

Computer Control with CoCo at Key Stage 2

Colin Masterman

*Adviser for Technology
States of Jersey Education
Committee*

Colin Masterman describes how he used control technology to help pupils bring their models to life

Computer control can be thought of as a very expensive switch attached to an overpriced power pack which, when told to do so, will happily turn lights on and off until the cows come home! I always think the best way to start a discussion about control with youngsters is to ask how many servants and slaves they have at home. When you have overcome the predictable references to parents and clarified the sort of servant we are talking about, a comprehensive brainstorm can normally be compiled which ranges from 'the thing which turns the light in the fridge off when you close the door' to 'what controls the immersion heater' and asks the question 'How does the video remember to tape *Red Dwarf*?' Children may also have encountered the building security lights which come on when somebody approaches, or the light fittings which can deter burglars by automatically switching lights on and off when you are out. Our children live in a world full of electronic and electrical control.

Several months ago I was invited (almost simultaneously) to work with staff and children in two different schools on topics which they felt had some potential for control technology. They had also heard that the Professional Development Centre had just invested in some control boxes and CoCo software from Commotion and they were interested to see them working.

The first group was a Year 6 class in a small but technologically adroit school where there was a good level of staff confidence and a high degree of pupil independence. Prior to my arrival, the class had spent some time making models which they wished to animate. The school also has a strong environmental strand, and they had plans to create some automatic greenhouses in the course of the following 12 months, so this exercise was seen as a taster in control techniques.

The second class was a Year 6 group in a girls' preparatory school where the member of staff was interested in — but terrified of — much that is deemed technological. They had been working on a communications topic, the culmination of which had been entry into a 'publish your own school paper' competition run by the local daily newspaper. I was to derive my work from this topic.

What does CoCo offer?

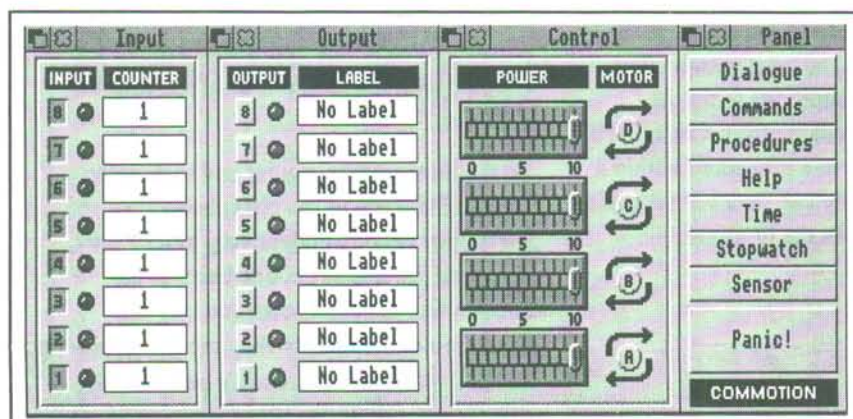
I am sure that many thousands of teachers have wrestled with the typing and syntax difficulties many BBC 'B' control programs presented and wondered if there wasn't an easier way of achieving the same results. Well, with the advent of 32-bit computers in schools and the Graphic User Interface (GUI) which RISCOS permits, the whole process becomes significantly more attractive and accessible to the pupil. With CoCo there are alternative ways of entering commands, making the whole process easier. Children can type in direct, select commands from a list using the mouse, or enter demands using the function keys.

When first loaded, CoCo displays a picture of either the Commotion control box or the old Lego Interface 'A'. Many schools may find the purchase of the Lego version very economical, particularly if they already have an old Lego control box and a user port I/O (stands for In/Out) podule for use with an overlay keyboard. Control boxes generally require a user port to be fitted to your computer.

Introducing children to the basic concepts behind control is extremely easy. When CoCo is run from the icon bar, a four-part screen appears containing movable sections entitled Inputs, Outputs, Control and Panel.

Straightforward use of the mouse within the Output section allows users to switch output lines on or off by clicking on output buttons numbered 1 to 8. The effect of such actions makes the appropriate picture of an LED on the VDU turn red, and simultaneously the real LED on the control box lights up too. If a lamp is plugged into the corresponding terminals on the control box that also illuminates, powered by the box itself. A buzzer can be substituted for the lamp and runs in the same way. The output panel allows individual switching of the eight output lines and thus eight separate items can be controlled. At this stage, switching is immediate, only occurring when the output buttons are clicked. No control programs can be written.

The four panels which load when CoCo is run



Alongside the outputs panel sits the Control section, which effectively pairs up outputs 1 and 2, 3 and 4, 5 and 6 etc., and uses them to run up to four motors. On previous control boxes motor reverse often had to be achieved by adding relays to the circuits, which tended to add to the complexity of the project. The Control panel also has 'sliders' which can be used to control motor speed or the brightness of a lamp.

The final section of this quick introduction to the software involves plugging a switch into one of the input sockets and noting that when the switch is closed, an LED lights and the counter records the event. Normally I introduce the children to the variety of input devices such as pressure mats, light-dependent resistors and tilt switches after they have had time to play with the program (especially the outputs) in more detail.

Two of CoCo's features which are particularly attractive to children are the realistic sounding alarm or siren and the inclusion of a speech module, so that the computer can be made to talk to you — perhaps offering advice or admonition according to which sensor you have activated! I use this section to introduce children to the dialogue box where commands can be typed in and then executed by the computer. If the computer is wired so that the sound comes through the monitor speakers, the volume can be significant and certainly better than the internal speakers of most computers.

From this simple launch, it is easy to introduce the concept of building procedures: collections of commands which can be called by their special name. For example, children might have a procedure which warns you that you are standing too close to a machine, and call the procedure WARN. The WARN procedure could be followed by a procedure which sets the siren going and flashes some lights too — called DANGER. Once both procedures have been built they can be accessed at any time from the dialogue box, or from within other procedures. They are additions to the commands already available from CoCo itself. A one-word reference to a procedure within a sequence might actually call up a very complex set of routines for use in the program.

■ The Tasks

Comic advertising

The communications group were asked to consider the launch of a new comic aimed at a particular readership, and then to design and make an active advert in the form of a maquette of a hoarding which could be activated by the proximity of passers by.

One pair of girls decided to promote a new comic which specialised in ghost stories. Their advert was built from a 400mm tall outline of a traditional 'ghost' shape. They mounted two lamps through the card in the spaces where eyes ought to be. They then cut a circular hole with a compass cutter just about central to the body of the ghost and mounted a small motor complete with a propeller blade: this arrangement was meant to blow air through the body.

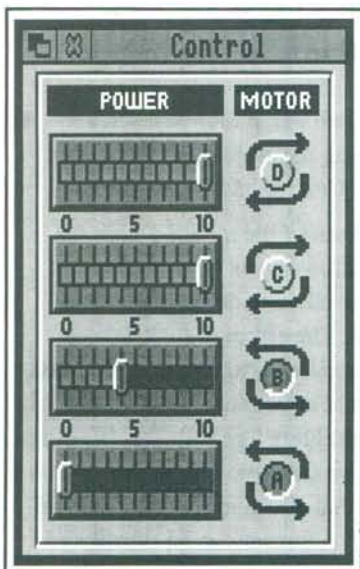
The whole structure was provided with a frame to make it free-standing and then the frontage was draped in polycotton which was glued carefully to the back of the model. Their intention was to have the ghostly shape standing quietly by the side of the pavement, perhaps with a blinking pair of eyes, somewhat diffused by the cotton. When a passer-by set off the control routine by treading on a pressure-mat, the fan would start up, filling the polycotton body with air and inflating it to give the ghost an appearance of coming to life. Additionally, through the speech synthesiser, the advert would invite people to subscribe to the comic. The effect of the ghostly shape combined with the diaphanous drapes and the twinkling eyes was extremely evocative and required a fair degree of imagination, constructional skills and procedure writing.

This class of girls, who had very little previous experience in control or D&T construction, produced work of a high quality in a very short time. I would like to believe that this degree of success was due in the main to the enormous potential which they could see in the task, coupled with the ease of use of the control software.

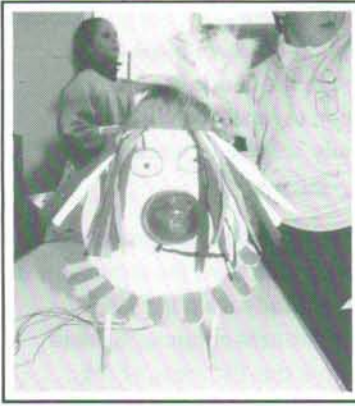
To facilitate rapid progress and to develop team skills, each of the girls chose to specialise. Having collectively agreed the design of the maquette, one became the builder, one the electrician and one the programmer. Inevitably they ran into problems and had to discuss and clarify periodically exactly what their intentions were. In an



The Outputs box, configured for use with the clown



The Control panel



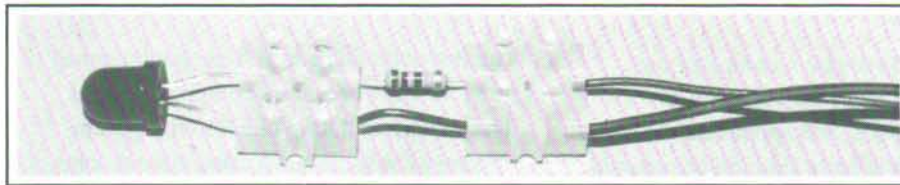
The Clown

attempt to assist the programmer, the girls wrote a paragraph which described in plain language exactly what the advert should do. The programmer then had to translate those intentions into a set of procedures.

Robots, Clowns and Puddings

The second group with whom I worked produced some models prior to my arrival, with a view to bringing them to life with the program. I was confronted with a 'robot' which was basically a well constructed box model, a large card Christmas pudding, and a delightful face of a clown complete with bulbous transparent green nose. The last object had been made from one of those washing-powder dispensing spheres.

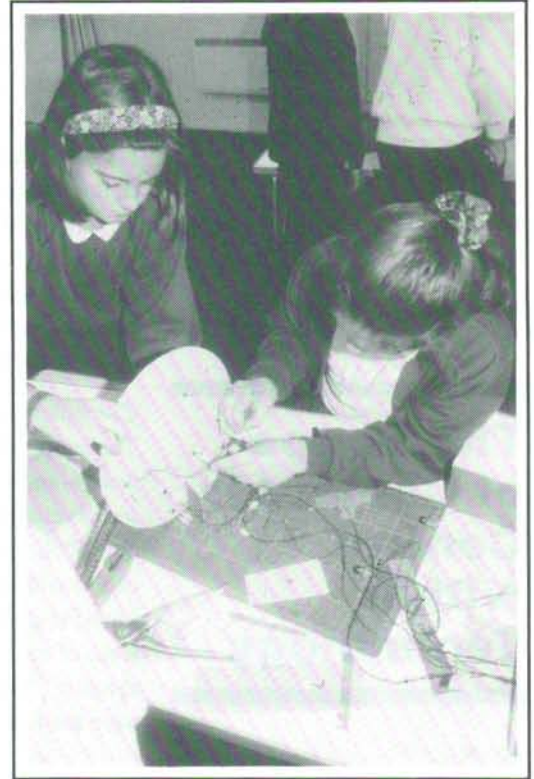
The class teacher had expressed an interest in using LEDs rather than lamps for this exercise, and I duly set to with the children wiring up *à la* batch production, a collection of buffered LEDs. I use terminal blocks for this as the components can suffer from early efforts at soldering. The terminal blocks can be hot glued onto the rear of card models and the LEDs can be bent through 90° and pushed into punched or card drilled holes.



Terminal blocks

The Christmas pudding was studded with a large number of red and green LEDs which were then wired amid a spaghetti of wires to the control box. The LEDs were grouped in parallel wired sets of four and they were randomly inset in the pudding. The children then programmed the box to flash the banks of LEDs fairly rapidly and the effect was a mass of quickly flickering 'currants' on the surface of the pudding. The wiring was eventually tidied up by placing it inside large-diameter straws which acted as a conduit.

The group who had built the robot wanted to make the arms rotate. Generally I try to avoid building mechanical devices when introducing control because limitations in construction can sometimes jeopardise the control objectives. Nevertheless, we linked a small motor via an elastic band to a bobbin on the dowel which supported the arms, and they spun. Luckily CoCo allows control of motor speed, so we were able to save the model from self-destruction!



Wiring up the Christmas pudding!

Additional features offered by CoCo include a stop-watch, a clock and the ability to act upon four sets of signals received from analogue sources such as sound, light and temperature sensors. All these offer tremendous potential to children — and tremendous fun whilst they are learning about control technology.



The Robot and the clown from behind