



Music by Touch

Music by Touch Pre-Quiz

- 1. Provide an example “stimulus-sensor-coordinator-effector-response” framework for both your (human) sense of touch and the robotic touch sensor.**
- 2. Explain how the LEGO touch sensor works.**

Music by Touch Pre-Quiz Answers

1. Provide an example “stimulus-sensor-coordinator-effector-response” framework for both your (human) sense of touch and the robotic touch sensor.

For human touch: hot object > touch using finger > nervous system > muscle > move finger back

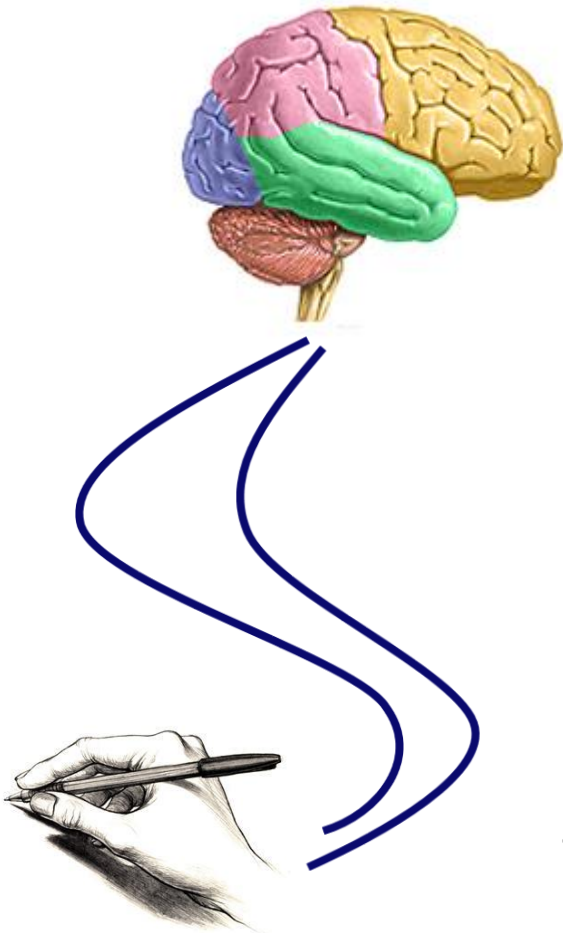
For LEGO setup: button pressed > touch sensor > cable connecting to brick > motor > move the motor

2. Explain how the LEGO touch sensor works.

When the touch sensor button is pressed, it closes a circuit (similar to when you turn on a light switch) and a current is sent to the LEGO brick, which then knows that the touch sensor button was pressed.

Human-Robot Similarities

Your hand is commanded
by your brain.



Similarly, the LEGO MINDSTORMS NXT intelligent
brick commands its motor to move.

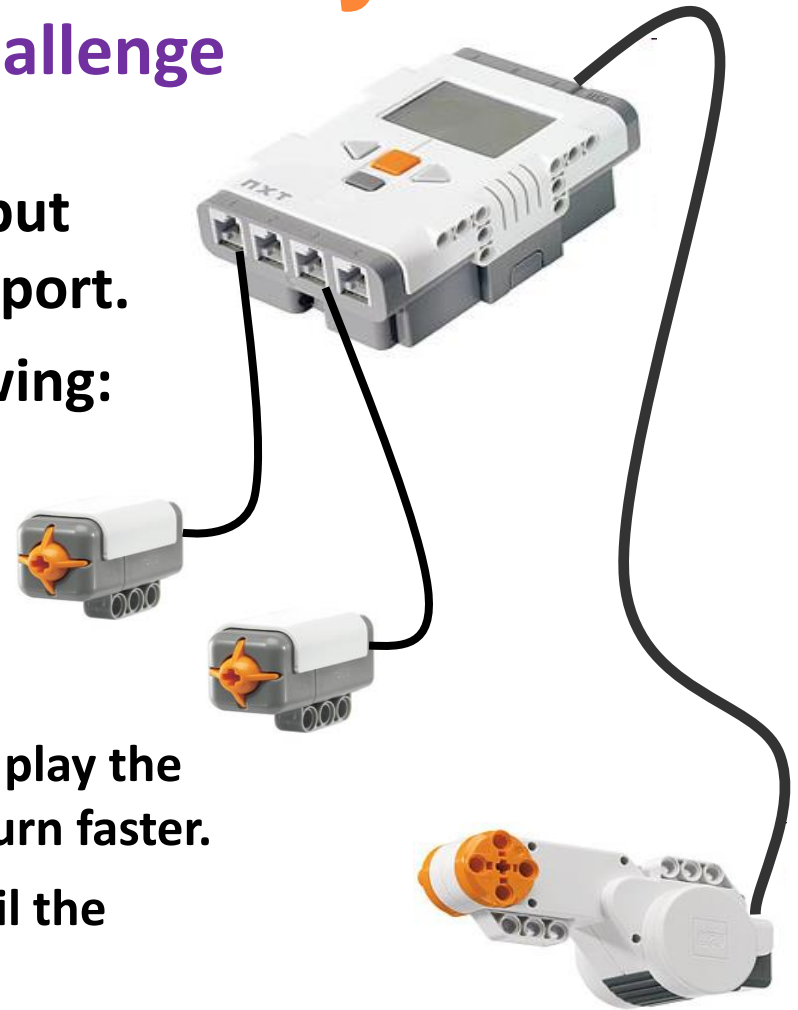
The next slide provides a design challenge to
show how this might be done. →

Music by Touch Activity

Engineering Design Challenge

Do This:

- **Attach 2 touch sensors to the input ports, and a motor to an output port.**
- **Write a program to do the following:**
 - If one touch sensor is touched, play a piece of music and keep rotating the wheel (attached to the motor) slowly.
 - If the other sensor is also touched, play the music faster and make the wheel turn faster.
 - Do this in a loop, continuously, until the program is stopped.
- **Write your program on a separate page and have your teacher check it before you begin.**



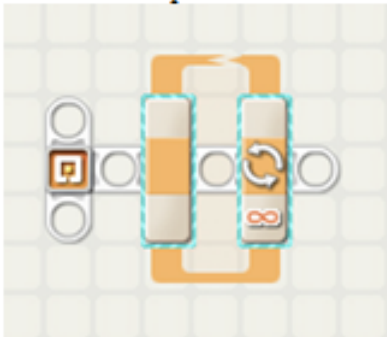
Answer: Programming the NXT Touch Sensor

Description:

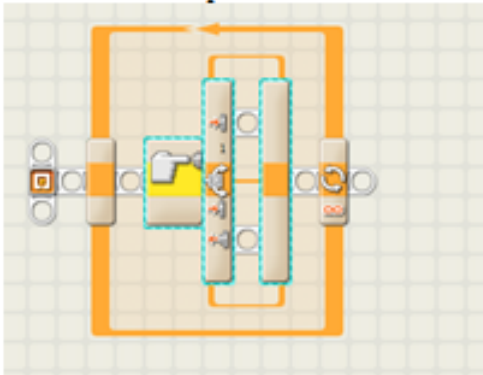
This program is for an NXT robot with two touch sensors (one attached to port 1 and the other to port 2) and one motor (attached to port A). The program will cause the robot to play a music softly and rotate the motor slowly when one touch sensor is touched and to play the music loudly and turn the motor fast when the other touch sensor is touched. It will do this continuously till the program is stopped.

Programming:

1) Click the "Loop" icon [second icon from the bottom] and drag the loop command onto the sequence beam.



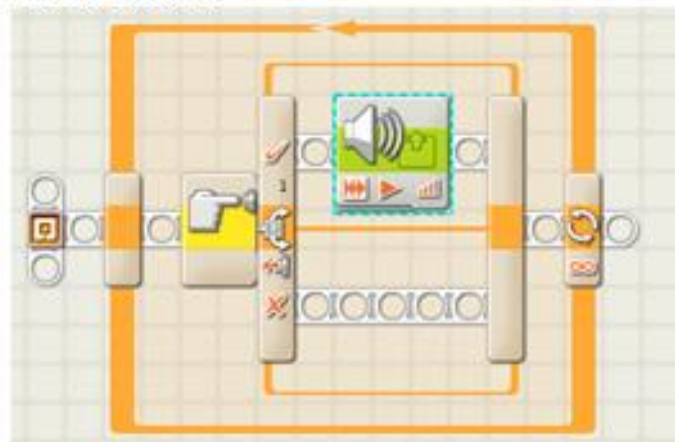
2) Click the "Switch" icon [last icon] and drag and drop it onto the sequence beam inside the "loop" command.



With the switch command highlighted, verify that the touch sensor, port 1, and the "bumped" option are selected.



3) Click and drag the "sound" icon [third from the top] onto the top sequence beam in the switch.



With the sound icon selected, make sure the volume is turned to 25, and pick one of the sound options from the list.



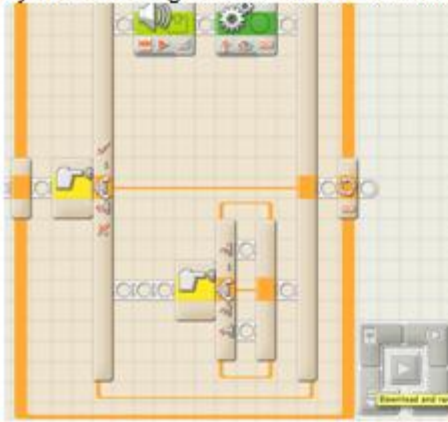
4) Click and drag a movement block next to the sound icon on the sequence beam.



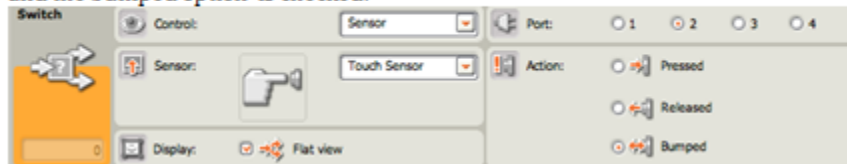
With the movement block highlighted, verify that only port A is selected, that the power is 25 and that the duration has been set to unlimited.



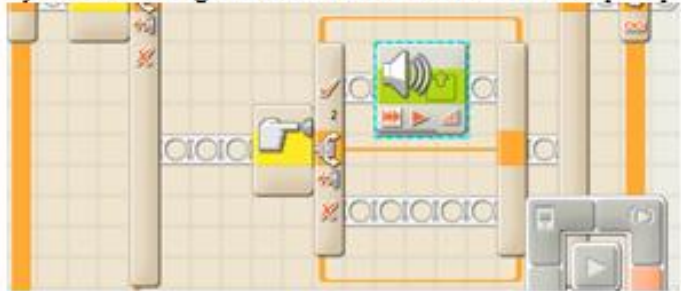
5) Click and drag another "Switch" icon onto the bottom sequence beam in the first "switch."



With the second switch icon selected, make sure that the touch sensor is selected, port two is selected, and the bumped option is checked.



6) Click and drag another "sound" icon onto the top sequence beam in the second switch.



Make sure that in the second sound icon the volume is turned to 75 and select a sound option from the list.



7) Click and drag another "move" icon onto the sequence beam in the second switch next to the "sound icon."



With this movement block selected make sure only port A is selected, the duration is set to unlimited, and the power is turned to 75.



Music by Touch Post-Quiz

- 1. Provide an example “stimulus-sensor-coordinator-effector-response” framework for both your (human) sense of touch and the robotic touch sensor activity you performed.**
- 2. Explain how the LEGO touch sensor works.**
- 3. Assume the brick is connected to a touch sensor and a motor. Sketch a simple program to move a motor when a touch sensor is pressed.**

Music by Touch Post-Quiz Answers

1. Provide an example “stimulus-sensor-coordinator-effector-response” framework for both your (human) sense of touch and the robotic touch sensor activity you performed.

For human touch: hot object > touch using finger > nervous system > muscle > move finger back

For LEGO setup: button pressed > touch sensor > cable connecting to brick > motor > move the motor

2. Explain how the LEGO touch sensor works.

When the touch sensor button is pressed, it closes a circuit (similar to when you turn on a light switch) and a current is sent to the LEGO brick, which then knows that the touch sensor button was pressed.

3. Assume the brick is connected to a touch sensor and a motor. Sketch a simple program to move a motor when a touch sensor is pressed.

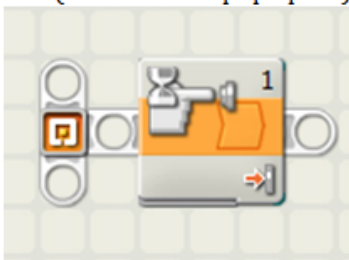
See #3 programming solution on next slide. →

Quiz Answer #3: Moving a Motor Using the Touch Sensor

Description: This program is for an NXT robot with an attached touch sensor. This program will cause the motor to move when the touch sensor is pressed. In this program the robot is set to do this motion only once.

Programming:

- 1) Hover over the “wait for” icon (third from bottom) and click on the touch icon (second in the pop up list) and drag the touch icon.



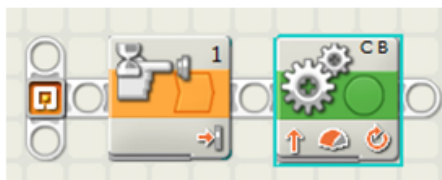
With the movement block highlighted, verify that the duration is set to unlimited.

With the touch sensor highlighted, verify the following information:

- a) Control: Sensor
- b) Sensor: Touch
- c) Port: 1 (or whatever port the sensor is connected to)



- 2) Drag the move icon to the right of the Touch command on the sequence beam and set rotations to 1000.



Vocabulary

- **sensor**: A device that converts one type of signal to another; for instance, the speedometer in a car collects physical data and calculates and displays the speed the car is moving.
- **tactile**: Related to touch.
- **stimulus**: A thing or event that causes a reaction.
- **transducer**: Another term for a sensor (see above).

Image Sources

Slide 1, 4, 5: LEGO parts; source: LEGO MINDSTORMS NXT User's Guide

Slide 4: brain; source: ADAM, Medline Plus, U.S. National Library of Medicine, National Institutes of Health:
<http://www.nlm.nih.gov/medlineplus/braindiseases.html>

Slide 4: writing hand; source: Microsoft® clipart: <http://office.microsoft.com/en-us/images/results.aspx?qu=hand&ex=1#ai:MC900382613|mt:1|>

Slides 6, 7, 8, 9, 12: Screen capture images by the author. Mini-activity adapted from
<http://www.compchal.org>