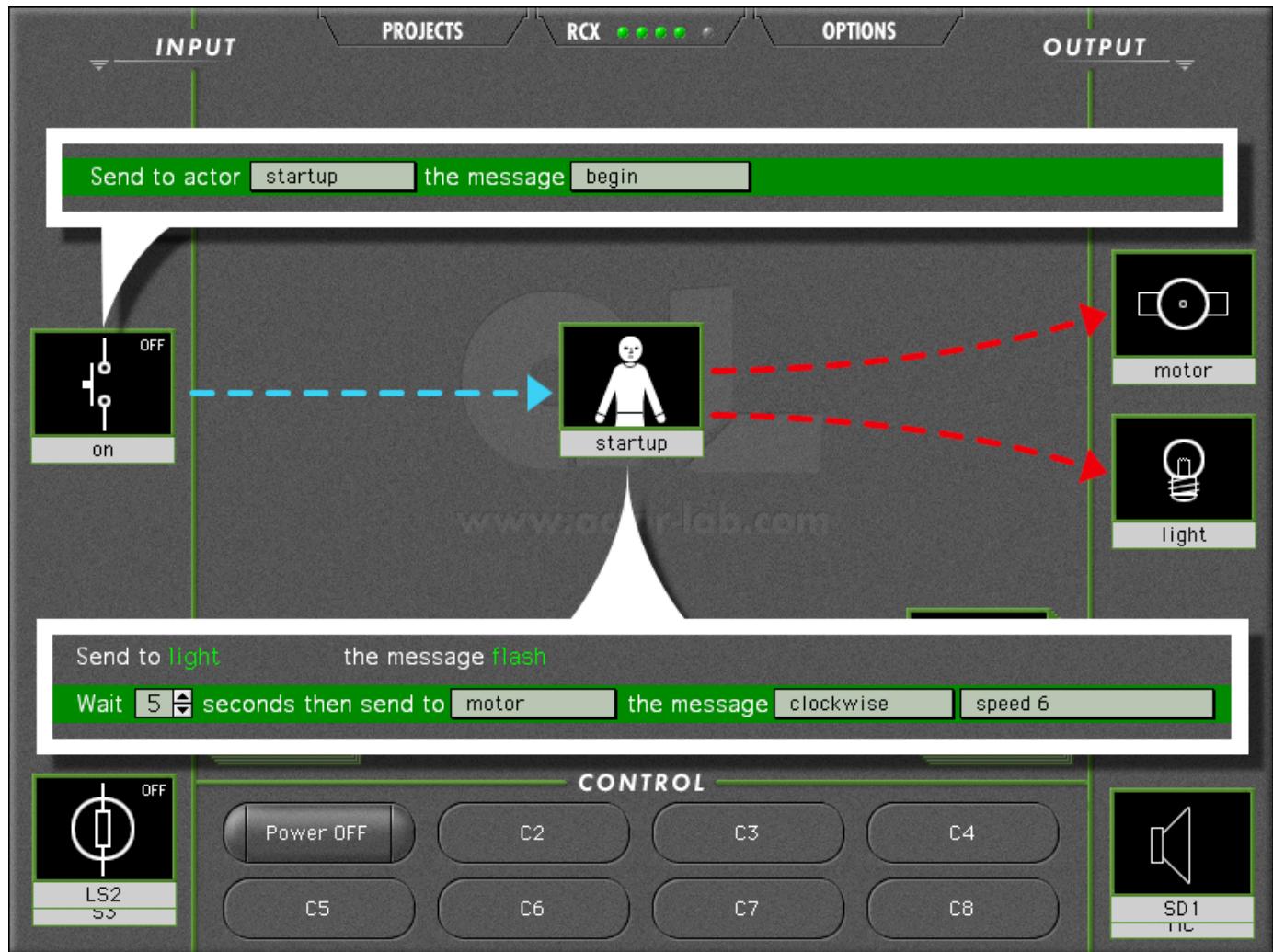


actor-lab



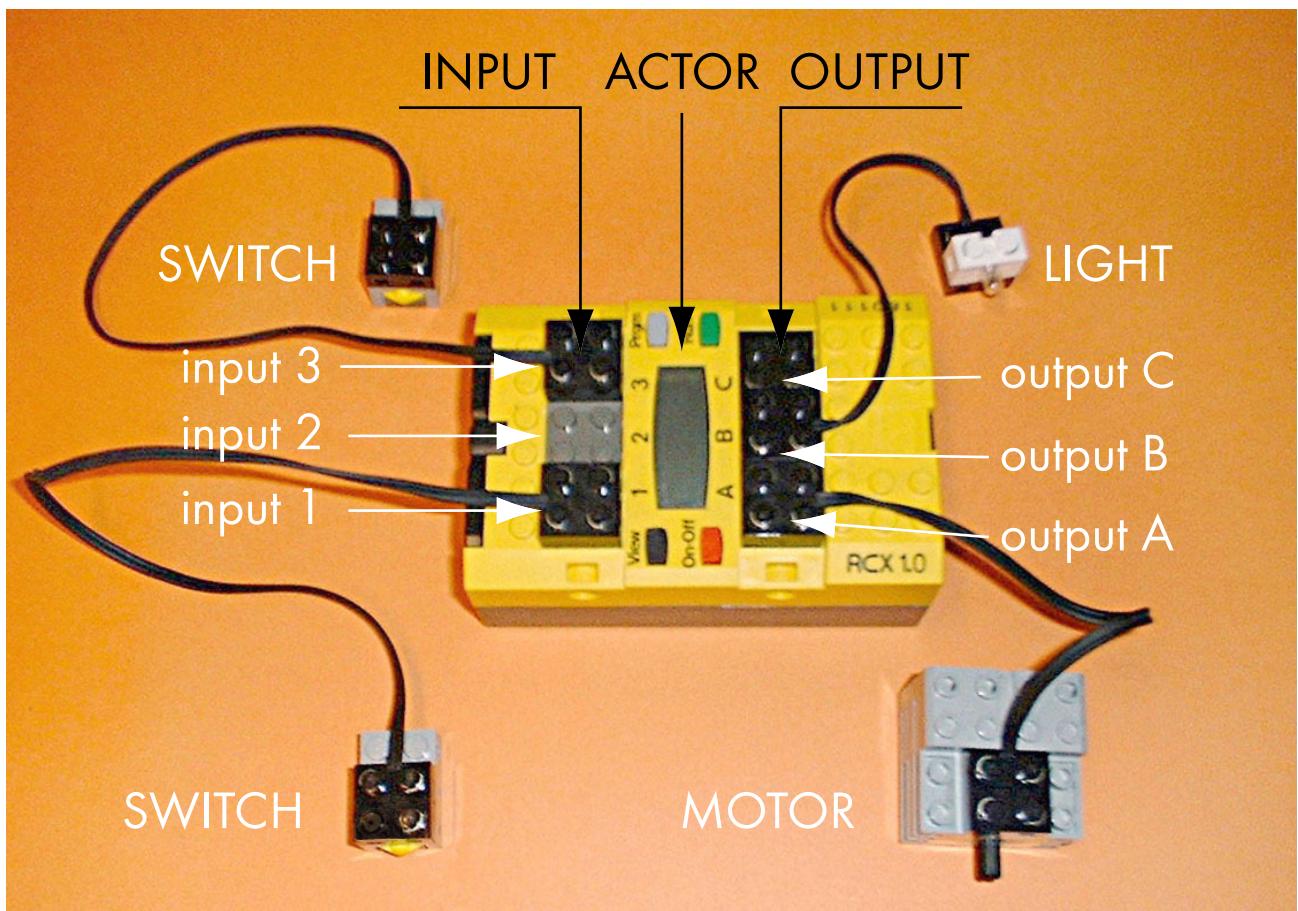
input → actor → output

switches
and
sensors

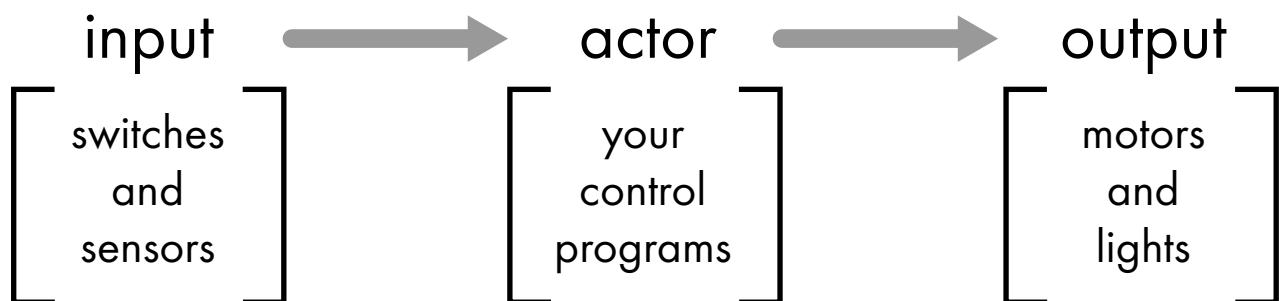
your
control
programs

motors
and
lights

The Lego brick

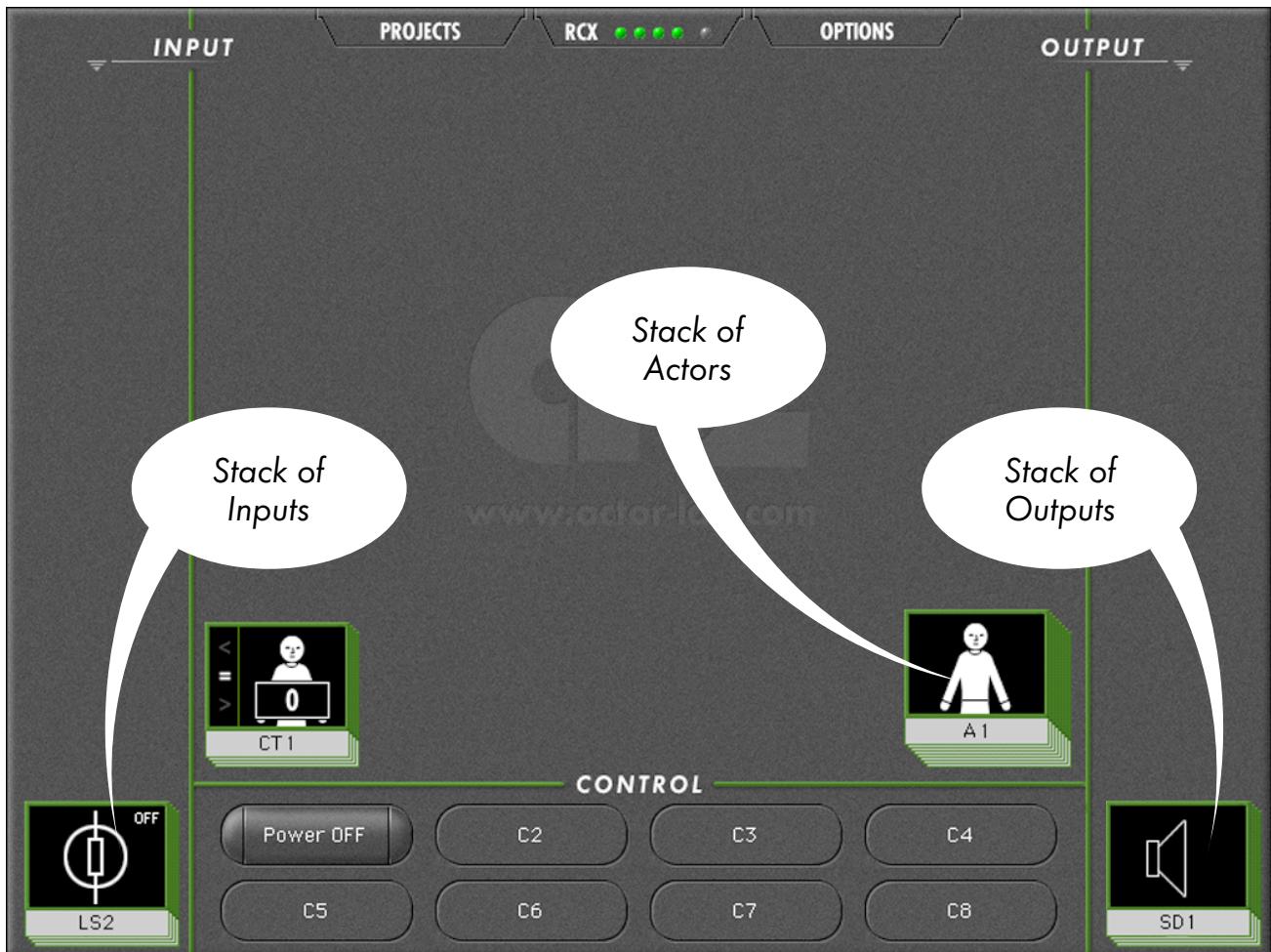


- 1 The Lego brick has three inputs (1, 2 and 3) that can be connected up to switches and light sensors. Having inputs means that the computer can respond to things happening, such as the switches being pressed in or the brightness of the light changing.
- 2 It also has three outputs (A, B and C) that can be connected up to motors and lights. Having outputs means that the computer can make things happen, like turning on motors or making the light flash on and off.
- 3 The control program is like a play with actors who read out their lines. You are the author of the play, and you have to work out what the actors should say and when they should say it.



Setting up

- 4 When you start a new project the screen looks like this-



- 5 There are stacks of inputs, actors and outputs ready for you to use.

- 6 To move things about you have to hold down the *Alt* key (it's the second key in on the bottom row of the keyboard), with one hand, and then use the mouse to drag them about. The inputs and outputs only move up and down, so you may have to shuffle them about to get to the one you want.

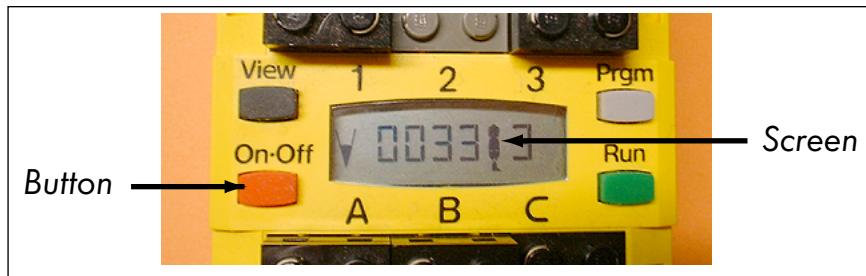


Continue Setting up on the next page →

- 7 If you drag on something without the *Alt* key held down, the computer will treat it as though you have just clicked on it. Instead of moving, it will just open up. Click on the Finish button and it will close again.



- 8 Look at the screen on the brick. If you can see numbers it is on and you don't have to do anything. If the screen is blank, press the red button on the brick. You will hear it beep, and numbers show on the screen.



- 9 Now look near the top of the computer screen and you should see 4 green lights like this-

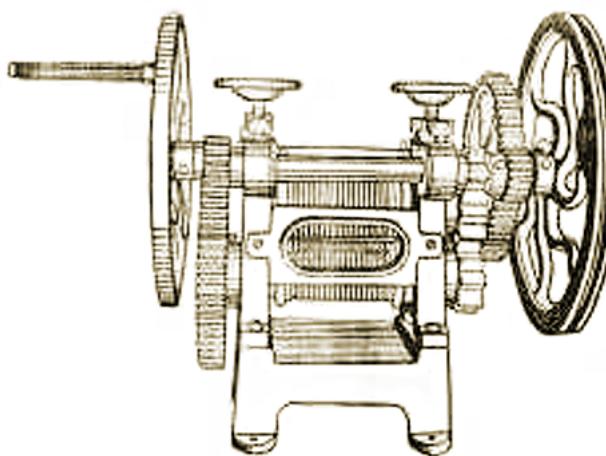


- 10 If the 4 green lights are on it means that the computer can send and receive messages from the brick. If all four lights are not on you will have to go and get help.

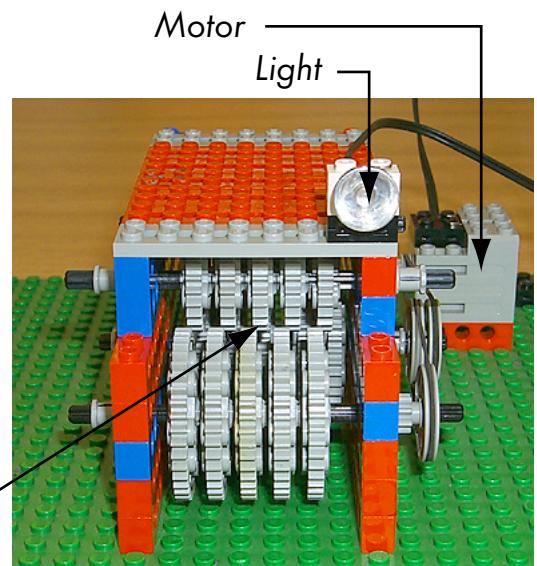
End of Setting up.

Task 1 - Controlling the Light & Motor on the Sugar Cane Crusher

- 1 Machines like this can be very dangerous for anyone feeding in the cane, and they become even more dangerous when they are driven by a motor. You have the task of making the Lego cane crusher safe to use.



Crushing Gears

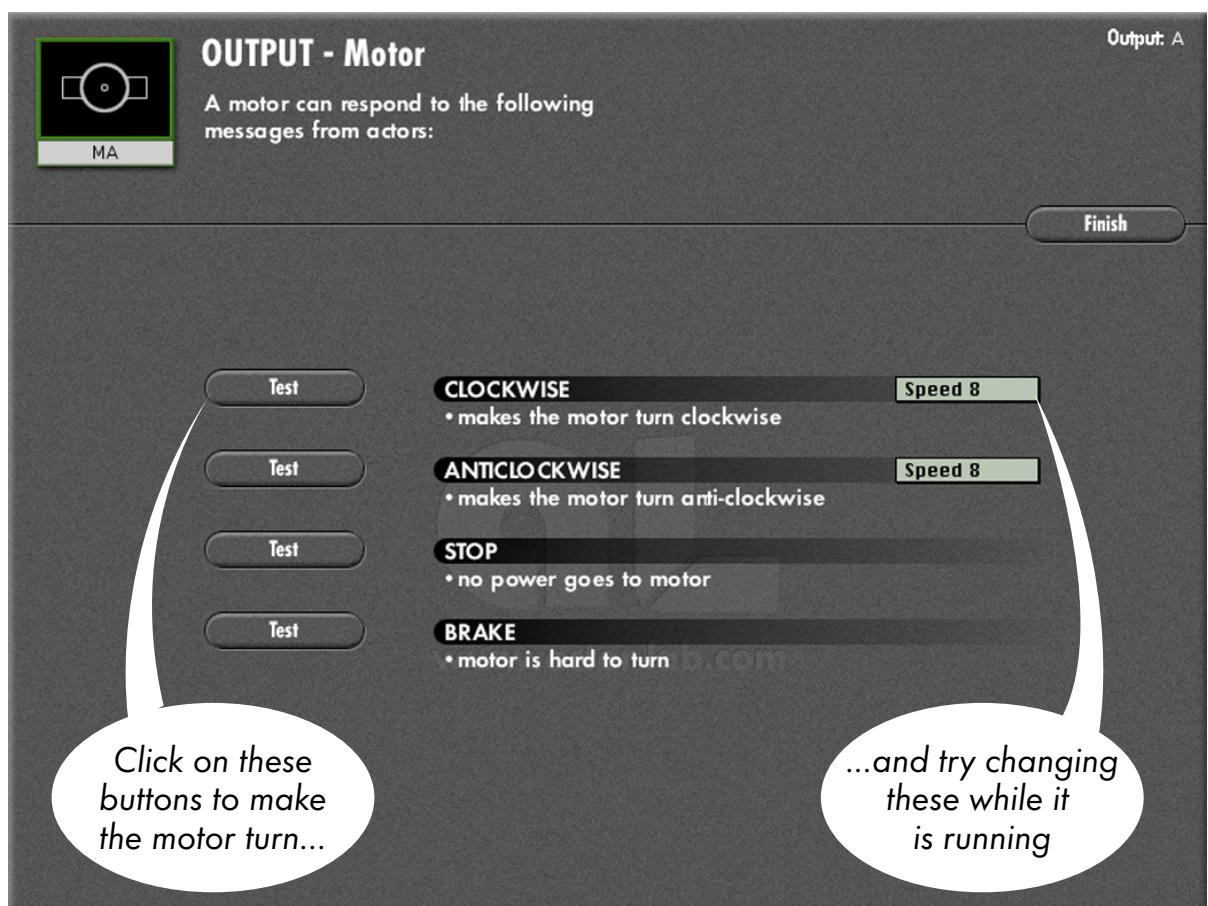


- 2 When the switch on top of the blue brick is pressed, your program has to make the light start flashing and the motor start up at half speed.
- 3 First you have to drag out the input called **S1**, the actor called **A1** and the outputs called **MA** and **LB**. Move them about until the screen looks something like this-

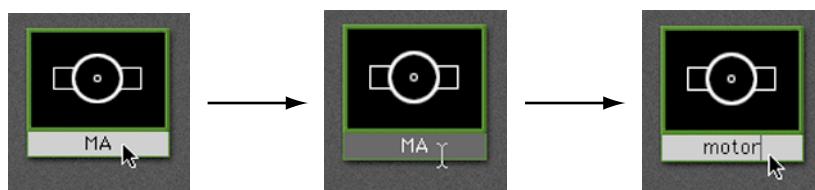


Continue Task 1 on the next page →

- 4 Now you have to check that everything is working, and give names to the things that you have dragged out.
- 5 Click on the motor called **MA** and you will see this-



- 6 Click where it says **MA** and then type in the word **motor**.

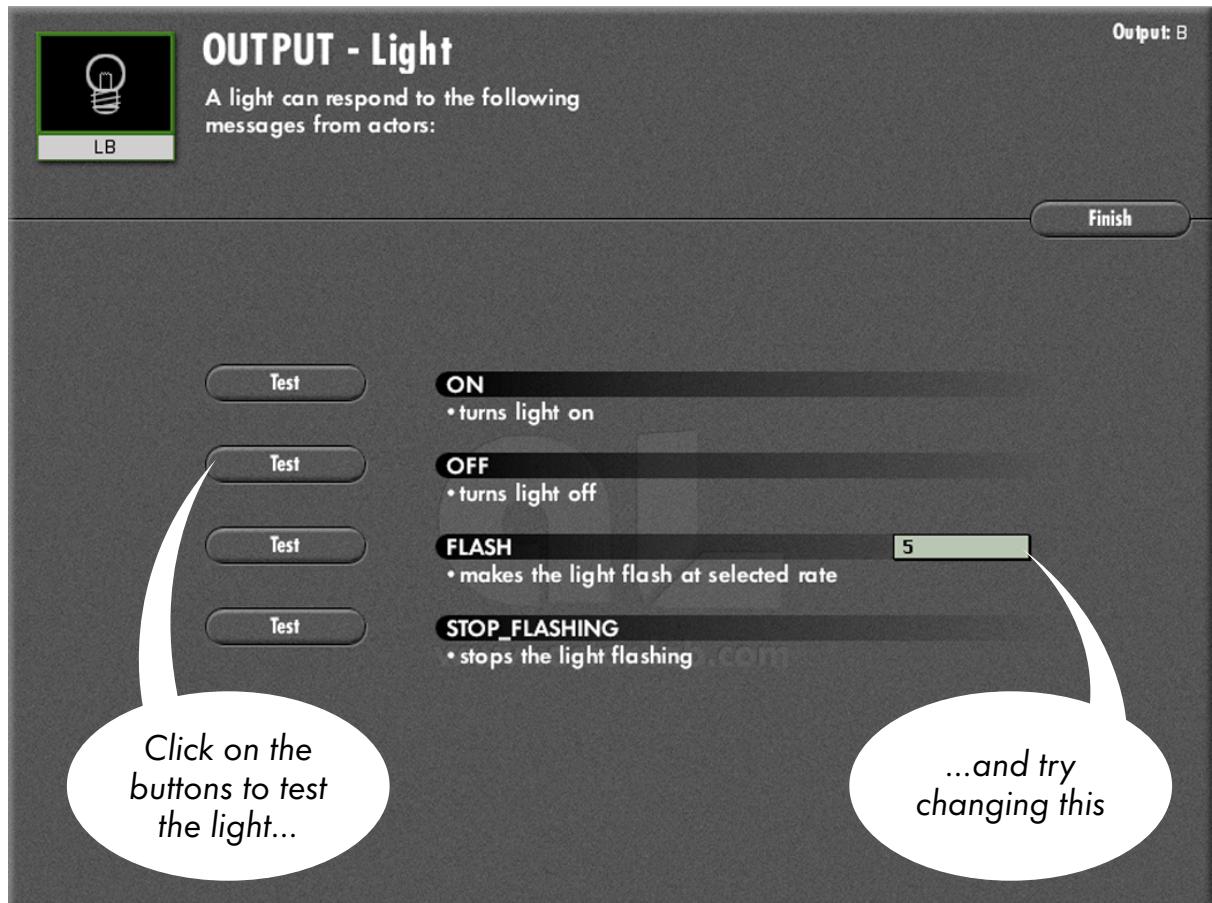


- 7 Now click **Finish** and the **motor** should look like this-



Continue Task 1 on the next page →

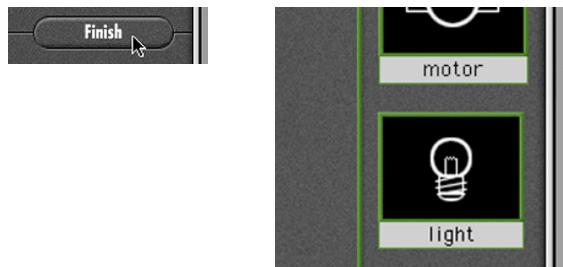
- 8 Now click on the light called **LB** and you will see this-



- 9 Click where it says **LB** and then type in the word **light**



- 10 Now click *Finish* and the light should look like this-



Continue Task 1 on the next page →

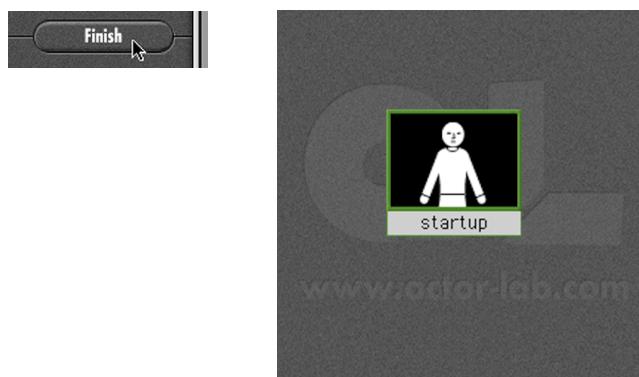
- 11 Click on the actor called **A1** and you will see this-



- 12 Click where it says **A1** and then type in the word **startup**



- 13 Now click *Finish* and the actor should look like this-

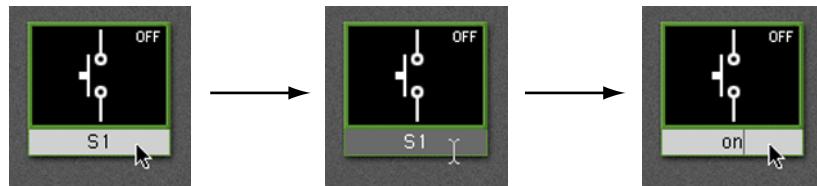


— Continue Task 1 on the next page —

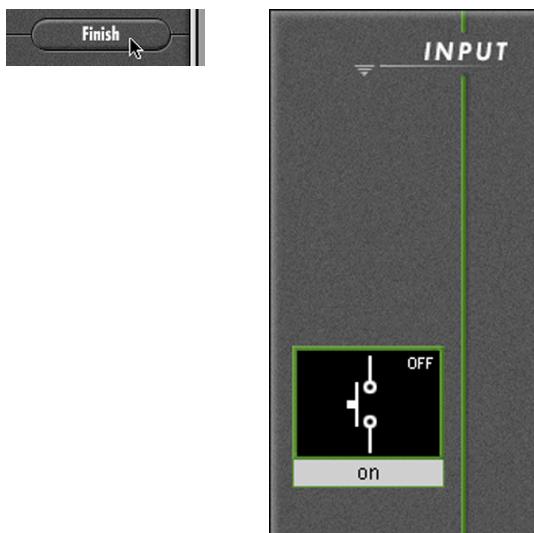
- 14** Click on the switch called **S1** and you will see this-



- 15** Click where it says **S1** and then type in the word **on**



- 16** Now click *Finish* and the switch should look like this-



You are now ready to begin writing your play-

— **Continue with Task 1 on the next page →**

17 Click on the actor called **startup**



18 Click on add a message



19 Now hold down on the ???



20 Pull the mouse down until the word *motor* is highlighted, and then let the mouse button back up.



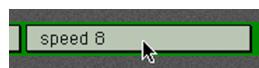
21 Roll down here-



and let go on *clockwise*

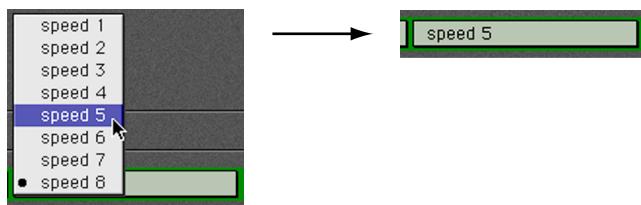


22 Roll down here-



— Continue with Task 1 on the next page —

and let go on speed 5



23 Click on add a message



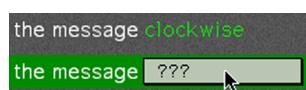
24 Roll down here-



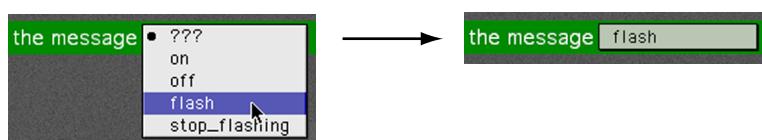
and let go on *light*



25 Roll down here-



and let go on *flash*

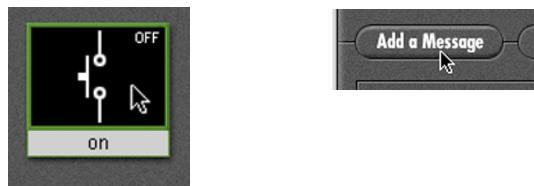


26 Click on *Finish*



— Continue with Task 1 on the next page —

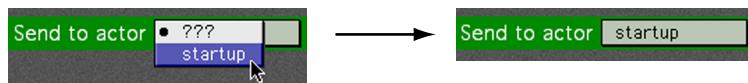
- 27** Click on the input called **on** and then click on **add a message**



- 28** Roll down here-



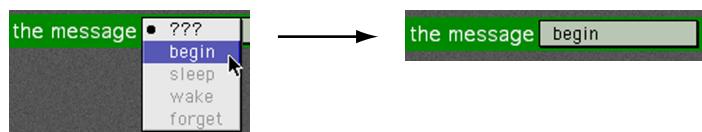
and let go on *startup*



- 29** Roll down here-



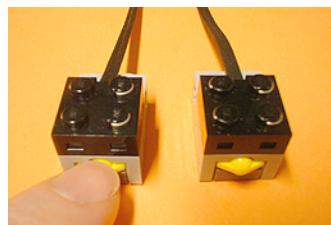
and let go on *begin*



- 30** Click on *Finish*



- 31** Now you have time to test out your program press in the *Lego switch*, and watch what happens on the screen



— Continue with Task 1 on the next page —

32 Did you see the messages being sent? Are the motor and light doing what you expected?

33 Click on Power OFF to stop the motor



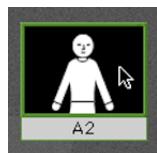
34 What does your program need now?

End of Task 1

Task 2 - Adding an Off switch

- 1 When the switch on top of the red brick is pressed, your program has to stop the light from flashing and make the motor stop.

- 2 Drag out the actor called A2



- 3 Open it up and change its name to **shutdown**



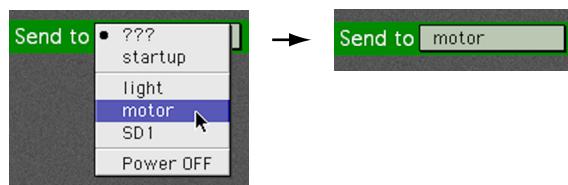
- 4 Click on add a message



- 5 Hold down here-



- 6 Pull the mouse down until the word *motor* is highlighted, and then let the mouse back up

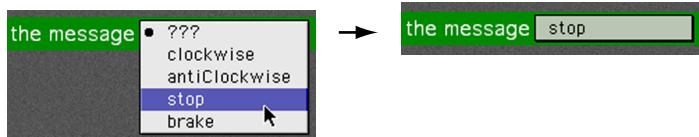


- 7 Roll down here-



Continue Task 2 on the next page →

and let go on *stop*



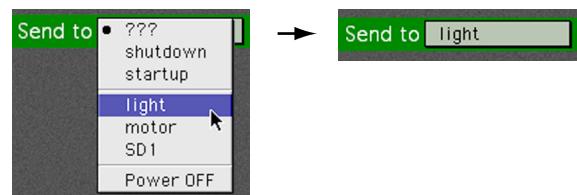
- 8** Click on *add a message*



- 9** Roll down here-



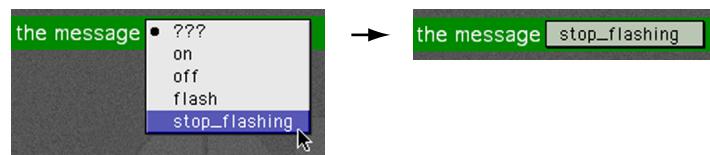
and let go on *light*



- 10** Roll down here-



and let go on *stopflashing*

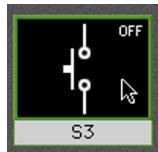


- 11** Click on *Finish*



Continue Task 2 on the next page →

12 Drag out the switch called **S3**



13 Open it up and change its name to **off**



14 Click on *add a message*



15 Roll down here-



and let go on *shutdown*



16 Roll down here-



and let go on *begin*

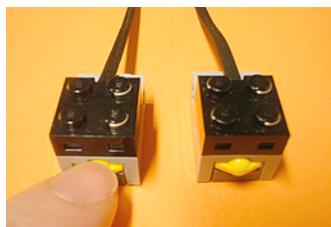


17 Click on *Finish*



Continue Task 2 on the next page →

- 18** Now test out your program. Press in the switch on top of the blue brick.



- 19** Now press in the switch on top of the red brick.



- 20** Are the motor and light doing what you expected?

End of Task 2

Task 3 - Adding a time delay

When the 'on' switch is pressed, your program has to start the light flashing, and then wait 5 seconds before making the motor start.
(This is one way to make machines safer.)

- 1 Click on the actor called **startup**



- 2 Click on the line that is sending a message to the motor, to select it



- 3 Click on add a delay



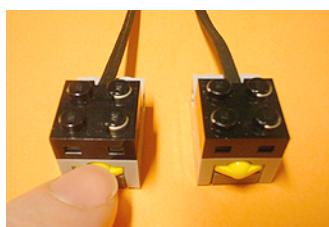
- 4 Click on the arrow until the number shows 5



- 5 Click on *Finish*



- 6 Now test out your program. Press in the 'on' switch



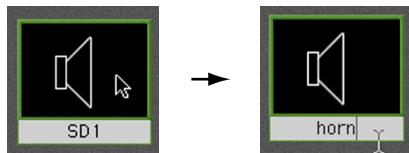
- 7 Are the motor and light doing what you expected?

End of Task 3

Task 4 - Adding a warning sound

When the 'on' button is pressed, your program has to start the light flashing and make a warning sound. After waiting 5 seconds it should make the motor start.

- 1 Drag out the output called **SD1**, and change its name to **horn**



- 2 Try out some of the sounds, and then click **Finish**



- 3 Click on the actor called **startup**



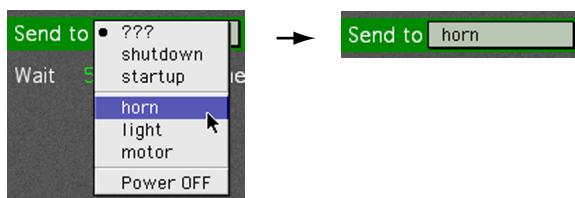
- 4 Click on **add a message**



- 5 Now hold down on this-



- 6 Pull the mouse down until the word **horn** is highlighted, and then let the mouse back up



Continue Task 4 on the next page →

7 Roll down here-



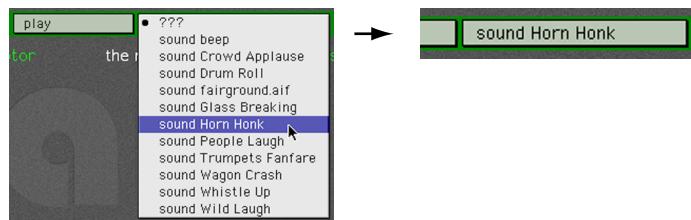
and let go on play



8 Roll down here-



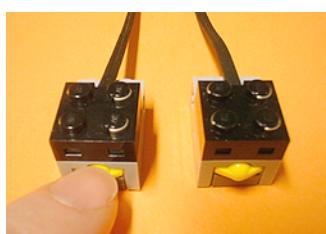
and let go on sound Horn Honk



9 Click on Finish



10 Test out your program. Press in the 'on' switch



11 Does it work as you expected?

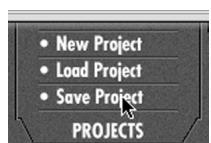
Continue Task 4 on the next page →

Now save the program.

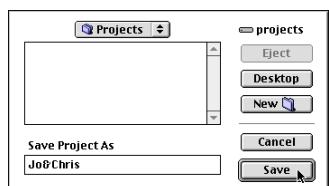
12 Click on *Projects*



13 Click on *Save*



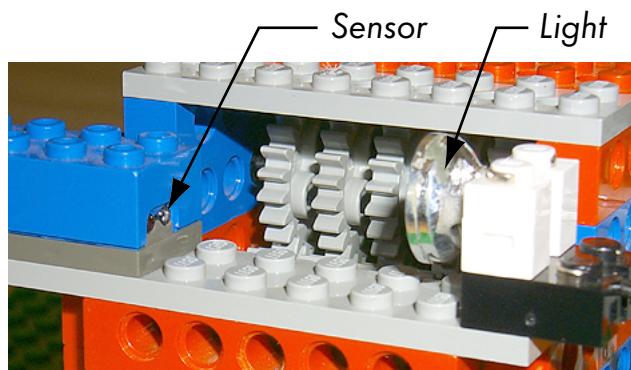
14 and save the program using your name



End of Task 4

Task 5 - A Safer Sugar Cane Crusher

- 1 You are going to use the light sensor to make the Lego crusher safer. The idea is that if anyone's finger goes near the crusher gears then the motor should stop automatically.
- 2 Make sure that the blue Lego light sensor is connected to input 2, and that the light is facing towards it.

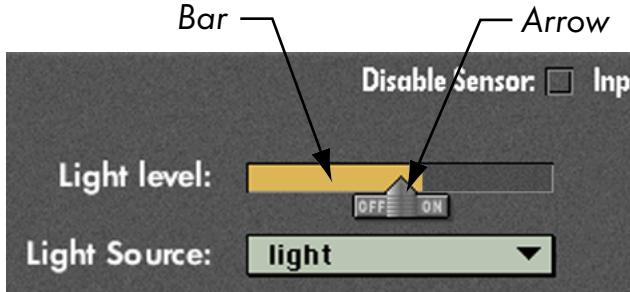


- 3 Load the program **Crusher- Task 5**
- 4 Click on the ON and OFF buttons on the control panel, and see which actors they send messages to.



- 5 You are going to use these buttons to start and stop the crusher, and not the Lego switches. Your crusher is going to have a touch screen controller.
- 6 Put messages into the actor called **startup** that:
 - turns the light ON,
 - makes a 'honk' sound,
 - and then waits 5 seconds before starting up the crusher.

Continue Task 5 on the next page →

- 7 Put messages into the actor called **shutdown** that:
- stops the crusher,
 - and turns off the light.
- 8 Test out your scripts by pressing the ON and OFF buttons on the control panel. (Make sure that the crusher gears are turning the right way.)
- 9 Now you are going to set up the light sensor. Click on the input called **sensor**, and you will see a yellow bar which shows how much light is falling on it.
- 
- 10 Now try putting your finger in between the light and the sensor, and watch the bar.
- 11 Drag the arrow a little to the right of the yellow bar- whilst your finger is in the gap.
- 12 Now when you move your finger in and out of the gap you will see the sensor icon blink on and off.
- 13 If someone's finger was being pulled into the crusher, you could use this change to send a message that stops the motor.
- 14 If the sensor blinks when only a thin piece of paper is going through, you will have to drag the arrow a little more to the right- but not too much or it will not change when you want it to.

Continue Task 5 on the next page →

- 15** Now you have to put a message in the input called **sensor**.
- 16** Which actor should you send a message to? Test out your idea. Does it work reliably?
- 17** Save your program.

End of Task 5

Task 6 - After a fault

- 1 If the sensor has shut down the crusher it means that something went wrong with the machine, or that someone made a mistake and nearly had an accident. In either case, it is important that the machine is not started up again before it has been checked. Usually a supervisor has to come along and 'reset' the machine with a key.
- 2 Your next problem is to add a reset button to the program you have just developed. We have done the easy bit of putting a reset button on the screen, you have to make it all work.
- 3 Load **Crusher- Task 6**
- 4 Notice anything different on the screen? Click on the ON button and watch what happens
- 5 Now click on the RESET button, and then again on the ON button
- 6 You have got to put one message into the input called **sensor** that will make the crusher turn off, and then add another message to stop it being turned on again.
- 7 Look at the messages in the actor called **setup** for ideas



- 8 Make sure that the sensor is going on and off at the right level before testing out your program.

End of Task 6