Modular Robot Wars

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JAMES DYSON FOUNDATION OUTREACH ACTIVITY

The purpose of my project was to investigate the challenges involved in self-reconfiguring modular robot design. One of the most important challenges I identified was specification of the interface between robotic modules; a well specified interface makes the rest of the design very straightforward, while a poorly specified interface can lead to many design problems down the road.

In modern engineering, many projects are developed by teams of tens or hundreds of engineers, so the importance of specifying interfaces cannot be understated, since it would be impossible for any one engineer to fully understand every aspect of the whole product. This is in contrast to most design tasks faced by school children, since typically they work alone or in small groups on fairly simple designs.

For these reasons, I decided that modular interfaces would be a useful focus of an outreach activity.

In order to keep the task interesting, I based the challenge on 'Robot Wars,' a television show which has recently returned to popularity after being re-booted. In the show, teams design and build remote-control robots which battle each other in an arena until one is immobilised. In my outreach activity, the remote-control aspect of the robots was replaced with a 'sticks and string' puppeteering approach, and the robots were made from cardboard, wooden skewers, tent pegs and tea spoons.

To help the students learn about modular engineering, I designed and manufactured some modular attachments before the event. I gave the male parts to four teams of students tasked with designing 'weapons' for the robots, and gave two female parts to each of two teams tasked with designing the chassis and armour of the robot 'bodies'. I did not specify which teams would be paired up, encouraging them to plan around the interface specification rather than designing individual robots.

The teams were, on the whole, successful in designing and making the robots. The two robot bodies were notably different but both performed fairly well. The weapon teams mostly produced 'axe' style weapons, to varying degrees of success. After a couple of bouts, I declared that one of the robots had been immobilised as the weapons and puppetry strings had mostly been destroyed, making the other robot the victor.

In my opinion, the students achieved the learning outcome of learning about the challenges of modular design and the importance of interface specification. Many of the students felt that the task had been well designed and seemed to enjoy it. Some students felt that the additional constraint of not knowing which teams would be paired together was unnecessary and made the task very difficult, as they had not been able to discuss the interfaces in detail. For a task lasting only half an hour, as this one did, that constraint may have been excessive. If I were to run the task again, I would also want to increase the time available to the students, so they could come up with more ambitious robot designs.