Worksheet 6
Braitenberg Vehicles

Purpose.

To investigate Braitenberg Vehicles 2a, 2b, 3a and 3b using the Webots simulator.

1. Vehicle 2b (Aggression)

Vehicle 2b is excited by the light source, it turns towards the source then increases its speed until it hits the light at a high speed.

(a) Open up the world **CBP_2403_BBDrive_Test_2.wbt** and make sure the controller **BBDrive_Test_2.c** is selected and open in the editor.

(b) Note down the starting (x,y) position of the ePuck and also of the PointLight (expand the tabs in the Scene Tree).

(c) Run the simulation. You may want to screen-snip the trajectory, or run the Octave script **BBDrive_Test_2** which will give you the trajectory in Fig.2.

(d) Play around with the simulation, changing the starting location of the ePuck. You could also change the intensity of the PointLight.

(e) Does the behaviour of the ePuck correspond with Braitenberg's intention of simulating 'Aggression' ?

2a fear   2b aggression

2. Exploring Vehicle 2b's neural circuit.

The neural circuit in the box below shows the connexions for Vehicle 2b. At the top you can see the left and right eyes and at
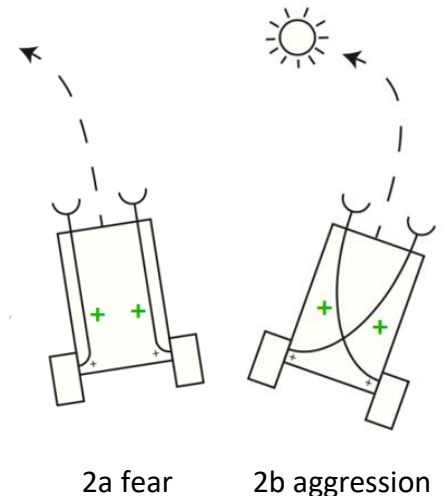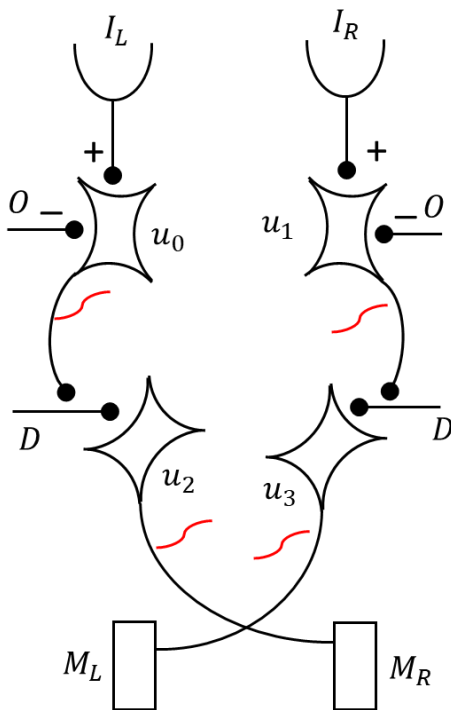
the bottom the left and right motors. You can also see the 'crossover' connexions which make this a vehicle type 2**b**.

All connexions are excitatory unless otherwise shown. Inputs O are the **offset** and D are the **maxDrive**.

(a) Rerun the simulation and look at Figure 1. The top plot shows the values of **inL** and **inR** which come from the simulated **analogRead(…)**. What are the max and min values?

(b) Use this information to explain (i) why the **offset** is set to 500 and why the values of **u[0]** and **u[1]** lie between 0 and 500 (second plot down).

(c) The third plot shows **outL1** and **outR1** which are the outputs of the sigmoid function for the topmost neurons. Explain how the value of **A** has been chosen to make the maximum value of this to be 1.0.

(d) Neurons **u[2]** and **u[3]** are the motor neurons. The final two plots show that the maximum drive is 50. Explain how the neural circuit achieves this.

3. Vehicle 2a (Fear)

Make a simple change to the controller code to obtain a vehicle 2a. Then make a planned mini-investigation and take some screen-snips or Octave trajectory plots.
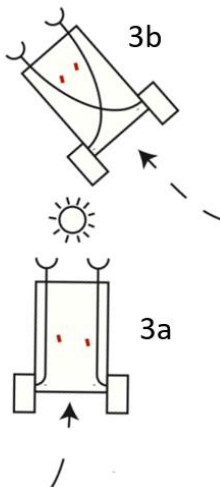
4. Vehicle 3a (Love)

Like vehicle 2b, vehicle 3a moves to the light, but it does not ram into it, rather it slows down and stops admiring the beautiful light.

Select the controller **BBDrive_Test_5a.c** which is set up to simulate vehicle 3a. Make an investigation of its behaviour. If you want to understand the code, then consult the book chapter. The controller uses *shunting inhibition* to effect the behaviour shown on the left.

5. Vehicle 3b (Explorer)

This vehicle also likes the light, but it keeps an eye open for other sources of light, perhaps more attractive.

Modify the above controller as required and investigate the explorer. Perhaps you will choose to add some more lights in the playground.