

George Boole and Robotics

Nowadays everyone is familiar with robots. In the future it is predicted that everyone, or at least every household, will have a personal robot to assist with all sorts of daily jobs. The household robot will be able to offer reminders about appointments, cut the grass and vacuum the house, put the rubbish out for collection, and many more routine tasks. For school students, the robot will be able to remind you to do your homework (could you get it to do your homework for you?), tidy your room and find missing items.

Robots are not able to think...yet! George Boole, the first professor of Mathematics at UCC, actually started the process of understanding how we – humans – make decisions. The ability to make decisions, for example, it's raining today so I will take a raincoat, is the basis for logical thinking.

During his time as Maths professor in Cork, George Boole endeavoured to de-construct thinking and re-construct it using decision-making as building blocks. He did this using 'functions' like AND and OR. One of his goals was to invent a 'thinking machine'. The rainy day example mentioned above can be helpful again:

IF it is raining today AND I am going to the shop, I will take an umbrella OR I will get a lift in the car.

At a first glance this might seem a bit silly that we are emphasising the AND and OR functions here. But using logic, such as it is raining, OR, it is not raining, we can make decisions. George Boole invented Boolean Logic to attempt to represent real-life decision-making situations. In Boolean Logic there are only 2 possible states: examples include ON/OFF, HIGH/LOW, TRUE/FALSE, 1/0, and many more. In the rainy day example above, we could represent raining as 1, and not raining as 0 (we could also just as easily use ON/OFF but we'll stick to 1's and 0's for now).

What George Boole could not have known though, is just how powerful his Boolean Logic was. It is an amazingly simple concept – just 1's and 0's, and functions such as AND and OR – yet this is the basis for every single computer, mobile phone, tablet and robot on planet Earth!

Today's robots – for example the *Sony Qrio* robot that can walk, jump and run – can *seem* (almost) life-like, but this is due to the ability of computer processors to make decisions and take actions so fast that it all *seems* like natural movement to us. But the basis of such advanced robots is exactly the same as a very simple robot whose function is to move between 2 boxes. For the simple robot, it gets information from a touch sensor to tell it that it has arrived at a box. The information is of the form 1 and 0: when it is 0 the robot moves in a straight line from the first box towards the second; when it reaches the second box its touch sensor is set to 1 and the robot turns around and moves in a straight line towards the first box. This happens forever, or at least until the batteries lose charge.

There is not enough space here to go into more detail about how the *Sony Qrio* robot works, but now that you know the basis of all robots, maybe you can use your imagination to design the next generation of robots that will be the ones for households and homework!