined text to a DISPLAY block configured to display Text on Line 3 with position X=2 and Y=40 (see Figure 15-4).

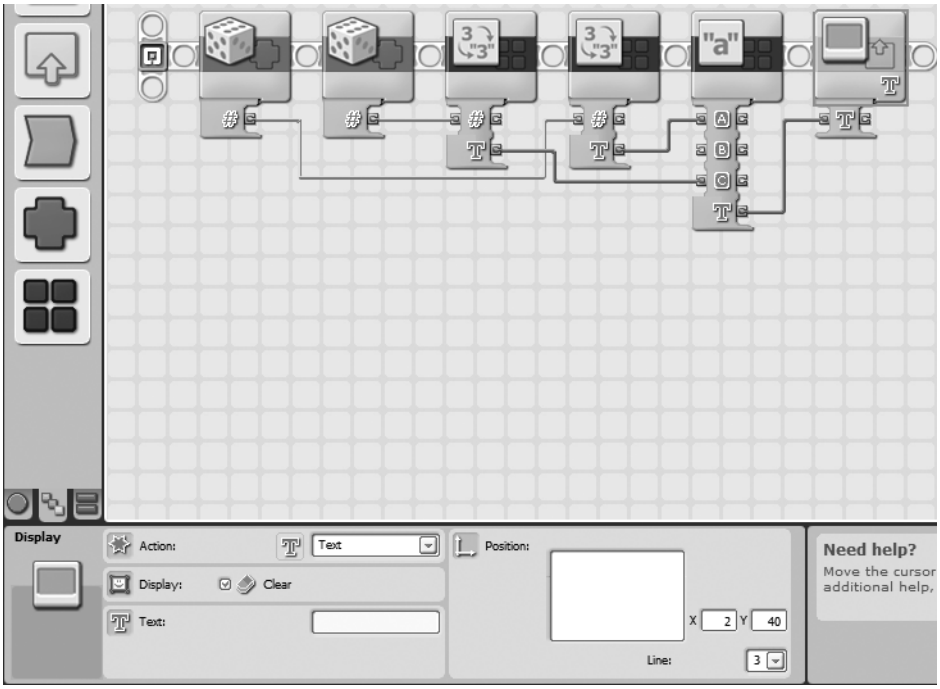

Figure 15-4. *The DISPLAY block will display a statement on the LCD screen.*

Now we're ready to see how the COMPARE block works. (Sorry it took so long to get here, but the COMPARE block by itself can't do anything—we need a good example with things to compare to see it in action.)

I'm going to break off a new beam to run in parallel. To do this, I hold down the Shift key and drag an extra beam, shown in Figure 15-5.

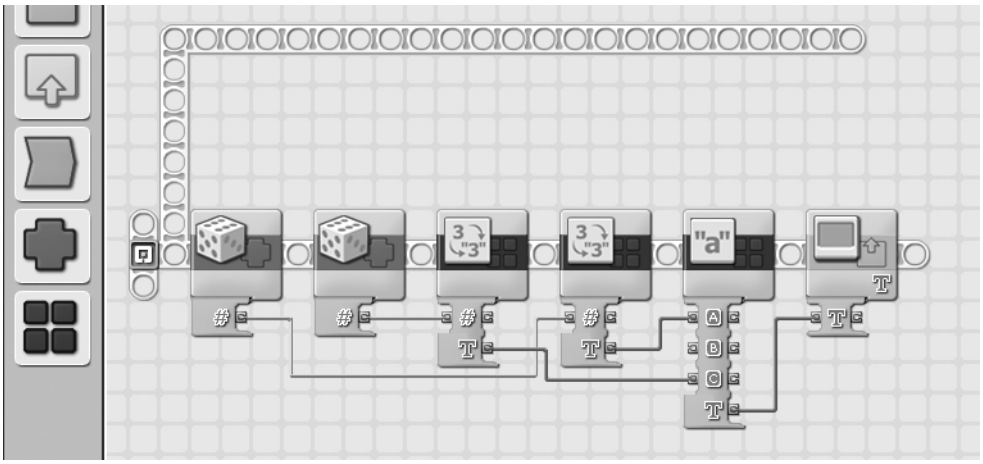

Figure 15-5. *An extra beam will be used to compare values.*

This parallel beam will let me compare value A to value B. Remember, I want to check the statement "A greater than B" and determine if it is True or False.

The first thing I need to do is drop the COMPARE block onto the new beam, as shown in Figure 15-6.

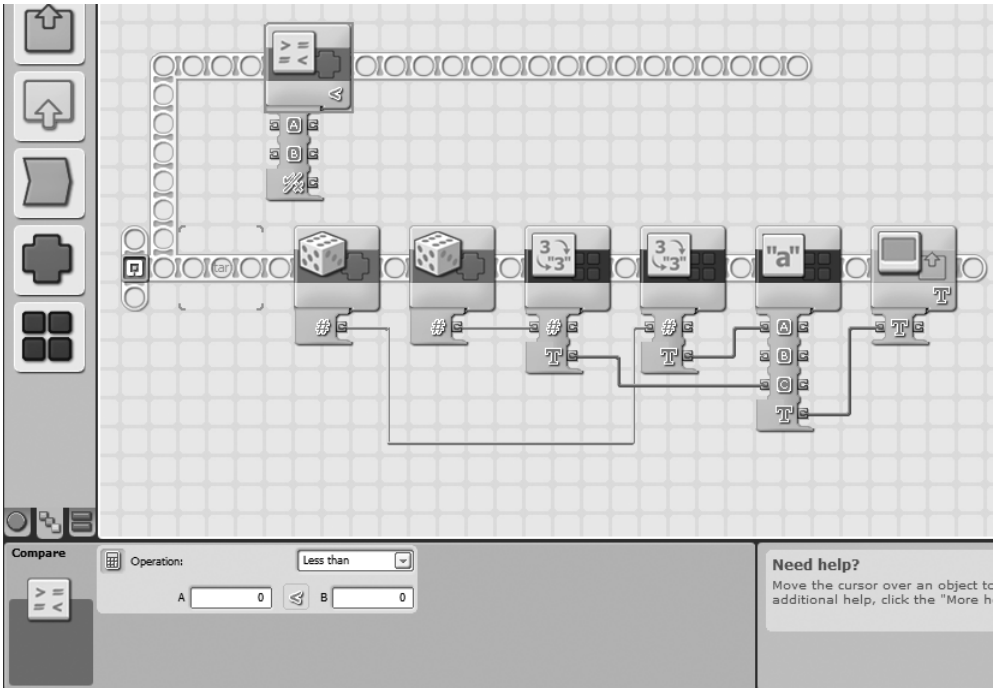

Figure 15-6. *The COMPARE block will check to see if value A is greater than value B.*

Notice in Figure 15-6 that the COMPARE block has two input data plugs. I'll take the original random numbers from the NUMBER TO TEXT blocks' output Number data plugs and drag data wires into the two COMPARE block input data plugs.

■ **Note** Back in Chapter 14, I told you that the NUMBER TO TEXT block had an output Number data plug that could be used to keep the number in Number format and not Text format. You'll use this ability now to send these original random numbers into the COMPARE block.

Carefully drag a data wire out of the second NUMBER TO TEXT block (the fourth one from the left) and into the value A's input data plug. Do the same for the first NUMBER TO TEXT block (the third from the left). This configuration is shown in Figure 15-7.

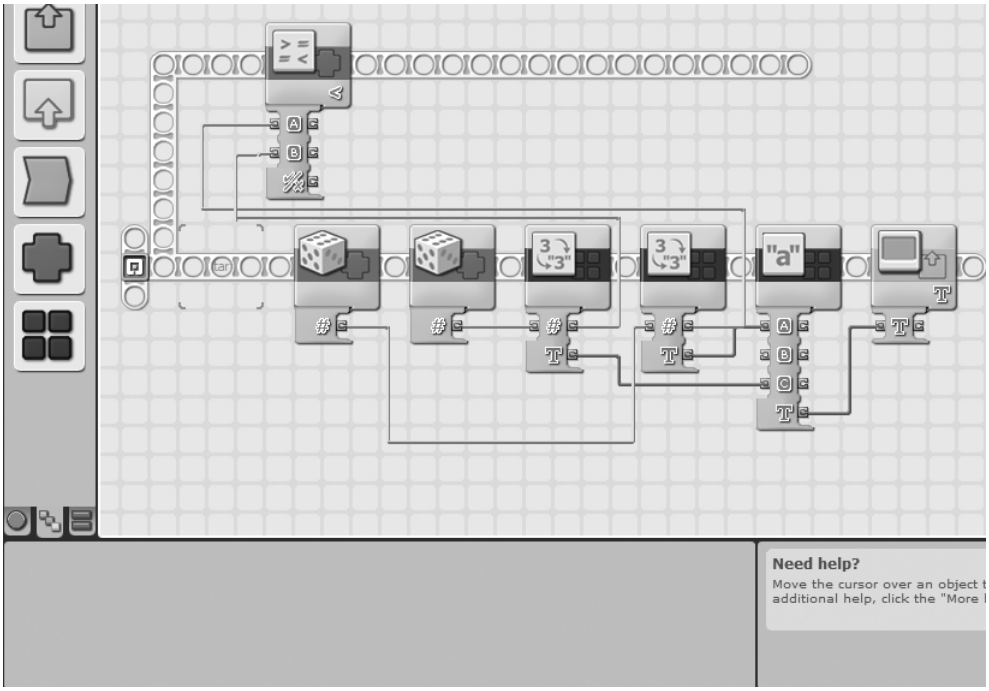

Figure 15-7. *Use the original number values as input for the COMPARE block.*

Now, click the COMPARE block to view its configuration panel (shown in Figure 15-8).

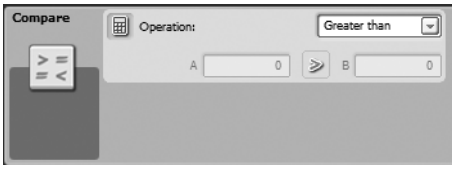

Figure 15-8. *The COMPARE block's configuration panel*

The COMPARE block's configuration panel has a drop-down menu in the Operation section. Click this drop-down, and you'll see three options: Less than, Greater than, and Equals.

If you choose the "Less than" option, the COMPARE block will evaluate the statement "A Less than B" and determine if it is True or False. If you choose the "Greater than" option, the COMPARE block will evaluate the statement "A Greater than B" and determine if it is True or False. And if you choose the Equals option, the statement "A Equals B" will be evaluated.

For my example, I choose the "Greater than" option, as shown in Figure 15-8. Now, my program will take the values for A and B and check to see if A is greater in value than B. The COMPARE block does this, and the answer will come from the output Result data plug.

If we go back to the pseudo-code, we'll see that I wanted True or False to be displayed on the LCD screen along with the original statement "A greater than B." To do this, I'm going to use the SWITCH block I covered in Chapter 12.

There are a bunch of items I need to configure for this to work. I drop a SWITCH block after the COMPARE block, and in the Display section, I uncheck the Flat view box (see Figure 15-9). In the Control section, I choose Value, and in the Type section, I choose Logic. I also drag a data wire out of the output Result data plug on the COMPARE block and connect it to the input data plug on the SWITCH block.

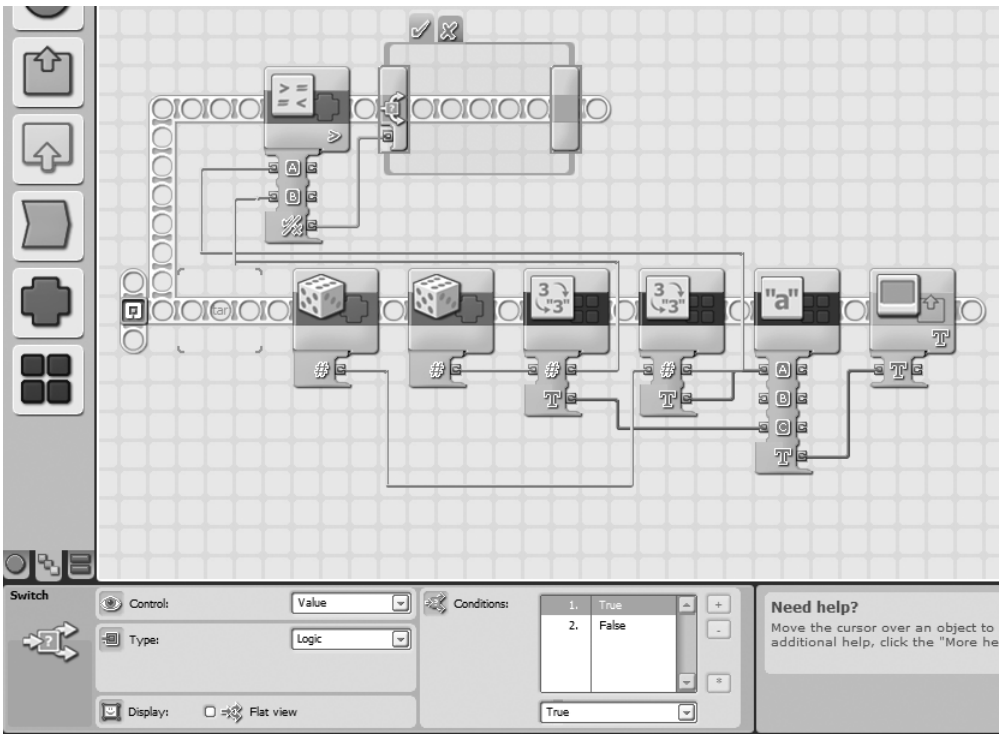

Figure 15-9. *The SWITCH block will help me display True or False on the screen.*

Next, I need to decide what will happen when the SWITCH block receives a True or a False signal from the COMPARE block. Let's start with the True tab; it's already selected in Figure 15-9.

I want to send the word "True" to the LCD display if the statement is True, so I'll drop in a TEXT block that will contain the word "True." This is shown in Figure 15-10.

In order for this text to appear on the LCD screen, I need to drop in another DISPLAY block on the original beam (see Figure 15-11). I drag a data wire out of the output Text data plug into the input Text data plug on this new DISPLAY block (I configured the block to display Text, and I also unchecked the Clear box).

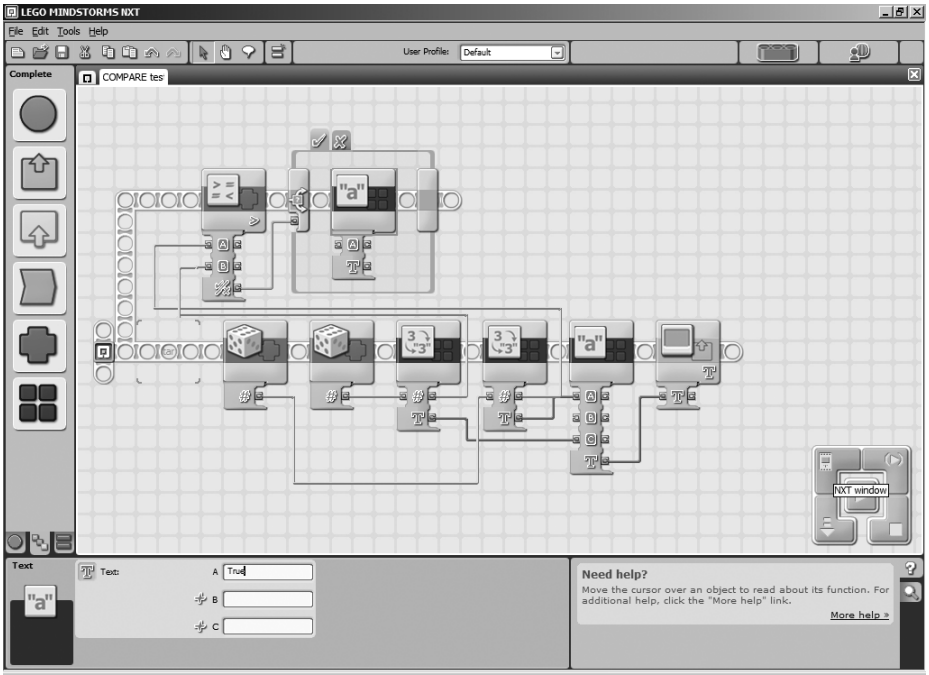

Figure 15-10. *This TEXT block contains the text "True".*

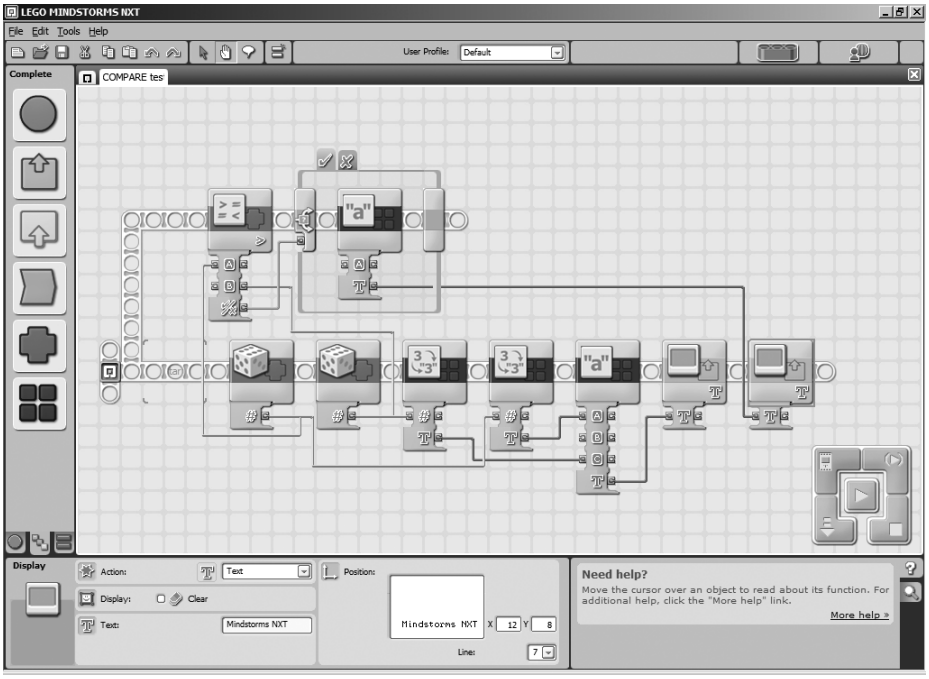

Figure 15-11. *A new DISPLAY block will display the text "True" if the statement is True.*

Now, to finish up this example, I click the other tab (the False tab) of the SWITCH block and drop a TEXT block inside, configured to hold the word "False." Just like the True tab, I drag a data wire out of the output Text data plug into the input Text data plug on a new, third DISPLAY block, as shown in Figure 15-12.

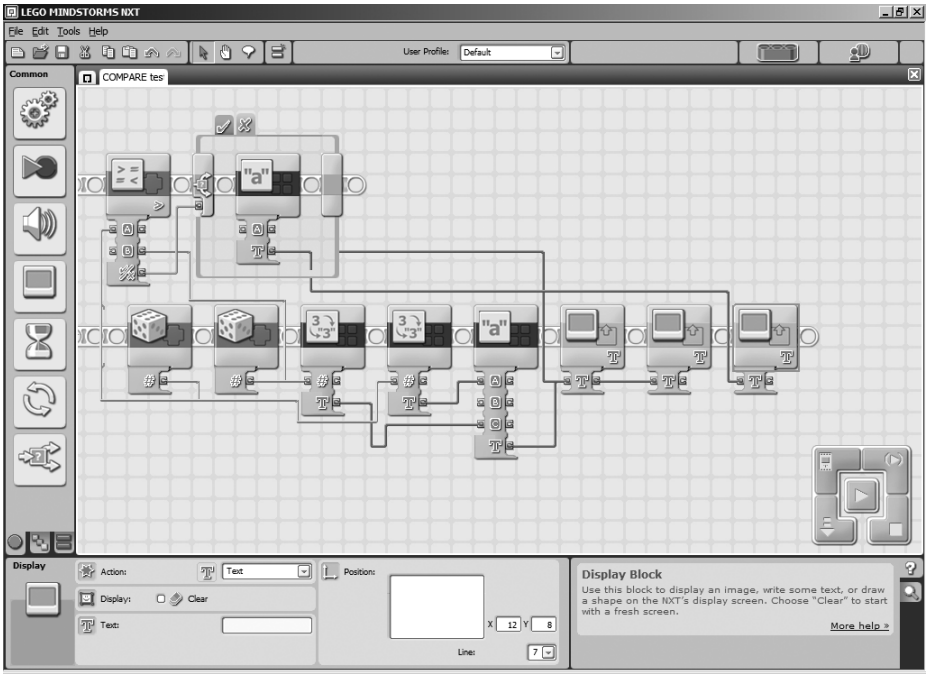

Figure 15-12. *The new DISPLAY block will display the text "False" if the statement is False.*

Finally, I drop in a NXT BUTTON WAIT block configured to wait for the left button to be pressed. This will give me time to view the results on the LCD screen (see Figure 15-13).

Let's walk through the program and see how it works. First, two RANDOM blocks generate two numbers, A and B. These numbers are converted to text (with the NUMBER TO TEXT blocks) and these "text numbers" are combined to create a text statement, "A greater than B," which is fed into a DISPLAY block.

After the random numbers are generated, these numbers are also fed into the COMPARE block, which takes the two numbers and looks to see if A is greater than B. If it is, the SWITCH statement executes the TEXT block in the True tab and displays the word "True" on the LCD screen. If A is not greater than B, the SWITCH statement executes the TEXT block in the False tab and displays the word "False" on the screen.

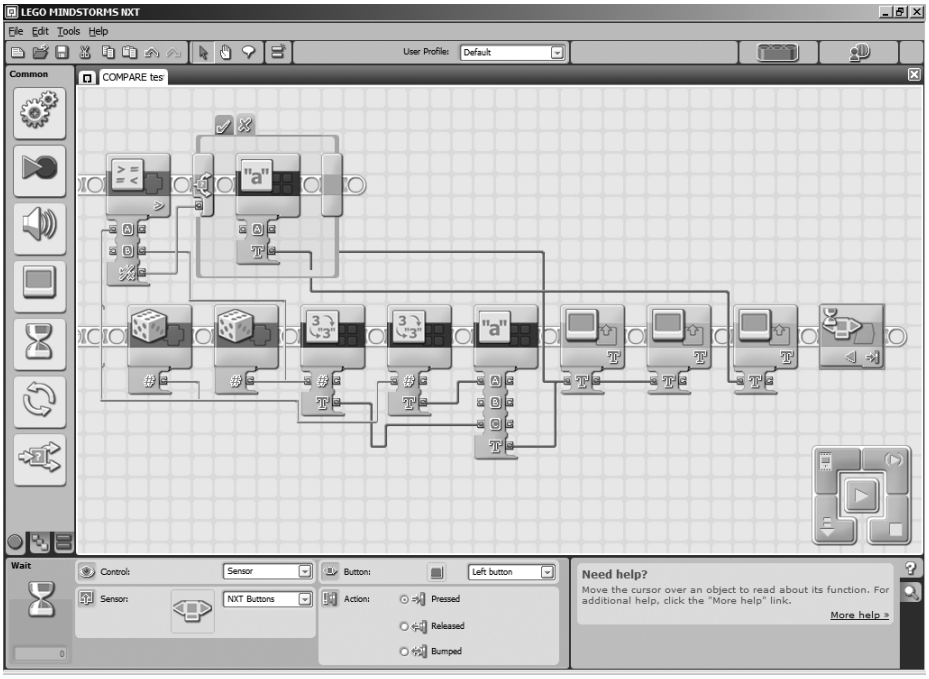

Figure 15-13. *A final NXT BUTTON WAIT block keeps the program from ending.*

I encourage you to create this program and test it yourself. You'll gain a better understanding of using wires, and you can tinker with it. Play around with changing the condition to "Less than" or Equals and see how the results change.

When you are finished, continue on to the next chapter, where I'll introduce you to the `RANGE` block.