

Lesson 1:

Introduction to Mobile Robotics

Why do robots need to move?

What defines a robot?

- **Sensory Input** – a robot has to take in information about its environment
- **Plan/Instructions/Programming** – a robot has to use that information to make a decision
- **Action** – a robot needs moving parts to carry out commands

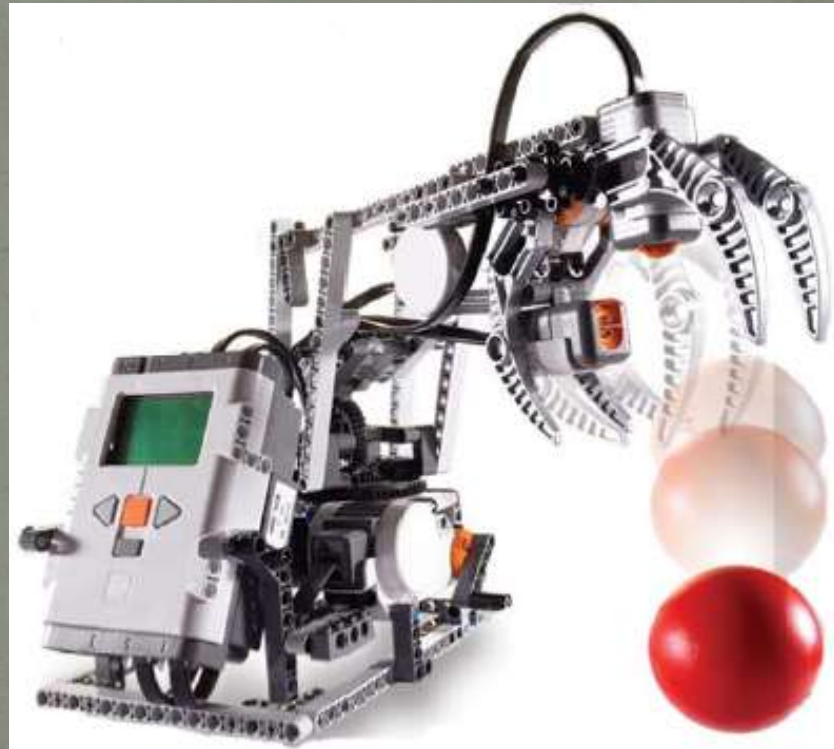
How do robots move anyway?

- Rotate
- Convey
- Walk
- Swim
- Fly
- Reach
- Bend
- Poke
- Roll
- Remote Control



Manipulative Movement

- Robots that use an arm, belt or other means to maneuver objects



Mobile Movement

- Robots that can move from place to place



Why go from place to place?

- Transport goods and materials
- Carry messages
- Get there faster
- Do a task while you're getting there or when you get there
- Collect information about what's there
- Get away from something

Most robots get around by rolling

- **Walking** is hard – it requires balancing
- **Swimming** only works in water
- **Flying** requires a lot of speed and energy
- Wheels and treads make moving over ground easier
- They provide stability with multiple points that touch the ground

How do rolling robots work?

- Sensors
- Motors
- Wheels
- Programming!



Main Components of Robotics

- **Build** – Mechanics, Mathematics, Physics
- **Program** – Building behaviors
- **Test** – Multiple trials
- **Communicate** – What did you work on or accomplish? What conclusions did you come to?
- **Modify & Test Again!**

Building

We will be using LEGO® pieces
to build our robots

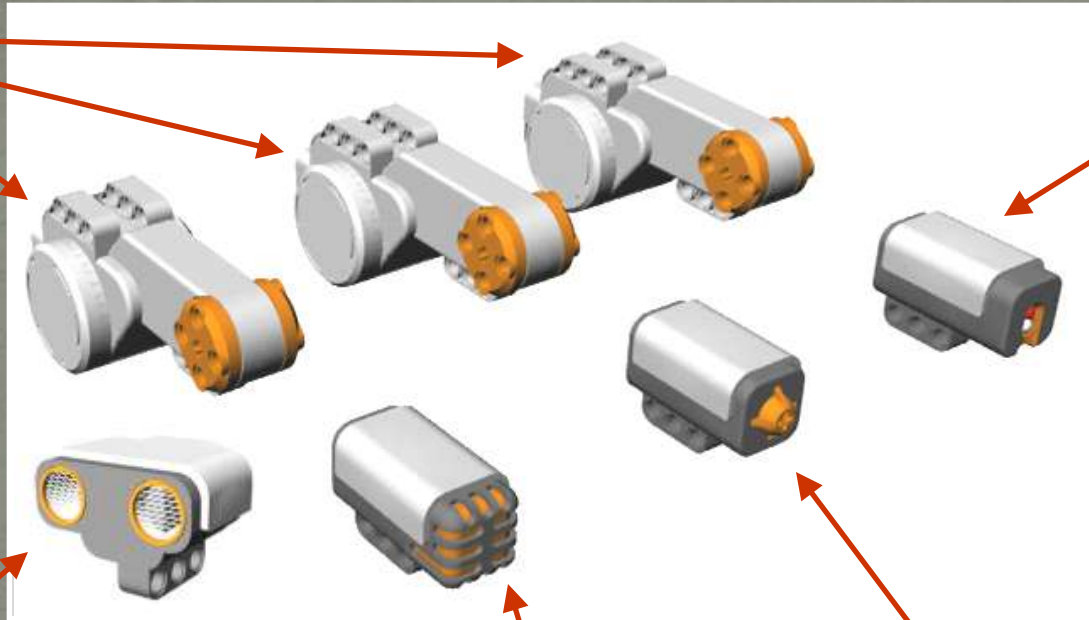
- Gears and axles
- Beams and connectors
- Motors and wheels
- Sensors and wires
- NXT programmable brick

Building *LEGO® Pieces*



Building *LEGO*[®] Motors and Sensors

Motors



Light
Sensor

Ultrasonic
Sensor

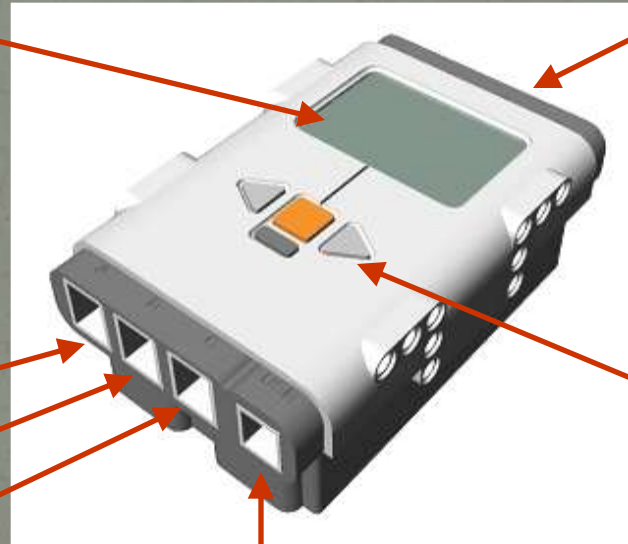
Sound
Sensor

Touch
Sensor

Building *LEGO® NXT*

LCD
Display
Screen

Sensor
Input
Ports



Motor
Output
Ports

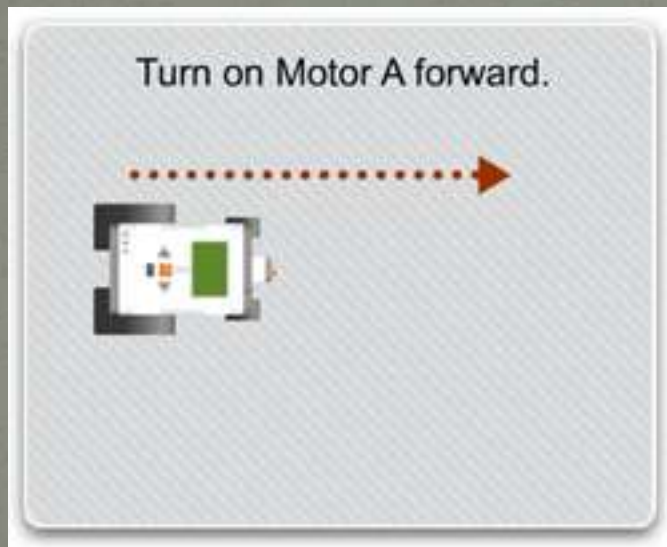
Navigation
Buttons

USB connection socket

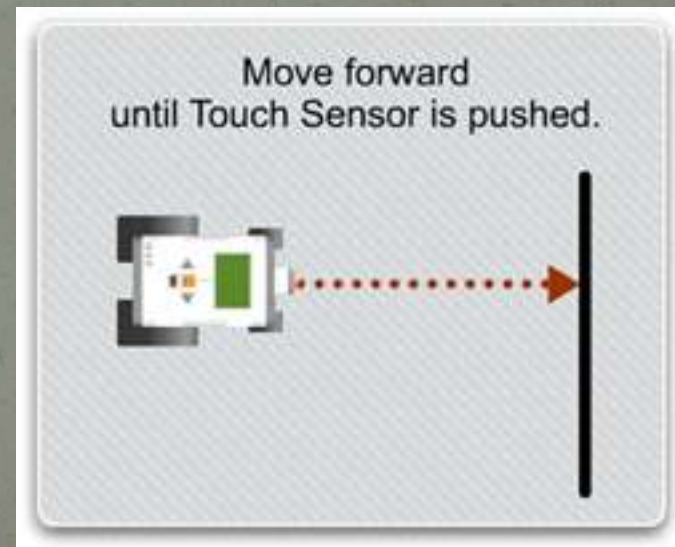
Programming Behaviors

- Giving the robot behaviors
- Complex behaviors are built from simple ones

The basic behavior...

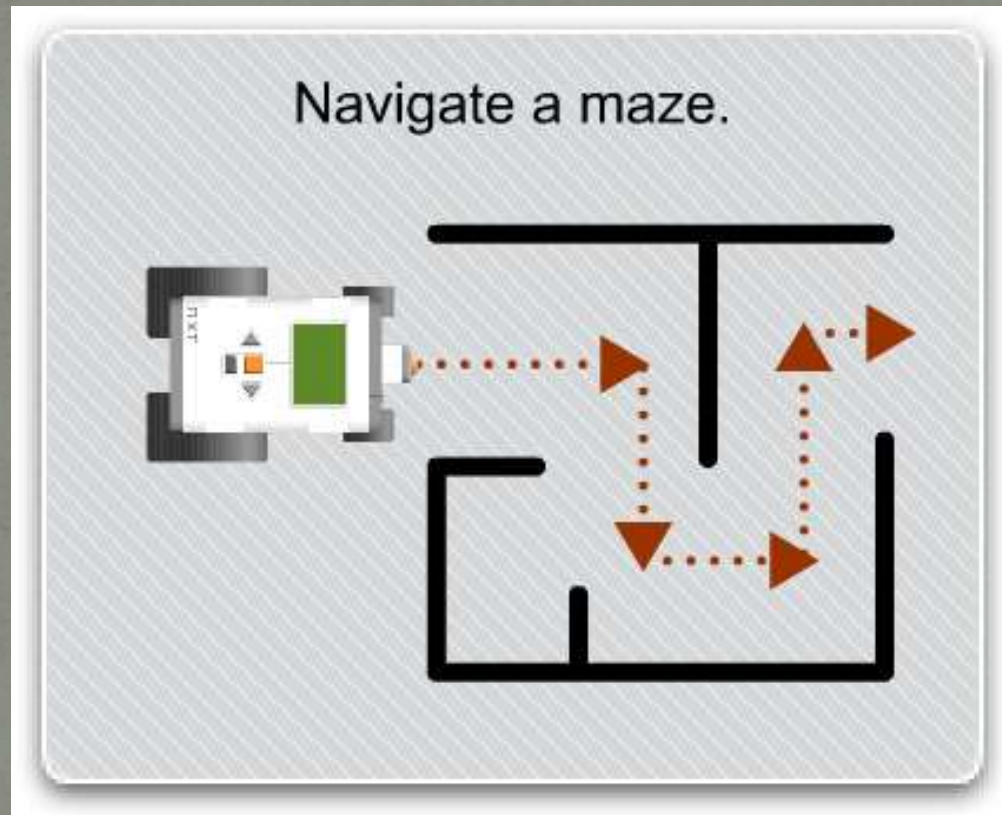


is used in the simple behavior:



Programming

...which is used in the complex behavior:



Programming *Screen Interface*

Blocks



The screenshot displays a software interface for programming. At the top is a menu bar with 'File', 'Edit', 'Tools', and 'Help'. Below it is a toolbar with various icons. The main workspace is a grid with a 'Programming Area' label. A sequence of three motor blocks is connected in a line, labeled 'B' and 'C'. The first block is a start block, followed by a motor block 'B', and then a motor block 'C'. A vertical sidebar on the left contains various block icons, with an orange arrow pointing to it from the word 'Blocks'. At the bottom, there is a 'Properties Area' with a 'Motor Block' section containing text: 'This block allows for precise control of one motor's speed. You can "ramp up" to a set speed or "ramp down" to a stop. By de-selecting "Wait for Completion," your program can move on to the next block once the Motor block has started a motor.' and a 'More help' link.

Programming Area

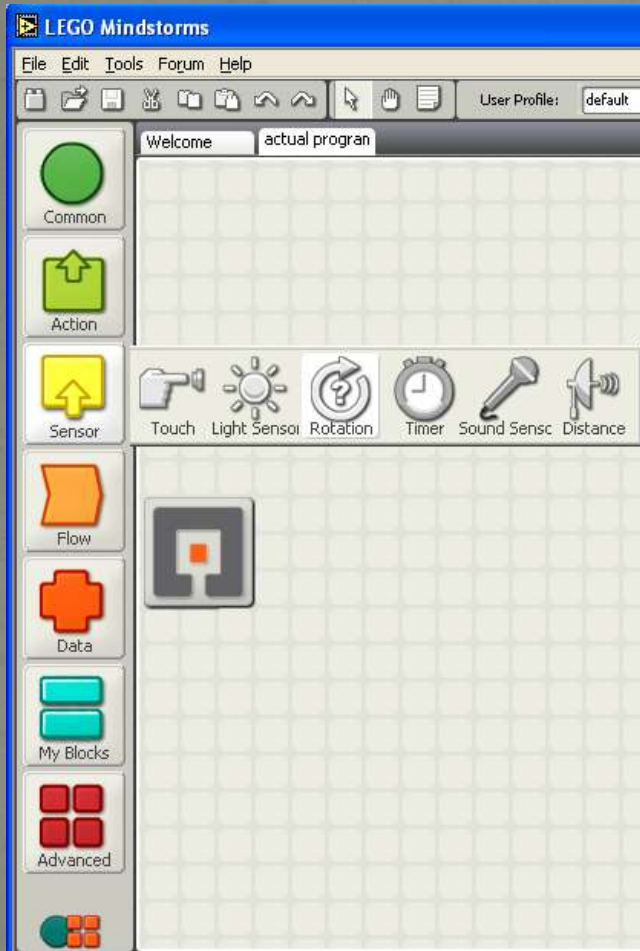
Properties Area

Motor Block

This block allows for precise control of one motor's speed. You can "ramp up" to a set speed or "ramp down" to a stop. By de-selecting "Wait for Completion," your program can move on to the next block once the Motor block has started a motor.

[More help >](#)

Programming *Blocks and Functions*



Program by dragging blocks from the menu on the left

Place them on the grid, and wire them together

Can create your own blocks called My Blocks

Testing *Why do we test?*

- Make sure it works!
- Understand what it can do
- Test everything multiple times to determine the repeatability
- Use the robot to test other phenomena

Testing

- When we test, we take data (numbers)
- We write our numbers down in organized charts
- We write down everything we can about the experiment
- Look at our data after we're finished

What is Engineering?

- Problem solving
- Teamwork
- Time management
- Testing
- Doing it over if it doesn't work correctly the first time!

Personal Assistant Robot



Personal Assistant Robot

- We will be making a mobile robot to help out in the classroom
- We will run tests on the robot to determine its capabilities
- Before it can do complicated behaviors, we have to teach it simple ones
- But before we program anything, we need to build