Tutorial 12:
Language and Robots

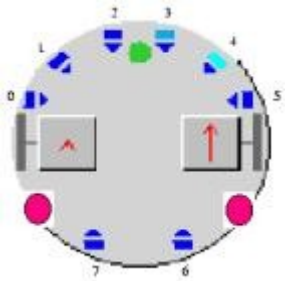
Name	Student no.

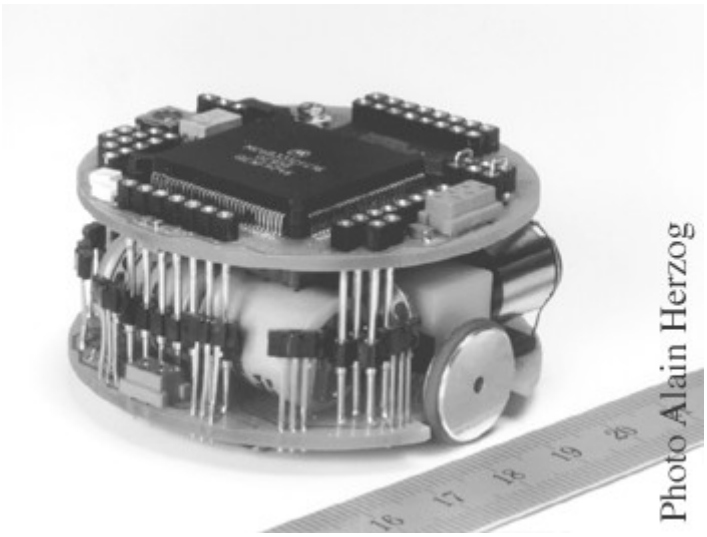
For this tutorial, you can discuss the questions in small groups (up to 4 students). Individually submit the answers to each of the 3 Questions.

Question 1

Assume you have 100 neural networks and 100 robots. Each neural network is controlling a robot. The robot is equipped with sensors and each sensor feeds into the neural network. The neural network's outputs control the motors. The robots all operate in the same 'world' and may thus 'see' each other and other objects.

a) Suggest a neural network architecture (nodes and connections) for controlling the Khepera robot (below; equipped with 8 infrared sensors and two motors).





Each neural network initially gets random weights and may thus exhibit random behaviour when let loose in the world. However, to keep running (survive) the robot needs to recharge every hour. There are 3 recharging stations which may (or may not) be recognized by the robot's neural network (i.e. sensor input caused by station may, or may not, stimulate motion towards it).

How can the neural networks be trained to find a recharging station? There are no examples available – after running them for a while we only have dead or alive robots. Here's a thought:

After a couple of hours of running most robots are flat. We select the ones still alive (and, by chance, there should be some) and *combine* their controllers (i.e. neural networks). We apply Darwin's principle: the survival of the fittest. If these *selected* robots survived for long, their descendants should do well too.

b) Suggest a mechanism of recombining the selected neural networks. Consider nature's way of coding for physical traits by means of genes, pair-wise sexual recombination of genetic material, population dynamics, and the odd chance of genetic mutation

Suppose that the robots also have a light that they can choose to have on or off.

c) Add the light to the neural network architecture that you designed earlier.

d) What types of signalling behaviours might evolve?

Question 2

Consider two robots that interact socially with humans in a movie or TV series that you have seen.

E.g. C-3PO or R2-D2 from Star Wars; David or Teddy from AI; Model 101, T-1000, or T-X from the Terminator movies; WALL-E or EVE from WALL-E; Rosie from the Jetsons; Johnny 5 from Short Circuit; Ash or Bishop from Aliens; Marvin from Hitchhiker's guide to the galaxy; Sonny from I-Robot; Bender from Futurama …

a) What technical abilities have the robots been given in order to socially interact with humans?

E.g. Face recognition, speech recognition …

b) Did the robots interact successfully with humans? Why or why not?

c) Did the robots learn new abilities? If they did, what did they learn and how did they learn?

Question 3

Consider the following question (used by the AusBiotech BioFutures Program in a Mock Summit of the United Nations):

"Should artificial beings capable of fooling humans into thinking that they are also human be allowed to exist?"

a) What technical abilities would robots require to fool humans into thinking that they are also human?

b) Answer the question, providing reasons.