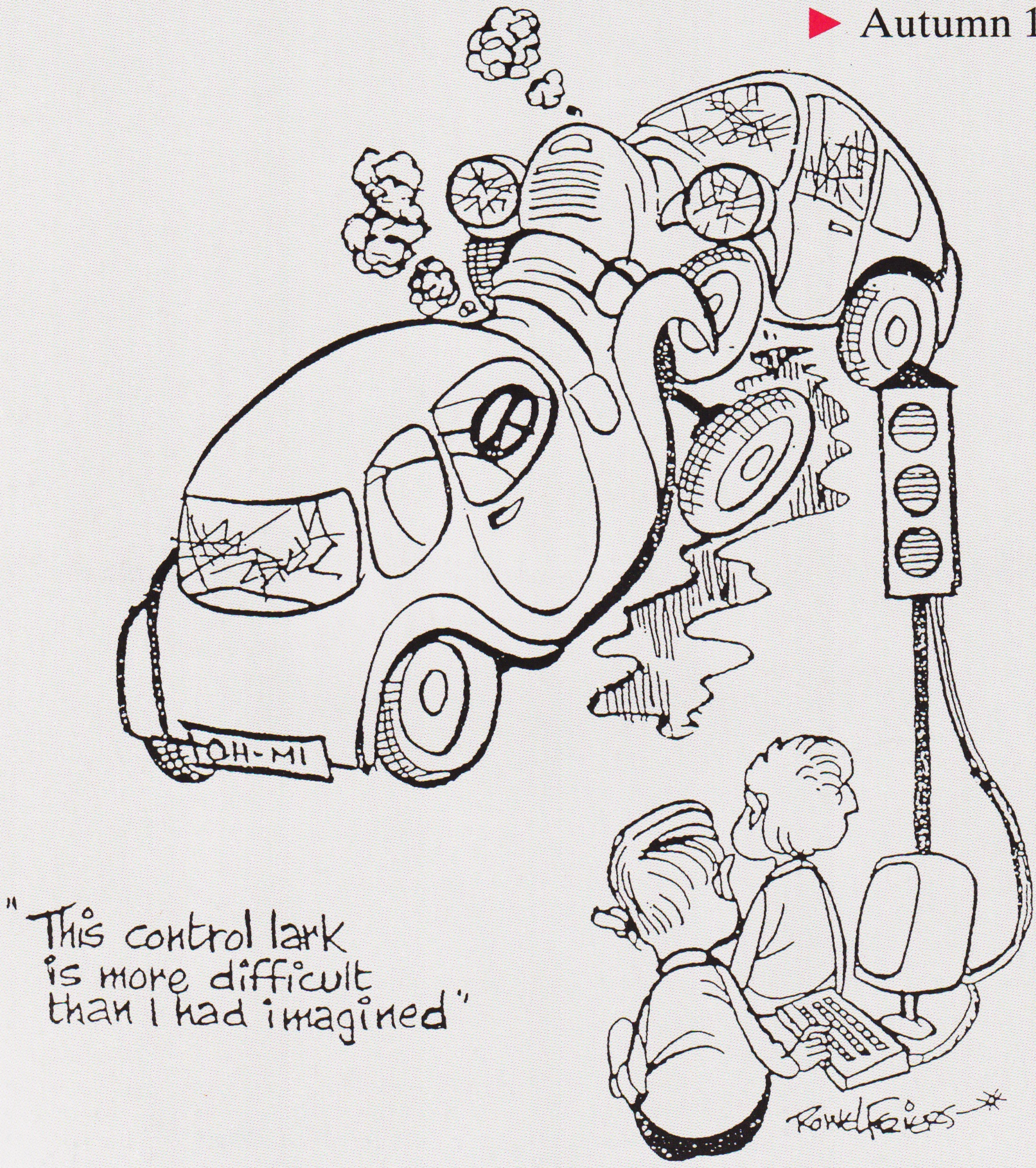
MICRO-SCOPE

▶ Technology Special

▶ Autumn 1991



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NEWMAN COLLEGE with MAPE

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MICRO-SCOPE Editor Chris Robson
Technology Special Editor Bill Urwin

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MICRO-SCOPE Technology Special

Editorial

Bill Urwin
Advisory Teacher for IT, Somerset

After initially agreeing to take on the job of editing the *Technology Special* and feeling that it couldn't be too difficult to fill 32 pages with good solid copy, I then made the fatal mistake of sitting down and thinking about it. Just what goes into a 'Technology' special? My mind changed from day to day on that one until I thought I would go mad. I decided, eventually, to lean towards 'Measurement and Control' articles where possible. Then I hit the real world. In the end, what you see before you is what most other editors of *MICRO-SCOPE* finish up with, a collection of articles which depend entirely on the goodwill of yet another set of hard-working teachers and educationalists who have been cajoled, pleaded with or blackmailed into putting pen to paper or finger to keyboard. I feel that I have been extremely lucky with the articles I have received, at a time when the world of education is a stressful and uncertain place with those in it often stretched to the limit just to keep pace with the rate of change. I thank all those who contributed despite all the other things they had to do (and I didn't need to blackmail any of them).

Inevitably there are things I would have loved to have seen articles about which are missing. Where are all the people who must be doing wonderful things in Design and Technology with *My World*? Who is doing anything on animation? Whatever happened to E-Mail? Who can explain in one paragraph exactly what a dongle does? We know you are out there and MAPE would love to hear from you. Heather Govier, in a recent article in the *Journal of Computer Assisted Learning* (Vol. 7 No. 3), gave a glowing tribute to the good things she has read in *MICRO-SCOPE*. We have a reputation to live up to so if you are doing anything worth shouting about, let us know.

One thing is certain, within the area of Technology there will be enough new things over the next few years to give us plenty to write about. Within MAPE we have been concerned that the recent government initiative on CD ROM technology has been mainly geared towards secondary schools. We have heard of one authority which has put some into primary schools and feel that there should be more. What is the national picture? If you know, let us know.

Educational rationale for the use of Control Technology in the primary school

Loretta Olusanya
Jubilee Primary School, Hackney

What is control? Anita Straker says that, since earliest times, people around the world have attempted to tap sources of energy in order to help them to adapt their environment and to exercise control over it. Tools were first created to extend the power and efficiency of human muscles. Hunting and farming equipment such as bows and arrows and ploughs all increased the control which people had over their food supplies.

Once something has been connected to a source of power, the control of the system this creates can be carried out in two ways:

- Manually, where human beings are needed to switch things on and off, such as in the electric lighting system of a house;
- automatically, where switching continues without any human action until a target is reached or until the power supply is turned off, as in a gas-fired central heating boiler.

Jim Flood observed that 'The development of the human species can be plotted in terms of the growth of our ability to exercise control over physical, natural and human resources.' Leonardo da Vinci invented many ingenious control systems including one which automatically rotated a cooking spit using the hot air rising from a fire. Our lives today are full of examples of how we have learned to control our world, with devices such as water taps, ovens with built-in timers, automatic supermarket doors, brake levers – the list is endless! Computers are increasingly being used to control things and again, we are surrounded by devices controlled by computers or microprocessors, such as washing machines, videos, traffic flow systems and robotic toys. Children accept these as part of their lives, but they need to be made fully aware of both their power and their limitations. Through first-hand experience of computer control in school, children can be encouraged to take a more active role in a society that is becoming ever more dependent on technology.

In the primary classroom, control technology is the coming together of various activities, which arise through normal classroom work and are therefore set in contexts which are relevant and appropriate to the children. These activities include working with a range of materials and techniques in 'design and make' activities, making simple electrical circuits, problem solving and programming. As children progress and gain experience they are capable of tackling more complex problems. The solutions they propose and build will become more sophisticated and, when appropriate, the computer can be used to control the outcomes of these activities.

A simple activity might involve:

- drawing a face on a paper plate;
- decorating it with other materials;
- making the eyes light up and wink;
- making the tongue protrude;
- making the nose buzz when pressed!

A simple computer control system in a primary classroom would consist of a computer, control interface box, control software and a range of switches and sensors such as lights, buzzers, light sensors, pressure pads and tilt switches.

A child who has built a model containing electrical components could connect it, through an interface box, to the computer. Simple commands typed in cause electrical components to be switched on and off. Sensors to detect changes in heat, light, magnetic field and sound can be added and a program written which will make the computer react to the changes that it detects. This will allow the model to be controlled automatically rather than manually.

From my experience of working with young children using control technology, I have found that it is a valuable way of extending the learning experiences which are recognised elements of good primary practice. Computer control activities give equal opportunities to all children and enable them to:

- have fun doing something worthwhile;
- enjoy themselves enthusiastically;
- be creative in the development of technological capability;
- become aware of control in their own environment and thus relate to reality;
- be rewarded intrinsically;
- be motivated;
- think independently, raising questions and initiating their own challenges;
- think in a logical and disciplined way;
- develop and use a range of manipulative, cognitive, conceptual, intellectual, emotional, physical and social skills appropriate to their stage of development;
- persevere, be patient and concentrate;
- work cooperatively.

In bringing together a range of activities, computer control naturally develops a cross-curricular approach. If children have experiences where they are learning new skills and acquiring knowledge and understanding in a relevant way, and not in isolation from the rest of the curriculum, they will be much more motivated; learning will be more successful and sustained. Computer control and the activities which lead up to it can provide just such experiences.

The teacher does not need to be an expert, but should be flexible in her approach and show a willingness to learn alongside the children.

Control activities are, however, very time consuming, especially if the models need to be durable, and can be expensive in terms of consumable materials. They also make great demands on teacher time and can be even more frustrating than other computer activities, since there are many more opportunities for things to go wrong!

It is worth persisting however; very young children find it difficult initially to share or cooperate in a learning situation and are very possessive with regard to toys, friends, teacher's and parent's attention. But the use of preliminary control activities gives them opportunities to cooperate, to share, to develop their use of language and gives them a firm foundation in the development of the technological ability which will be vital for the citizens of the 21st Century.

References

Anita Straker, *Children Using Computers*, 1989, Blackwell.

Jim Flood, *Learning Through Control*, in the MEP Primary Project pack, 'Posing and Solving Problems using Control Technology'. 1985, MEP/NORICC.

Programming for Control: Policy to Practice, 1989, NCET

For more information about control boxes and suitable software, teachers are advised to contact their LEA Computer Centre, IT Adviser or advisory teachers who may be able to recommend items which have LEA subsidies, or which can be supported with in-service activities.

It's very pretty, but what does it mean?

Angela McFarlane
Senior Lecturer: IT in Science Education, Homerton College, Cambridge

Throughout their school life, from an early age, children draw lots of graphs to represent data they have collected. These might be block graphs of the number of children who have a pet dog, cat or fish, at key stage 1; bar charts or pictograms showing the distribution of eye colour in a class at key stage 2; line graphs showing the daily temperature over a month at key stage 3; scattergrams and histograms from opinion poll data at key stage 4.

At the end of this process of seemingly endless graph drawing many children are capable of drawing a variety of types of graph quite competently. The number of successes will rise if they are given the range of each axis (and told which variable goes up the side and which one along the bottom). However if you ask children to make meaningful comments on the data they have displayed, or ask them why you draw a graph in the first place, or why you don't always join up the points, fewer and fewer are able to give coherent explanations.

It seems odd that after spending so much time on graph work, much of it specifically aimed at helping children to understand graphs, many children just don't get it. Now before you get too excited I'm afraid that I can't tell you why this happens, or even suggest a patent method to cure the problem. However I suspect one problem is that children fail to make the link between the information they have gathered and the graph they draw, especially when the graph is constructed after the information is collected rather than at the same time. I'd like to suggest an approach which might help some children, some of the time.

One of the things computers are quite good at is drawing graphs; how good depends on the software and the computer. There is an increasing range of devices available for schools, many developed especially for primary children, which not only draw a graph, but draw it while something is changing. For example the Motion Sensor will draw a graph of a child's movement over a short period of time (see below for details of this device). The child sees the graph appearing as s/he moves; moreover the program will produce a graph for the child to try and copy (Fig. 1). This is a very powerful learning experience for the child, and the rest of the group who give helpful instructions! Children can take it in turns to have a go and print out their attempt to keep as a record. The co-operation, problem solving and language work alone involved here make the activity worthwhile.

During the first encounter with the Motion Sensor by a group of seven-year-olds, who were not very familiar with line graphs, one child worked out that having started walking too fast (the trace was too steep compared to the one he was trying to copy) standing still made his line go straight across so it caught the original and he could start moving again, more slowly (Fig. 2).

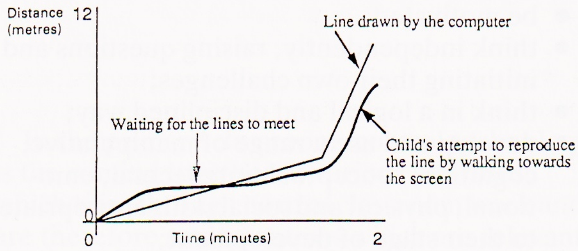


Figure 2 *The type of graph which can be produced with the Motion Sensor.*

In order to do that he had worked out something about the relationship between rates of change and slopes of graphs, including what a graph does if nothing is changing. Naturally he would not have used that language to describe what he was doing, but nevertheless his actions relied on an intuitive understanding of these things. The children were engaged in some high level data interpretation, and having a great deal of fun.

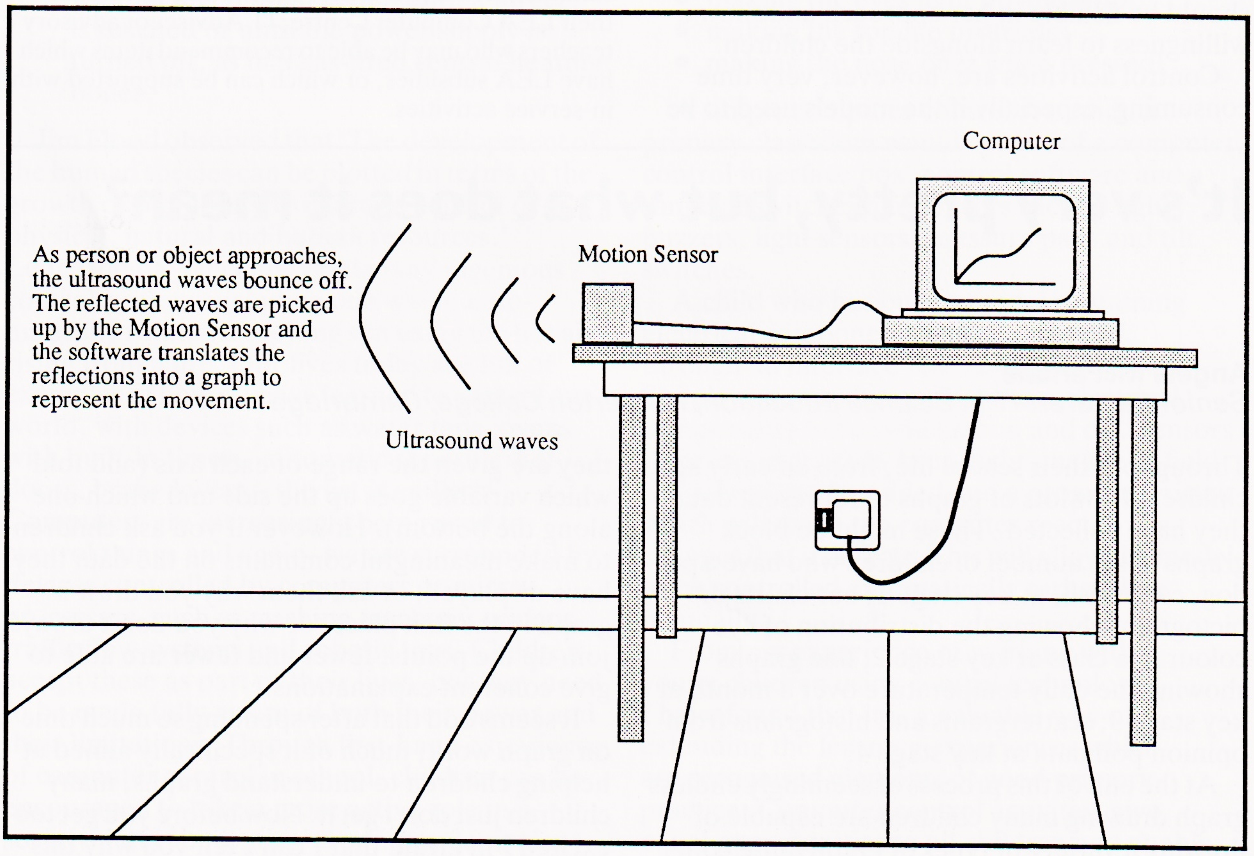


Figure 1 *The Motion Sensor.*

Those children would have had great difficulty in drawing the graphs they had created, or in taking the measurements the Motion Sensor was taking. By having the computer do these things the children were free to concentrate on the skills of graph interpretation, and to learn something about distance/time graphs. The experience of having your own movements mapped on a graph *as you make them* provides a powerful link between the measurements being made and the presentation of those measurements in a traditional line graph format. Those children were making interpretations of graphs that older children, whose experience of graph drawing comes *after* the gathering of information, never simultaneously, find very hard.

I am not suggesting for a moment that we give up teaching children to draw graphs, or stop them taking measurements for themselves. Neither am I advocating talking to all seven-year-olds about rate changes and gradients of lines. All I'm suggesting is that some of these computer-based resources, which draw graphs as the child experiences a change, have enormous potential to help children understand graphs a bit better. Which could mean that all the hours of experience of drawing graphs throughout their school life could become more meaningful.

Many thanks to the children of Little Thetford C.E. Primary School, Little Thetford, Cambs.

The Motion Sensor is available from Educational Electronics, 28 Lake Street, Leighton Buzzard, Beds. A version is currently available for the BBC; other versions are planned. The present price for the device plus software is £66.00.

Creativity in the classroom with Fred the Roamer

Graham Gordon
Norton St. Philip Primary School, Somerset

About a year ago, Fred arrived complete with box and instructions. He was to become a 'model' pupil! Looking like a tortoise the children soon gave him features, eyes and nose, but what was he and what was he called? During the first lunchtime one child, using some of the leftover 'features', made the word 'Fred' and stuck it on him. This proved to be a popular title. My class of years 2, 3 and 4 were fascinated by him and couldn't wait to examine him and make him work.

The year 4 children won the resultant 'draw' to decide first use and whilst they played there were lots of envious children watching and peering over books. Soon they realized that the fingertip controls on the top of his body responded in sequence. He moved in units of 30 cm forwards and backwards but what about turning? There was much experimentation and then the first challenge was issued. 'Can you make him do six different movements and record it so that someone else will know how to repeat the sequence?' A whole day's work followed, with much consumption of paper! After about an hour, one child suggested that they ought to make a chart showing how he could be programmed! Gold star to that girl. The chart was rewritten several times and eventually set out on a large A1 sheet for everyone to see 'How to make Fred work'.

It was now time for the 'group' to show the rest of the class how Fred performed with each person desperate to get the best and most complicated six sequence movement. Loud applause as the children were able to follow the illustrated sequence chart written by each person, watch Fred being programmed and then see the end result.

Day 2 started with the year 2 children feeling sorry that Fred lived in a box and didn't have a cover to keep him warm. Some of the group suggested that they try and make him move around the classroom. The discussion continued until the group agreed to work together to do three different tasks:

Task 1 – make a square with books like a field and put obstacles for him to go around.
Task 2 – build a garage for Fred to live in.
Task 3 – design a cover to keep him warm.

Task 1

The books idea started well but no agreement was reached as to the size and position of obstacles. One sheet of A1 paper (white was thought the best) was originally tried, but Fred soon came off the side. Eventually, six A1 sheets were taped together and a border drawn around the edge. Several large rectangular building bricks were sent for from the Reception class. Great experimentation followed: how many bricks should be used? where should the start and finish lines be? what route should be drawn out and can Fred do it? There were lots of attempts and failures and lots of reasoned debate. This took most of one day and ended up as two separate challenges.

Challenge 1
A large rectangle, six A1 sheets, three large building bricks standing on their ends in a painted rectangle. Three routes, same start and finish positions, coloured and graded according to the length and difficulty. Children were allowed to put moves in singly and a chart was kept of the fastest times for each route using a stopwatch and recording on three charts. Children used three clipboards and paper the same colour as the route. Since then there have been regular challenges to beat the best time.

Challenge 2
Eight A1 sheets were joined and a racing circuit planned. The group drew it on the sheets, putting in a very complicated design and realised that it would take too long. They then planned another design on a small sheet of paper which when agreed was drawn on the reverse of the main sheets. A large circle with a 'chicane' was drawn. The rules were agreed: no penalties for going off the track but you must return to it from the exact spot you left it at. Stopwatches recorded the times which were written on a clipboard pad. Fred was later given a racing costume. A large display sheet with 'lap times' and challenges issued. One pair even challenged each other to put the complete program into Fred before starting. Eventually, they were successful and smashed the lap record. The circuit is currently being 'modernised' and new rules devised to make 'programming' more difficult!

Task 2

We have the advantage of having 'Somertech' (a technology kit) available, and a large quantity of wood, glue and tools. How long and wide is he? Does his garage need to be tall, and will it need a door? The children were encouraged to sketch a possible plan, then make accurate measurements. This took a lot of solving, the most difficult being how to discover the width and length accurately. Eventually, one child took two large plastic building blocks, put them flush on either side of 'Fred', carefully removed him and measured the gap, repeating this for the front and rear. It was lovely to see inspiration and the response of the peer group of such a simple solution. After measurement had been completed a picture was made using strips of paper accurately cut according to the plan. The side and top elevations could be matched when constructed for accuracy, similar to building plans. When the final structure was made and glued there was great excitement as Fred was guided home and after several experiments programmed to stop right inside. The structure was covered with stiff card and a planning session was called by the children to decide how to decorate it and how to construct a door. This work and interest lasted for almost half a term.

Task 3

Four children decided to make several covers for 'Fred'. Paper ones proved not very durable so other suggestions included knitting, cutting, using binca and decorating them with his name and coloured patterns. These ended up being the symbols that form part of his program. Finally, felt was used and similar patterns and decorations as for binca were made. There are still arguments about whether to put his nightclothes on before or after he goes into the garage but the group were pleased with the volume of their work.

Finally, year 3 found it was their turn. By now they realised that Fred was easy to program and they wanted a really hard challenge! They were asked to design a container that would carry a heavy weight. This container was to be attached to Fred who had to pull the heaviest total of weight a distance of one metre. 'Jinks' type technology materials were available and many different designs were used, all successfully. One design included a sledge which rolled across dowelling rods laid at spaced intervals! All the others used wooden wheels.

The first problem was making the 'container' strong enough for the weight and finding the best way to attach it to Fred. 'Hey diddle, diddle, there's a hole in my middle' took on a new meaning for Fred. The weight proved a problem as we soon ran out of 1 kg weights. Children's dictionaries were found to weigh 500 g each and were pressed into service. Much weighing, testing, balancing and severe scrutinising took place. The measured distance was marked out and theories put into practice. By now the whole class was at fever pitch with excitement as each model was tested, finished, great cheers, and returned to the start for more weight to be added. Everyone succeeded in the task. You must try it yourself and see if you can shift over 10.5 kg, which was the best we could do.

Since then there have been other challenges issued to the whole class and they include:

1. The steepest incline that Fred will ascend – great for measuring angles of elevation but a good gripping surface is needed – inside of a Lego box top?
2. Can you make Fred play 'Happy Birthday' or a nursery rhyme?
3. Is it possible to show a way that Fred can add and subtract (a number line should be the outcome of this)?
4. Will Fred draw pictures using squares, triangles and rectangles? Can he draw a circle? Will you use different colours?

There is no end to the number of challenges you can invent for Fred. Sometimes he gets tired and we allow him to hibernate but the children soon demand his return and I am hoping they will soon set challenges for each other. It is important in this work that the children learn to record all the inputs they make and follow each stage on their records as Fred performs. In this way they can quickly spot any programming errors. Each child now has a 'Fred Folder' and programs are kept for future reference. The children are encouraged to write a short note about each program to remind themselves and inform anyone else who reads it about the type of program. They are also giving each program its own special name. A recent addition to the folder is an index/contents page at the front. The whole folder makes good reading and shows an accurate record of the child's understanding and progression. For younger children I am preparing a sheet with the programming symbols at the top to remind them, with lines for writing on underneath. Already the Reception class has begun to show a great interest in Fred so he will be going to their class next term 'on vacation'. But don't worry, his cousin 'Myrtle the Turtle' will be with us by then.

Children learning together

Pam Earnshaw
Advisory Teacher for IT, Somerset

We often suggest to children the idea that they might like to write stories or poems for their younger schoolmates. In the past I have been surprised and delighted by the standard of work often produced when children are encouraged to write for younger audiences.

I wanted to find out whether it was practical for Year 5 and 6 children to design and make overlays for younger children. I was also interested to see if it would fulfil any of the requirements of the Design and Technology programmes of study, particularly at Levels 4 and 5.

The school was a small village primary (six classes); the children came from classrooms which were adjacent. A mixed-ability group of four girls and three boys (Year 5/6) volunteered to take part in the activity. All the children concerned had used overlays, prepared for them by their teacher to help them with their writing at some time. Some had taken part in a project to record their adventures at camp on *Touch Explorer Plus* during the previous term. The whole school was involved in a project on the subject of animals at the time.

We began the activity by discussing ways the children had used the Concept Keyboard when they had been in the infants. Could they remember? Had it helped them? Would they have liked an overlay designed just for them, which incorporated the ideas that they wanted?

Their first task was to identify whether there were any children in the present Year 2 or 3 classes who would like an overlay designed for a story they might like to write, as part of their animal projects. They discussed the idea with the Year 2/3 teacher, who said she thought it was a wonderful idea.

'If possible can you include something about camouflage, as we will be learning about that next,' she said.

There was no shortage of volunteers from Year 2, so seven had to be selected from the willing band.

Beforehand we had discussed strategies for

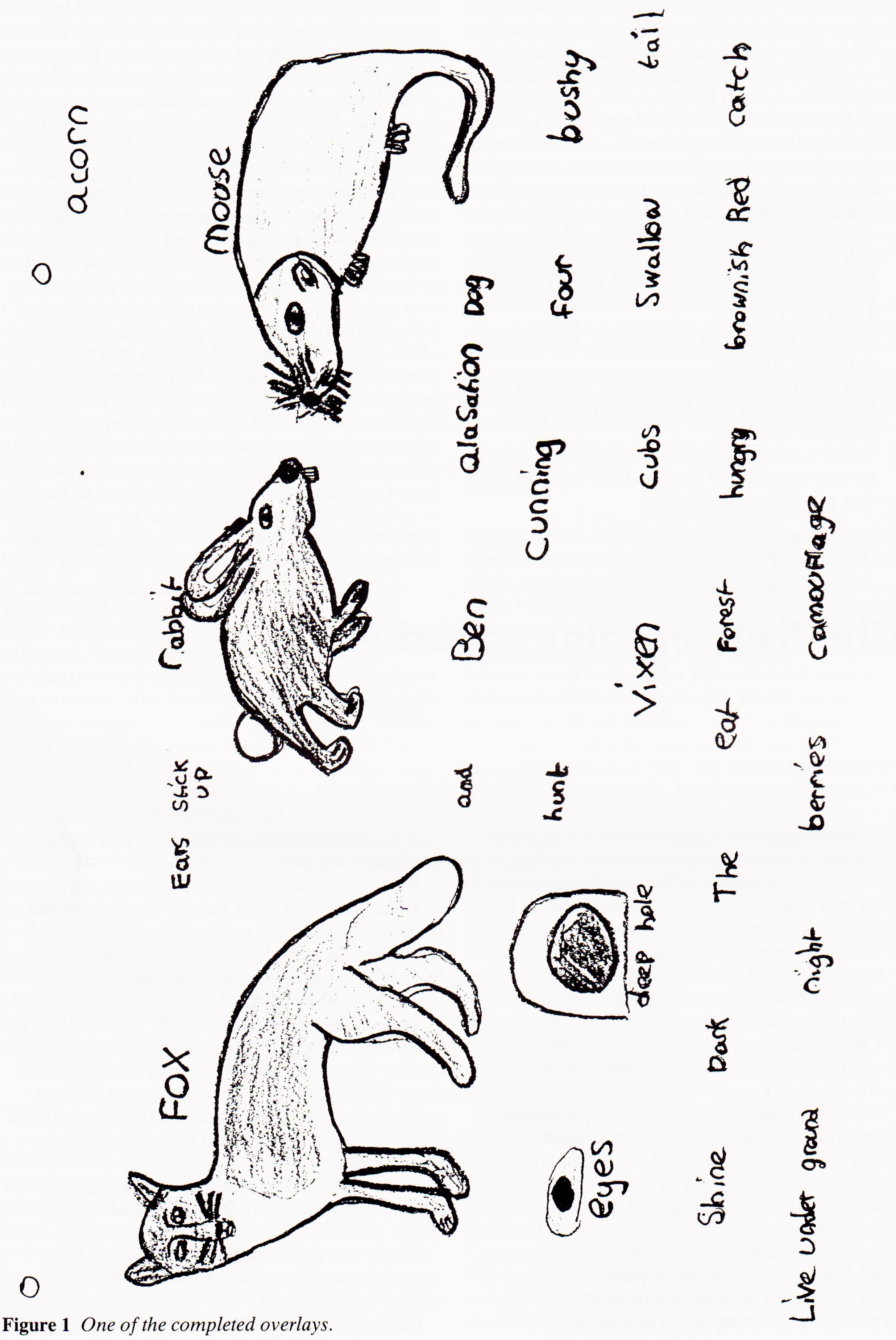


Figure 1 *One of the completed overlays.*

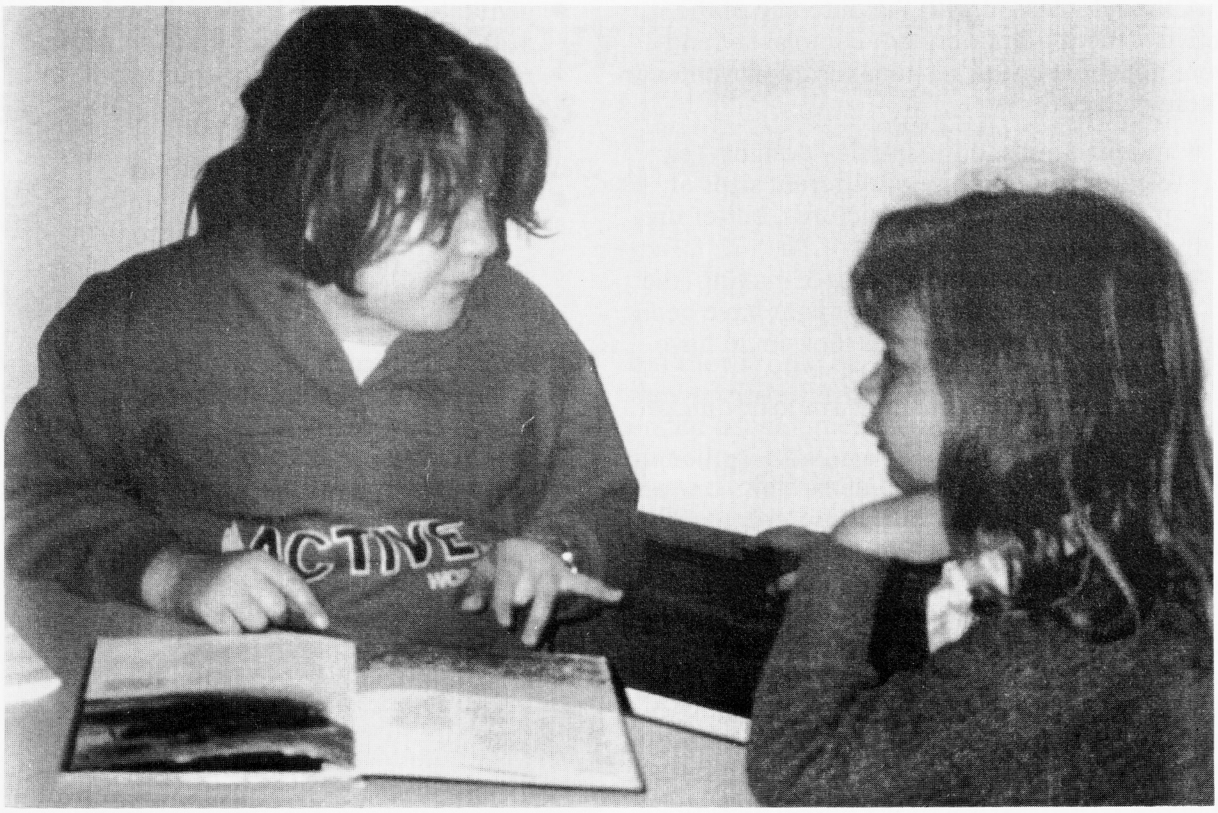


Figure 2 *The younger children discuss their ideas with their Year 5 partner who is to make the overlay.*

engaging the infants in talking about the stories they wanted to write about.

'Is it OK to give them ideas if they have none of their own?'

'What sort of things might interest them?'

The children decided that the best approach would be to take the infants into the library, where a selection of books on animals would be displayed, so that they could do some talking and browsing at the same time.

'Do you think we need to make notes?'

'Yes, because we will need to know what words we have to put on the overlays.'

Paired up with one of the infants, each of the juniors, equipped with notebook and pencil, found a corner in the library to sit and look at the display of books and talk about animal stories. This took 30–40 minutes.

The infants then went back to their classrooms, leaving the juniors to design and make the overlays. Most of the notes the juniors had made consisted of lists of words. We discussed these, talking about various ways they could be arranged to give the infants cues for reading them.

'Are there any other cues other than pictures that can be used?'

I gave the children some example overlays to look at where words which were linked in meaning or grammar were grouped. I explained to them the importance of making their design fit exactly on the overlay grid and gave them copies of the grid to use as templates for their designs.

We discussed the advantages of cutting and pasting over drawing directly onto the overlay. It is important to be able to change the position of something to fit in something else, or move it to be close to something it could be associated with, should that be necessary later on.

When they had finished sketching out their ideas the older children took them back to the infants to check that they had included all that was needed and that they could be interpreted easily. Following this visit some amendments were made and the finishing touches were soon being added.

I then showed them how to make overlays using the MAPE program *Stylus*. I was surprised by the speed at which they picked this up. In no time they were confidently keying their words in – and once started not one of them came back for further help from me!

In no time at all the overlays were being used by the infants. Stories were soon pouring hot from the printer. The overlays proved so successful that not only were they used by other members of the same class, but by many of Year 3 also.

Although pleased with the outcome of the activity, the juniors were not complacent and were not short on suggestions for improvement. These included:

- modifications to the overlay designs, (eg clearer printing, use of different sizes of print, use of magazine pictures, better use of colour);
- modifications to the process of making (the group felt that the infants might have been involved more – perhaps they could have helped with the pictures);
- all the group felt that they would be quicker at keying in next time.

The thing they had all found most difficult was standing back at the end and letting their overlay be used. They had wanted to participate and help with the story writing.

On reflection, this group of Year 5/6 children completed the project so easily, I think it could have been managed equally well by younger children. The activity had so many benefits, including social, language and the use of information handling skills for a purpose. It covered, in broad terms, all four of the design and technology attainment targets; the aspects of the programmes of study it touched are listed below.

Programmes of study

Developing and using artefacts, systems and environments

- plan how practical activities may be organised
- use knowledge and judgements to make decisions in the light of priorities or constraints
- identify the parts of a system and their functions, and use this knowledge to inform their designing and making activities
- test simple objects they have made
- recognise that the control of a system involves inputs, outputs, feedback and stability of that system
- understand that it may be necessary to practise an operation in order to improve quality.

Working with materials

- develop co-ordination and control in using equipment
- finish work carefully
- select and use the equipment correctly
- check the condition of equipment before use
- generate ideas and develop them further using a variety of techniques and media
- recognise the purpose of equipment, to understand the way it works and use it.

Developing and communicating ideas

- develop styles of visual communication, which take account of what is to be conveyed, the audience and the medium to be used.

Satisfying needs and addressing opportunities

- be aware that the appearance of artefacts, systems and environments is important to consumers and users
- make adjustments as a result of evaluation.

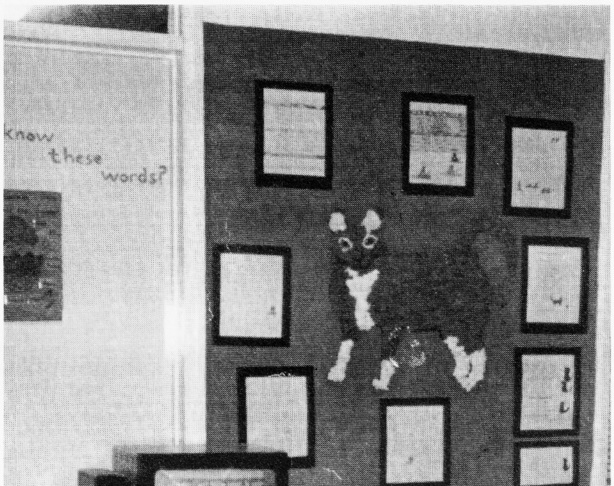


Figure 3 *Testing time! The Year 5 children take their overlays back to their learning partners to find out how they stand up to the test.*

(Control) Technology starting with stories

Martin Longley
Advisory Teacher (IT), Dorset

Many teachers are concerned about the implications of the National Curriculum with regard to technology. Control Technology in particular is seen as a threat because it involves concepts that they are not entirely confident about, and they find it difficult to integrate the required activities into a cross-curricular approach. The result is often anxiety and worry.

Familiarity and confidence with the concepts involved can only be gained through experience. There is no short cut or instant solution that can be applied. Confidence can be increased however by finding a familiar starting point that is an important and integral part of the established curriculum.

The National Curriculum with its 'systems and artefacts', its 'identifying needs' etc is not a terribly friendly document. Much of the emphasis of the examples concentrates on 'real-life' situations. These are often not appropriate to primary age children because they force attitudes and experiences upon the children that they are not necessarily ready for.

It is important for the children to experience a real situation such as a mini enterprise in a context which enables them to fully appreciate the complexities of such an undertaking. To get the best from such an exercise, the children really need to examine the process holistically and not just be involved in the production line aspects. (*'See Margery Swinton's article for some excellent advice on how to undertake an enterprise project'* – Ed.)

Stories are an essential and central part of the primary curriculum. Using them as starting points for technology activities not only provides a familiar environment for teachers, it also enables children to use their imagination and extend their understanding of the stories. Every story (yes, *every* story) can provide a number of starting points for technology activities. Control Technology is a natural extension to technology. Computer control merely adds an element of automation. These distinctions are important.

When considering starting from stories, a teacher may look at published packs as an easy way in. There are several packs on the market but they should be looked at critically to see if they provide enough opportunity for open-ended development. Once confidence has been gained, possibilities begin to present themselves in almost every story you look at, using software which is already available in school and stories that are in every classroom. I am sure teachers and their pupils can come up with some excellent ideas. After all, that is part of the exercise: identifying needs.

Just consider nursery rhymes. Jack and Jill have a definite need for a safe way of climbing up the hill. What solutions can you think of? (I've always been worried about them climbing the hill to fetch water – think about it!). How about a spider frightener for Miss Muffet or a sheep counter for Bo Peep?

Some stories involve technology as a central theme. *Stanley Bagshaw and the Fourteen-foot Wheel* by Bob Wilson is a case in point. With some wonderful language ('mould-grommets' and 'sprocketogriffler') and a machine that goes wrong it is a rich vein of technology starting points. However stories that do not seem to involve much technology such as Roald Dahl's *Enormous Crocodile* can also be used. Ask the pupils, 'If you lived in a jungle with an enormous crocodile, what would you do to protect yourselves and your families?' Someone will undoubtedly suggest building a fence or moat around the village. What about the gate or drawbridge? First design and make a working model (a drawbridge is particularly challenging). Who is going to be on duty to shut the gate or raise the drawbridge when the enormous crocodile attempts to get in and eat up some scrumptious, munchy children?

Can the job be automated by using a computer? After all it should be possible to get a computer to detect the difference between an enormous crocodile and an ordinary villager. (Hint: try a light gate; that is a beam of light directed onto a Light Dependent Resistor in a dark tube (black pipe lagging is ideal). If the villagers have spindly legs then light will still get through. The enormous crocodile will cut out all the light and so trigger the alarm!)

We have undertaken a variety of activities in Dorset schools. Some have been inspired by songs (*The Wheels on the Bus*, Fig. 1), some by nursery rhymes (*Hey Diddle Diddle*), and some by stories (*Goldilocks*, and *The Hobbit*). With just a little imagination – something that children never seem to be short of – almost any aspect of the 'normal curriculum' can have a technology aspect. There is no need frantically to redesign the incorporation of technology within the curriculum. In fact, the problem often becomes that of knowing when to stop, as one idea invariably leads to another and children refine and improve solutions.

One other constant problem within schools is lack of resources. Good tools are essential for technology work but they are reusable and the cost can be spread over a number of years. Cheap (and often free) materials can be used. Problem-solving tasks are often enhanced by questions such as: 'What is the best way to join a yoghurt pot to a piece of card?' or 'How can a light bulb be fixed onto an old margarine tub?' Don't worry too much about attainment targets before starting technology work. Just record in a simple way what goes on. Towards the end of a project, review what has taken place and you will find that a large number of attainment targets have been covered. Some will obviously need further work but the task is far less daunting once a start has been made.

Finally, two conflicting observations on using computer control as part of a Technology project. Only use computer control where it enhances and extends the activity and where children see it as a natural extension to the work. Do not use it because you feel you 'have to'. On the other hand, be aware of the knowledge and understanding that children possess. I can still vividly recall a six-year-old girl telling me with great confidence that in order to make a burglar alarm to protect her parrot (made out of card and kept in a cage made out of an old cardboard box), we would need a SENSOR.

'What's that?', I asked.

'Oh, you know,' was her reply, 'one of those things which opens the doors in the supermarket for you.'

'How does it work?'

'Oh I don't know exactly, but it's got something to do with light.'

Later when I recounted this to the staff, several admitted that they had little or no idea how automatic doors worked. The conclusion is simple; don't underestimate the children's ability and knowledge.

Figure 1 *No problem – it's all under Control.*

A badge making enterprise with the Archimedes

Margery Swinton
Staff Tutor (Primary Computers), Central Region, Scotland

I came away from BETT '90 having seen some great software and the badge-making kit produced by London Emblem plc. This item excited me the most because I could see a lot of potential in it. Nine months later, after attending a Shell Junior Enterprise Initiative INSET and having experimented myself with the Archimedes computer and *Draw* package (both new to me), I took a deep breath and launched into introducing a P7 class (11–12 year-olds) to the Archimedes.

The children at Riverside Primary School in Stirling are very fortunate in that the regional computer centre is sited on the upper floor of their school. They were thus able to come into the Archimedes lab for instruction in RISC OS and then *Draw*. After five weeks the majority of the 28 pupils were quite at home with most of the basic options in *Draw* as well as mouse control. I should say that none of our primary schools have mouse-controlled software for their BBC Masters. Whilst the pupils were drawing I was working on some badges for a school trip abroad and the 'Mountain Search and Rescue Dogs' association. The children wanted to be able to do that too and a chance remark to the school PTA gave the pupils their first brief: design a badge for the PTA to wear.

At this point the children worked in the lab for 45 minutes a week and had an Archimedes in their classroom all the time. My time input now was about one hour a week. Badge drafts were done in two ways, either freehand sketches on paper or rough doodles on the computer. Whilst working on these pictures the pupils had to share file discs, saving and amending their work as time permitted. When the designs were completed the children learned how to scale them down to the required badge size of 55mm. Class discussion led to 12 designs being selected for the PTA to cast their votes upon. The 12 badges were grouped on an A4 page and printed on an Integrex 132 colour printer (the Centre's, not the school's!). After selecting their badge the PTA placed an order for 36 badges.

Flushed with this success and with the Christmas Fayre fast approaching could we produce Christmassy badges and keyrings? (Materials to make both are available from the company.) Some good designs were forthcoming but we needed something else. Public domain clip art

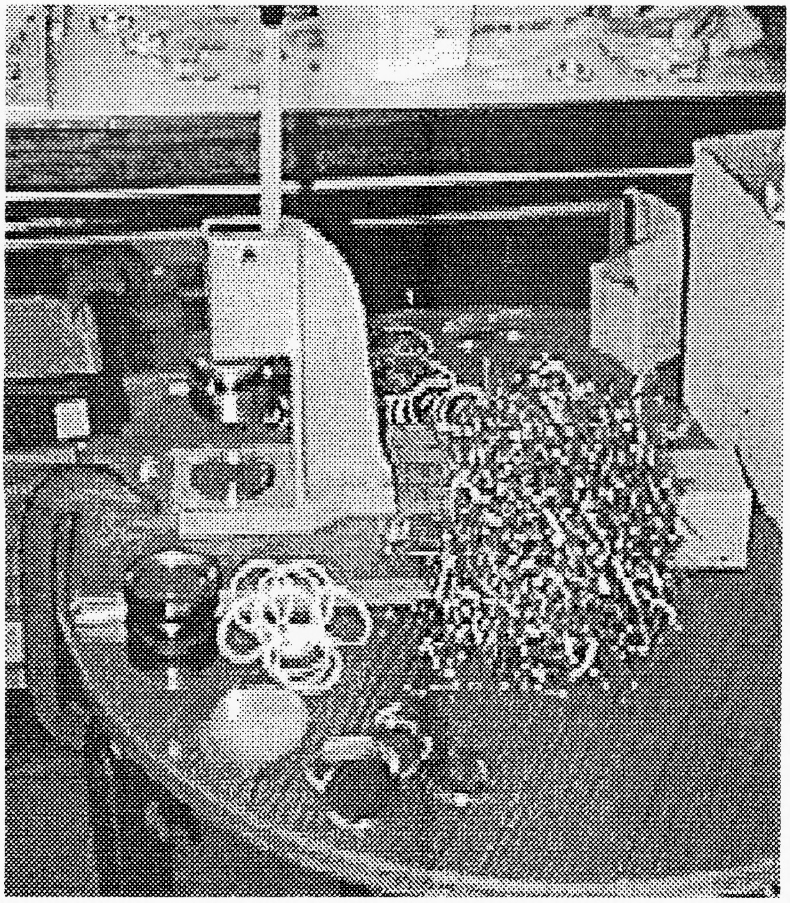


Figure 1 *The badge making kit – showing the die, press, cellophane circles, plastic rings, metal badges and pins.*

Figure 2 *Producing the badge – we screwed the badge press onto a board, which was then clamped onto the table. This made it much easier for primary children to operate.*

had some good sprites, rather than drawfiles, but these were black and white and would need to be coloured. We all learned how to use *Paint*, another of the free software programs that comes with the Archimedes. We learned how to use the scanner and scanned in two pictures which were duly altered (for copyright reasons) and coloured. Christmas sales grossed £345.

By now there was quite a lot of interest in the badges and it was clear that we would have to address the costing side in a less haphazard manner. The mathematics of this project has been quite a headache since prices depend on whether badges (in the two sizes we can now produce) or keyrings are produced. Keyrings are more expensive. Costs could be kept down if badges were monochrome rather than coloured. At this time we were using the Hewlett Packard Paintjet, and the paper and cartridge costs were quite high as well as the process being time consuming. In a bid to reduce colour costs we found a colour photocopying company in Glasgow. However another cost factor was now introduced because the price per sheet varied depending on the number of photocopies required. We all started to look at spreadsheets. These had not been used in our primary schools before and the group looking at them thought they were wonderful. We are using *Data Sweet* from Hampshire LEA.

Since Christmas orders have been coming in from all over Scotland. We have produced school Centenary and Silver Jubilee badges. A school in a neighbouring authority asked us to make 21st birthday badges for them and recently we have been completing a large order for a church rebuilding fund on Speyside and a rural 'Knockout' in a Grampian village. To date we have produced over 2600 assorted badges and keyrings.

We, the children and myself, for we are very much a team, have had to advance our skills in order to offer a better and more varied service. We have started to look at the possibilities of using clip art much more for quality pictures. I am experimenting with the Canon ION camera, a video still camera, which enables photographs to be tranferred to the computer via a video digitiser. This would mean we could go to the customer with an extended service. We have looked at *Font FX*, a program which enables text to be printed around the perimeter of the badge, with shadow, upright or sloping. I do not think it will stop at this stage; something new will come along and we shall eagerly embrace it if it is of any use. The class are also about to get design instruction from an art specialist in order that they can produce a company name and logo. They are about to offer a customised school sports badge and monitor badge. We hope to get the marketing costs down still further by producing a quality customised badge which schools will find hard to refuse. Well, we can all dream . . .

This project has been enthusiastically received by both the school and the class involved. It is hoped that it will become a school project which the top juniors will take on board each year. The school aims to buy its own badge maker and computer, but I think they like the idea of the camera and scanner as well! My dream aim would be for us to earn enough money to acquire a VAT number!

The school and pupils are lucky to have the regional computer centre on site for it has enabled them to have access to a wide range of expensive equipment not normally available. They have not had to buy software because they are covered by the site licence. However they have shown that they are capable of using advanced technology and could use it if it were available in our primary schools.

The project has become truly cross curricular

Some thoughts on assessing IT

Bill Urwin
Advisory Teacher for IT, Somerset

At a recent INSET session on Assessing IT Capability, a teacher posed the question, 'What level of IT Capability do teachers need before they can assess the IT Capability of their children?' The question raised a laugh from the group of teachers there but the laughter had a nervous edge to it. For those of us there as Advisory Teachers, it was a question we had raised ourselves many times over the past year. During that year, schools have been charged with recording the IT experiences of the children in their care, so that teacher assessment can take place based on something more than guesswork. At the beginning of the year we did not feel unduly worried, as the Technology SATs would be there to give an assessment where nothing else existed. As this year has progressed, and the importance of SATs has seemingly slipped lower and lower down the totem pole, our fears for those teachers who are not very IT capable have grown proportionately.

Within Somerset we have tried to give guidance to teachers as to how they recognise IT Capability in the first place, how children get better at it and how the teacher records and assesses it. Though I do not have the space within this article to go into everything we have produced, I hope to give a helpful thumbnail sketch which will enable those teachers who are not very IT capable themselves to get a clearer picture of the task required of them and how they might set about it.

At the heart of IT Capability lies the idea of pupil autonomy. The goal is a child who, in a given situation, considers the possible choices. If an IT solution is the best way forward, the child chooses the relevant software/hardware, completes the task and is able to justify why she/he chose to do it that way. This goal will not be fully achieved by many children until late in their secondary school careers if at all. Primary schools have the task of preparing the ground and setting up the rules so that the goal is possible. This does mean integrated planning for IT experiences and it does mean having clear strategies for dealing with the inevitable technical and organisational problems which will occur. Where I have seen these conditions occurring, the rate of progress of the children is astounding.

To teachers unfamiliar with IT, the statutory orders can be quite daunting. Strange new words and phrases are common and getting an overview is difficult. In Somerset, we have tried to collate and in some cases interpret the statements so that teachers can get a clearer picture of what IT Capability is. As a rough rule of thumb, when assessing the level of an activity, the following guide is useful.

Level One activities are where the child is merely responding to things on screen. Most early maths and language games fall into this category.

Level Two implies that a child should be using a program which allows some kind of creative activity to take place eg writing, producing a tune or a picture.

Level Three implies the ability to store, retrieve and manipulate the writing, tune or picture.

Levels above this generally show an increase in the sophistication of use. One important point to arise from this regards the use of simple little programs which give practice in discrete skills. There is a danger in allowing their usefulness in enabling children to explore areas in other subjects, which might be at Level Two, Three or above, to mask the fact that they will only ever allow attainment at Level One for IT Capability.

The pull-out section on the two centre pages overleaf is an attempt to give some contextual exemplars for the statements of attainment. The activities outlined are those which a child might typically be involved in to achieve a specific Attainment Target. The activities cover the five strands of IT. They are related to BBC or Archimedes software but could be translated to fit other microworlds. Since showing this section to Phil Moore at NCET and receiving his comments, we have also produced similar sheets for Mathematics, English and Science contexts. Hopefully, these sheets will help teachers to see what IT Capability looks like in a classroom setting and what is meant by progression within a strand.

EXEMPLAR CRITERIA FOR IT STATEMENTS OF ATTAINMENT - KEY STAGES 1 AND 2

LEVEL	COMMUNICATING INFORMATION **CI**	HANDLING INFORMATION **HI**	MODELLING **M**	MEASUREMENT AND CONTROL **CT**	APPLICATIONS AND EFFECTS **AP**
	Pupils should be able to:	Pupils should be able to:	Pupils should be able to:	Pupils should be able to:	Pupils should be able to:
1	operate the keyboard, Touch Screen, switch, mouse or concept keyboard to use an appropriate program which is already loaded.	operate the keyboard, Touch Screen, switch, mouse or concept keyboard to use an appropriate program which is already loaded.		demonstrate their understanding of cause and effect in the control of everyday equipment eg. "If I press this switch on the TV it will change the channel."	
2	use either a word-processor eg. Stylus, with or without a Concept Keyboard an art program eg. Flare or a music program eg. Compose or Hybrid software, to produce a sequence of letters, words, pictures, sounds, or symbols which convey meaning.	create a piece of work, on the computer, save it and retrieve it.			
3	to build on work at level two, with the addition of simple amendments to their original and the production of a further draft, eg. presentation of a first and amended draft of a piece of writing where spelling and punctuation may have been amended and words added or deleted.	collect information in a form which is appropriate to be entered into a database structure which has already been prepared. Be able to select and retrieve (output) from this information eg. searching the information to find a specific record.		use a sequence of instructions to control the movement of an object or person eg. Roamer, Pip, turtle, screen turtle or a friend.	communicate their understanding of the differences between using IT and other methods eg. using a word processor with a concept keyboard as opposed to handwriting ; comment on the ease with which work can be altered using a word processor or a graph printed out from data in a database.

4	demonstrate their further development from level three by making substantial revisions to the original eg. use the power of the word processor to restructure a piece of work by block moving sections of the text to clarify the meaning and heighten the impact. Create a finished product which utilises the design features of the package to improve the layout, fonts, underline etc. or: use an art package and develop part of the original to produce further designs which may include changes to the size, orientation, colour and pattern of the original.	demonstrate their development from level three by their ability to: add further information to an existing database; check the accuracy of existing information and amend it if necessary; use the database for their own enquiries framing appropriate questions; understand that the validity of information in a database depends on the accurate entry of data.	recognise patterns and rules which govern a computer program eg. using a Logo procedure for drawing a square, recognise which value within the procedure needs to be changed to alter the size of the square. or: use simulations such as Eureka, Bounce, or Mary Rose to explore and identify the rules which govern them.	write a procedure for a specific purpose, which contains a sequence of commands to control movement of a turtle, Roamer, Pip, screen turtle or device connected to a buffer-box.	give examples from their own experience of how computers are used in everyday life eg. using a computer database in the library or bookshop to check on the availability of a book; a concept overlay cash register at a fast food checkout; a bank cash dispenser and robots on TV car adverts.
5	demonstrate their further development from level four by showing a greater awareness of the purpose of the presentation and the audience for which it is intended. eg. write a story for younger children; use a DTP package to produce a Christmas card.	independently create a database which can be used effectively by themselves or others. This will include identification of the questions likely to be asked of the database and the data required to answer those questions.	demonstrate their development from level four by using their understanding of the rules governing the model to form and test predicted outcomes and simple hypotheses eg. modify variables in a Logo procedure to produce a desired effect.	write a procedure which contains a series of commands to control the above range of devices, having specified beforehand the sequence to be carried out eg. a procedure to draw a pentagon in Logo or to simulate a set of traffic lights using Contact.	discuss the implications for the use of IT in a range of applications involving personal information eg. Census records, doctor's records etc.

The task faced by most teachers in coming to terms with assessing IT in classrooms, within the timescale imposed upon them and with often meagre resources, is enormous. My advice to those in despair is to identify where they are now, then take small, achievable steps towards where they need to be. Above all, shout for help. Most authorities have Advisory Teachers for IT who are there to help you make those steps. If yours hasn't, perhaps you could write direct to SEAC. . . .

Those wishing further information on the Somerset Primary Guidelines for IT should contact Allen Coe, County IT Inspector, County Hall, Taunton, Somerset.

with art and design, maths and language work taking prominent places. Perhaps the most important factor is that these subjects have all become very real and exciting. To the Riverside pupils the world of work and school is seen as one through technology.

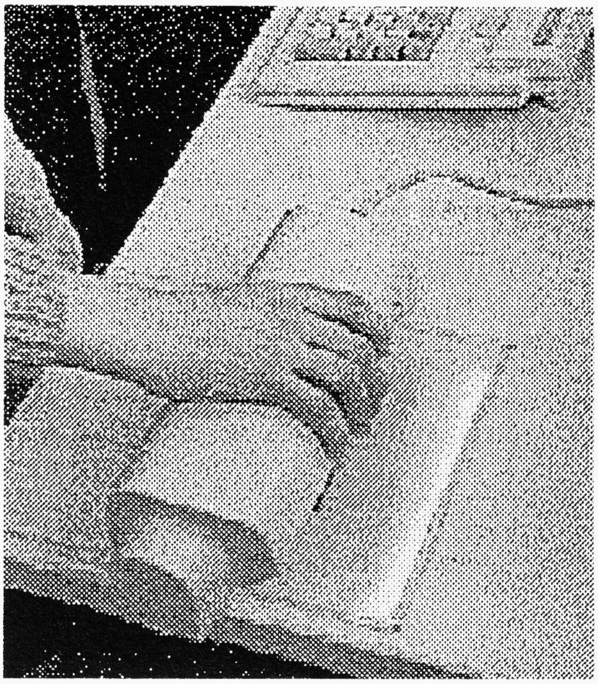


Figure 3 *Using the scanner from Computer Concepts.*

Figure 4 *Discussing the quality of scanned objects.*

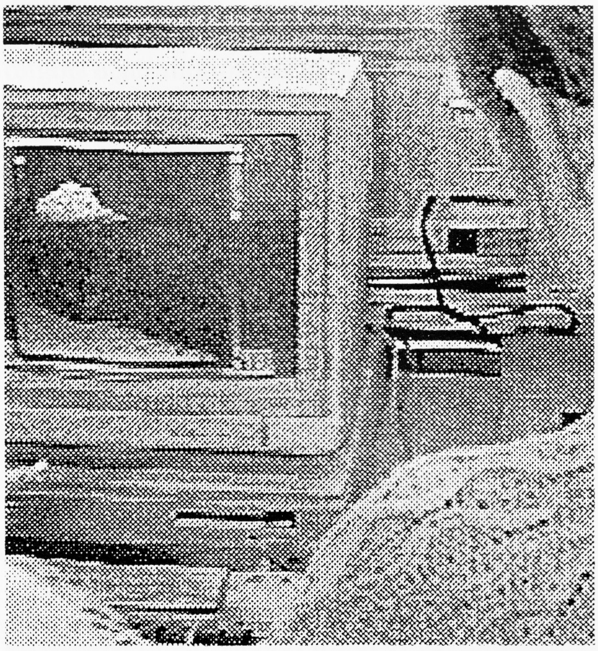


Figure 5 *Scanning a blazer badge – it is just starting to show on screen.*

Figure 6 *Learning to use 'paint' to colour up scanned images.*

Microtec Control:

a refreshingly simple approach to Control Technology

Andrea Woodward
Clock House Junior School, Bradford

An article describing an ambitious Year 6 project, linking 'Jinks' type technology to computer control. The project was made possible by the use of a novel control system from Calsystems.

In a technological world, 'control' forms an essential part of our everyday lives from the first bleep of the digital alarm clock as we awake, centrally heated, in the morning, to the last flick of the reading lamp switch as we go to bed at night, safe in the knowledge that the clothes in the tumble drier will be dry by morning and the video is taking care of the last half of the film that we've only seen twice before! Yes – we all, now, take control of our environment without conscious thought and without too much stress.

Control and the National Curriculum

It is not surprising, therefore, that the National Curriculum Orders for Technology place such a high degree of emphasis on control and its associated activities. In the Attainment Targets and Programmes of Study for Technology and Information Technology within Key Stages 1 and 2, control is mentioned no fewer than 20 times and the very first sentence of the Programmes of Study for the IT component, Key Stage 1 (ages 5–7!), stresses the development of pupils' awareness of control in our everyday lives.

In a balanced primary curriculum, we should, therefore, be introducing control technology at an early age and this is certainly reflected by the many computer control systems available to schools. So why is this not happening?

Beginners beware!

As a total beginner to control technology and a fairly reluctant computer user in general, I was lucky (or unlucky!) enough to experiment with three different control systems including one based on Logo, (. . . sorry all you logophiles out there . . .) at my local teachers' centre. I found all three systems frustrating to use and I began to feel that there was no system suitable for use with the wide range of ages, abilities and cultural backgrounds of the pupils found in most primary schools. I believe that the main reason for this is that the design of most systems is fundamentally flawed. A good teacher would hardly begin teaching mathematics by looking at Calculus. Similarly, it would seem ridiculous to plan the same lesson for delivery to both Year 1 and Year 6. No – a good teacher introduces all aspects of the curriculum in a simple way, progressing gradually as individual pupils gain experience and their understanding and interest grow.

Unfortunately this logic has not been applied to the design of the control packages which I tried out, with most systems containing a single piece of software to be used by Year 1 and Year 6 alike. Even worse, all three systems began with some kind of programming language which was often more difficult to use than the simple control problem that I was trying to solve. To me, this made no sense at all.

Discovering Microtec

All forms of environmental control in real life attempt to mimic the human sensor (sight, sound, touch, taste and smell) and motor (muscles) system, and the co-ordination of that system in early childhood is a simple learning experience relying on correction and feedback from our senses, mainly those of touch and sight. Babies manage to learn readily the most complex of control problems – throwing a spoon with incredible accuracy to just miss the high chair tray but accurately find the new carpet! They manage this without recourse to language – that comes much later.

Those of you who were able to attend the presentation of Microtec Control by Joe Kellett at the MAPE National Conference at Jordanhill College will have seen a control system which is different – very different – and the reason, I suspect, is that it has been designed by an experienced teacher, not a software engineer. The emphasis with Microtec Control by Calsystems is 'simplicity', and the whole package is based on sound educational principles with a very large helping of practical common sense.

Complete 'simplicity'

The interface is 'simple', with six output lines, four of which can be on/off or pulsed, and two of which are permanently reversible for motor control. It has sensible electronic protection to allow pupils the freedom to experiment with wiring without risk to the control pack or to the computer. Connections are made via two inexpensive multi-plugs so the many wires necessary for complex simulation models don't have to be separately reconnected every time the interface is used or the model changed. The two analogue inputs use a separate lead and are colour coded for clarity. Light and temperature sensors are provided in the pack and their basic design allows even the most inexperienced teacher to copy them cheaply. The power supply delivers 2 amps of power from a safe 'plug in' type unit and both the interface and power supply come with longer than average cables so you don't have to work right on top of the computer. The whole package is housed in a tough plastic A4 case which can stand up to the rigours of shared usage and the User Guide is written in plain English without recourse to the usual incomprehensible computer jargon which accompanies most such packs. It is photo-copyright free and packed with practical advice and examples, many of which are resident on the software disc. As a reluctant and relatively inexperienced computer user, all these things appealed to me – I can live with simplicity!

Figure 1 *The Microtec Control System: simple enough for beginners like me!*

Multi-level software

It is, however, the software itself which sets Microtec apart from most other systems. Microtec is not a single piece of control software but instead a suite of four different levels of control starting with a simple and amazingly effective 'non-language'-based control system and progressing logically through to more sophisticated levels of control. Each level leads smoothly into the next and the pupils always use whatever they have previously learned as they progress to the next higher level of control. Now those principles are educationally sound and offer the possibilities of the enjoyment experienced in computer control to pupils of a wide range of differing ages and abilities as well as to the average primary teacher!

MICROTEC turns conventional control thinking on its head

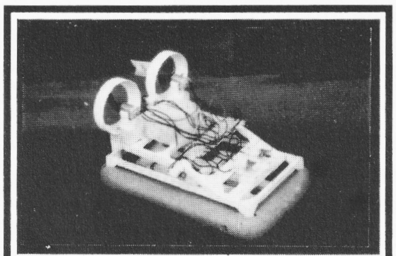
The particularly new and impressive Level 2 – Memory Control turns conventional control thinking on its head. It is a learning system, based, I suspect, on industrial robots which are led though complex control problems and learn by their mistakes. At this level, even pupils of limited ability are able to produce accurate and complex control sequences which rarely need correction. When their efforts are saved to disc, they can be loaded into the higher levels of control and the Microtec software then translates what they have done into a written control language. Microtec has approached the problem of control by working in the reverse way to most other systems and the logic of this approach is only too apparent when you begin to use the kit in the primary classroom.

I was confident that even the most complex control problems could be tackled easily by my Year 6 pupils using Microtec. I therefore took advantage of the Calsystems' generous discount to MAPE members on their control package (Joe Kellett, the designer, is himself a MAPE member). We were then able to spend much more time in the planning, organisation, development and making of the models associated with their project on control.

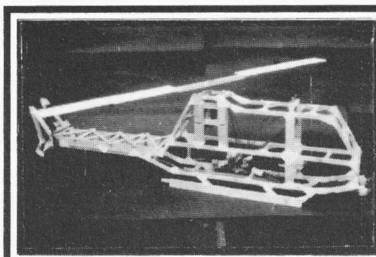
We started by looking at models made with either Lego or Fischer Technic. These were connected up to the Microtec interface – it is compatible with most construction systems. The example models served to stimulate the pupils' own ideas and gave them a chance to familiarise themselves with the control software. The pupils were then split up into small groups and they

A SELECTION OF SOME OF THE CONTROL MODELS

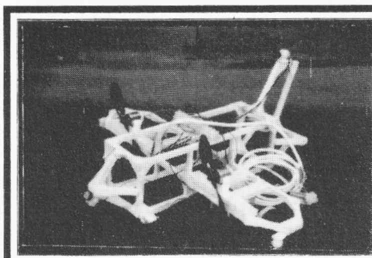
THE WHOLE PROJECT TOOK OVER 3 MONTHS, WORKING AROUND TWO HOURS A WEEK BUT COVERED MANY OF THE STATEMENTS OF ATTAINMENT, LEVEL 2, FOR TECHNOLOGY IN THE NATIONAL CURRICULUM.



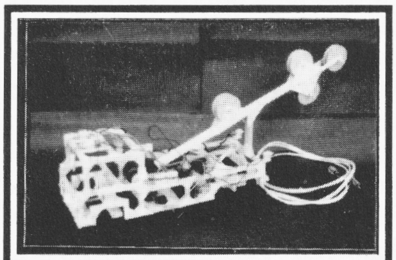
HOVERCRAFT



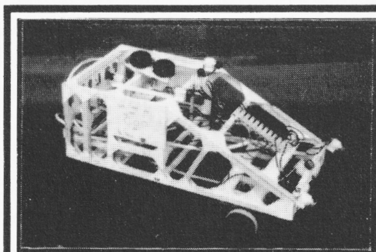
HELICOPTER



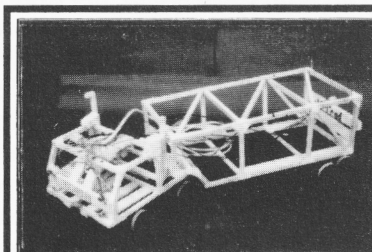
AEROPLANE



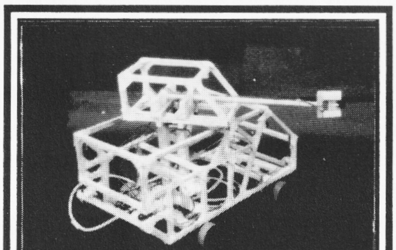
BREAKDOWN TRUCK



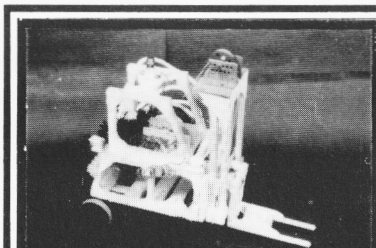
POLICE CAR



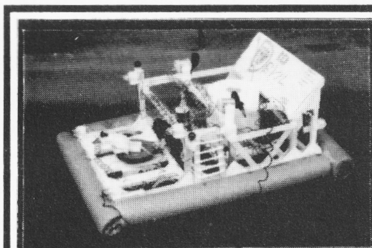
ARTICULATED LORRY



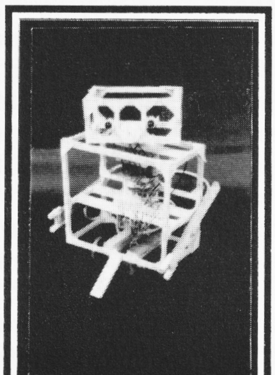
TANK



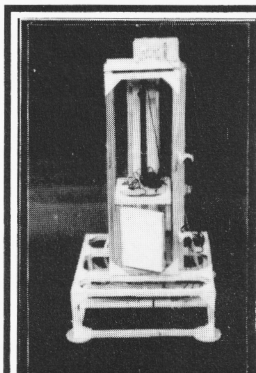
FORK-LIFT TRUCK



FIRE PATROL



ROBOT



LIFT

Figure 2

began to generate their own ideas of what type of models would lend themselves to control technology. At this point all the pupils were asked briefly to outline design proposals for the model they wanted to make. This was done mainly through sketches. Each pupil then presented his idea to the group and they voted for the design that they felt was the most interesting and the most achievable. Final choices included: aeroplane, helicopter, fork-lift truck, tank, fire engine, hovercraft, robot, lift and breakdown truck. The models were to be made using 'Jinks' type construction and then powered by compact motor/gearbox units, bulbs, buzzers etc. These components are also available in a separate output pack from Calsystems.

Having decided on the final model, the group then made scale drawings to use as cutting templates. The various tasks were divided among members of the group and construction began. The basic method of construction was the same for all models. Two identical (almost!) side frames were made by first tacking them together with low temperature glue guns and then strength was given by securing all joints with card triangles and PVA glue. Cross pieces, all cut to the same length, were then used to hold the two sides together and other details were added. The electrical components (motor/gear-boxes, bulbs, buzzers, motors with propellers etc) were then attached by either screwing them to double-width wood or glue gunning them in place. A 12-way terminal block was strategically placed somewhere on the model and the wires from all the components were connected back to that block. The planning sheets supplied with the Microtec pack were used to plan connections

Figure 3 *Thoughtful planning and good electrical components brings Jinks technology to life.*

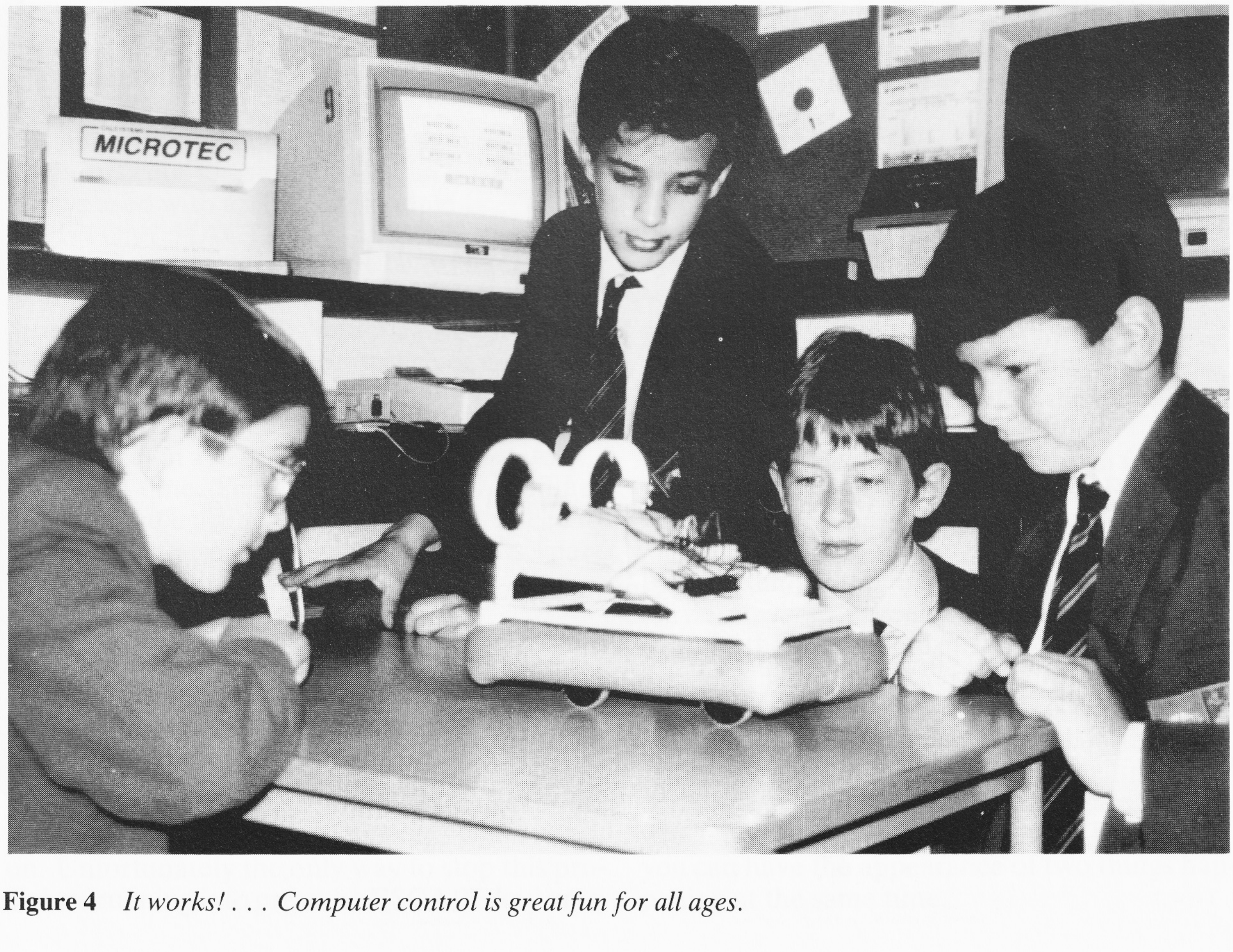


Figure 4 *It works! . . . Computer control is great fun for all ages.*

and having decided which output lines were to power the various components, the final wiring from the model to the connecting plugs was made using colour coded multi-core cable. The finished models were tested using Microtec Level 1 – Direct Control and the inevitable short circuits etc were discovered and rectified. Since all groups reached their final stages of construction at different times, the computer time did not have to be rationed and since all levels of Microtec Control are self-contained (the disc does not have to be left in place once a control level is loaded), we were able to use three BBC computers with the single control disc.

Microtec – very popular with the pupils

Microtec proved very popular with the pupils and they all found the software very easy to use. Depending upon the type of model, all four levels of control were used and I was quite amazed by the sophistication of the finished control sequences. Indeed, the project was so successful that we finished by inviting the children's parents in to see the final models being powered and controlled by computer.

I hope that the photographs give some idea of the overall standard of construction. What they can't show is the sheer joy experienced by all those involved as they saw their own ideas come together and their own models actually move under the control of the computer. Computer control certainly captures the imagination of pupils of all ages and I can thoroughly recommend Microtec to all primary teachers, especially those, who, like me, are not very confident with the computer and are newcomers to the fun of control technology.

Discounts for MAPE members

Microtec control is available through the NES/Arnold catalogue or can be ordered direct from Calsystems Ltd, FREEPOST LS2357, Pudsey, West Yorkshire, LS28 7YY. Tel. (0532) 562924.

When ordered direct from Calsystems, MAPE members receive a 20 per cent discount on all their products. Microtec is currently available for the BBC B, B+ and Master 128 range of computers but I understand that they are at present versioning for Archimedes/A3000, RM Nimbus and IBM compatible PCs.

Hard sums with *Contact*

Keith Hemsley
NCET

Contact was designed as a low-cost, easy-to-use control program for younger children. Although not as powerful as Control Logo, on which it is based, *Contact* will allow fairly sophisticated control programs to be created and run. The manual, which comes with the program, is a step-by-step introduction to the features of *Contact* and does not attempt to provide answers to all the control problems which may arise from classroom projects. Indeed, it would run contrary to the open-ended nature of *Contact* to provide prescriptive solutions to problems.

However, I have been aware through using *Contact* in INSET that a number of questions arise repeatedly and I have come to the conclusion that it would be useful to provide some sample solutions to those problems.

NB. From here onwards I am assuming the reader has used *Contact* and has some insight into the questions posed.

Why doesn't INPUTON? work for me?

It is important to understand how INPUTON? works in order to use it. First of all it is almost always used with an IF; for example IF INPUTON? 5 [ACTION] . . . in this case the procedure ACTION will only be called if the switch in input 5 is 'on' when it is checked. The problem most people have is making sure that *Contact* is checking the occurrence of an event when the event occurs.

Think of INPUTON? as a 'sniff'. Like a sniff it is centred on a particular sensor and lasts for a very short time. The trick is to keep on sniffing until you catch the aroma. To do this you need to write a procedure which constantly checks a particular input.

eg
TO SNIFF
IF INPUTON? 5 [PRINT "switch pressed"]
(print a message if the switch is pressed)
SNIFF (run the procedure again)

This is a recursive procedure which constantly checks input 5 and prints a message when it is on. Unfortunately the only way to stop this procedure running is to press the ESCAPE key or to add an extra line to make the procedure stop running.

eg
TO SNIFF
IF INPUTON? 5 [PRINT "switch pressed"]
(print a message if the switch is pressed)
IF INPUTON? 3 [STOP]
(stop SNIFF if the switch is pressed)
SNIFF (run the procedure again)

How can I make *Contact* run two procedures at the same time?

The short answer is that you can't. The BBC micro is only capable of doing one task at a time. However you can make your procedures look as though more than one thing is happening at the same time.

You have built a level crossing barrier. When a train approaches a procedure, FLASH flashes the barrier lights for 10 seconds and then the barrier lowers.

TO BARRIER
REPEAT 10 (call FLASH 10 times)
FLASH
END
LOWER

TO LOWER
SWITCHON 3
(start the motor which lowers the barrier)
WAIT 60
(wait for 6 seconds – the time taken for the barrier to lower)
SWITCHOFF 3 (stop the motor)

In this example the lights flash first and the barrier lowers afterwards. To understand how to make them appear to operate at the same time first look carefully at the procedure LOWER: apart from when output 3 is switched on and off (accounting for a few microseconds) the procedure is actually doing nothing but waiting for 6 seconds to pass. If you substitute an action which takes 6 seconds for the 'WAIT 60' then you can have the appearance of two things happening at the same time.

In the barrier example this would be:

TO LOWER
SWITCHON 3
REPEAT 6
(calling FLASH 6 times takes 6 seconds)
FLASH
END
SWITCHOFF 3

How do I make *Contact* count events?

An 'event' in this case is anything that happens to complete a circuit; ie some type of switch such as a pressure pad, a light switch, a magnetic switch or a simple contact switch like two drawing pins touching together. If the switch is connected to an input on the control interface then *Contact* can be programmed to recognise when the switch is pressed.

The following procedures will count the number of times a switch connected to input 4 is pressed.

TO GO
MAKE PRESSES=0
(give a variable 'PRESSES' a value of 0)
ADDUP (call the procedure ADDUP)
HOOT
PRINT "Ten events counted"

TO ADDUP
IF PRESSES=10 [STOP]
(stop ADDUP when 10 events have been counted)
WAIT UNTIL INPUTON? 4
(wait until switch 4 is pressed)
WAIT UNTIL INPUTOFF? 4
(wait until switch 4 is 'unpressed')
MAKE PRESSES 1 MORE
(add 1 to the value of PRESSES)
ADDUP

How can I use WAIT UNTIL to check more than one input?

WAIT UNTIL is very useful in a basic 'story' type of program where a number of events happen in a predetermined sequence. For example the following procedure might control a series of actions to open a castle drawbridge which is triggered to lower by a pressure pad and to raise when a light beam is broken.

TO CASTLE
WAIT UNTIL INPUTON? 2
(wait until someone treads on a pressure pad)
LOWER
(lower the drawbridge)
WAIT UNTIL INPUTOFF? 6
(wait until they have crossed the drawbridge)
RAISE (raise the drawbridge)

However WAIT UNTIL creates problems if you want to check more than one input. The solution is to write your own WAIT UNTIL procedure which checks more than one input.

TO WAITIL
IF INPUTON? 2 OR INPUTON? 3 OR INPUTOFF? 6 [STOP]
WAITIL

WAITIL is a recursive procedure which keeps running until either input 2 or input 3 is on or input 6 is off.

How can I make *Contact* 'remember' that a switch has been pressed?

This might arise if you were trying to convert a traffic-light procedure to incorporate a pedestrian crossing. The two major problems are, firstly, how to maintain a check on the crossing button at the same time as operating the traffic light sequence and secondly, how to record the pressing of the button so that the pedestrians can be directed to cross when the lights are on red. The original traffic-light sequence might look like this:

TO TRAFFIC
SWITCHON 1 (switch on the red light)
WAIT 100 (wait 10 seconds)
SWITCHON 2 (switch on the amber light)
WAIT 50 (wait 5 seconds)
SWITCHOFF 1 2 (switch off red and amber)
SWITCHON 3 (switch on green)
WAIT 100 (wait 10 seconds)
SWITCHOFF 3 (switch off green)
TRAFFIC (call TRAFFIC again)

Apart from a few microseconds when lights are switched on and off most of this procedure consists of waiting for time to pass. As with the barrier example above, replace the WAIT 50 with a procedure which checks the crossing button input for 5 seconds and creates a marker when the button has been pressed.

In the example below output 8 is used as a marker:

TO TRAFFIC
SWITCHON 1 (switch on the red light)
IF OUTPUTON? 8 [CROSS]
(if output 8 [the marker] is on, call a crossing procedure)
CHECK
CHECK (two CHECKS = wait 10 seconds)

SWITCHON 2 (switch on the amber light)
CHECK (wait 5 seconds)
SWITCHOFF 1 2 (switch off red and amber)
SWITCHON 3 (switch on green)
CHECK
CHECK (wait 10 seconds)
SWITCHOFF 3 (switch off green)
TRAFFIC (call TRAFFIC again)

TO CHECK
REPEAT 30
IF INPUTON? 2 [SWITCHON 8]
(if the button is pressed switch on the marker)
END

TO CROSS
SWITCHON 4 (switch on the 'green man . . .')
WAIT 100 (. . . for 10 seconds)
REPEAT 20
SWITCHON 4 5 (flash the 'green man' and sound a buzzer 20 times)
WAIT 3
SWITCHOFF 4 5
WAIT 3
END
SWITCHOFF 8 (switch off the marker)

If you do not have a spare output to use as a marker then you can change the value of a variable instead. For example in the following version of the traffic light problem the procedure GO creates a variable called BUTTON with a value of 0 and then calls TRAFFIC. When the crossing button is pressed CHECK makes BUTTON equal to 1.

TO GO
MAKE BUTTON =0
TRAFFIC

TO CHECK
REPEAT 30
IF INPUTON? 2 [MAKE BUTTON = 1]
END

TO TRAFFIC
SWITCHON 1 (switch on the red light)
IF BUTTON =1 [CROSS]
(if the value of BUTTON is 1 call a crossing procedure)
CHECK
CHECK (two CHECKS = wait 10 seconds)
SWITCHON 2 (switch on the amber light)
CHECK (wait 5 seconds)
SWITCHOFF 1 2 (switch off red and amber)
SWITCHON 3 (switch on green)
CHECK
CHECK (wait 10 seconds)
SWITCHOFF 3 (switch off green)
TRAFFIC (call TRAFFIC again)

TO CROSS
REPEAT 30
SWITCHON 4 (switch on the 'green man . . .')
WAIT 100 (. . . for 10 seconds)
REPEAT 20
SWITCHON 4 5 (flash the 'green man' and sound a buzzer 20 times)
WAIT 3
SWITCHOFF 4 5
WAIT 3
END
MAKE BUTTON = 0

Can I control motor speed with *Contact*?

Yes, if you have a BBC Master and *Contact version 3.5*. A new command, ***POWER** has been added which allows the output of power to be pulsed at different rates. Also included in the new version is a method of converting procedures written in *Contact* into a code which will run much more quickly on the BBC Master. *Contact 3.5* will run on a BBC B but will not support the ***POWER** command.

Is *Contact* available for the Archimedes?

Not yet but we're working on it! An enhanced version of *Contact* (*!Contact*) will form half of a new control package for the Archimedes, called 'Touch and Go'. This will be available early next year. It will have a similar look to *Contact* but with extra facilities including automatic counting and graphing of inputs, renaming and copying of procedures and the facility to create procedures in direct mode by using the mouse.

The other half of 'Touch and Go' is the data-logging program *!Prism*. The whole package will be RISC OS compatible, enabling the children to control models or log data at the same time as they are also using the machine for another application such as word processing. An important feature of 'Touch and Go' is that both *!Contact* and *!Prism* will communicate with each other, allowing complex interactions between control and data-logging.

Although this article has addressed some of the more awkward problems that teachers may meet which working in this area, *Contact* also offers a very simple introduction to control technology. NCET produce a pack of support materials entitled 'Primary Technology – The Place of Computer Control' which provides all the information necessary to get started. Included in the pack is the *Contact* software (for BBC B or Master). It will require a standard

8 input/output control interface (buffer box). The pack costs £27.50 and is available from NCET Publications, Sir William Lyons Road, University of Warwick Science Park, Coventry CV4 7EZ.

Two booklets from the pack are available separately from the same address: *Techniques for Technology* (£5.95) and *Programming for Control* (£4.95).

The *Contact* software can be purchased separately. In the first instance, check with your county IT team to see if they sell it at a subsidised rate. If not, it can be bought from Resource, Exeter Grove, Doncaster DN2 4PY. For details of version 3.5 with power control, contact NCET.

There are various buffer boxes on the market. In the first instance it is probably wise to ask your county IT team for their recommendation. NCET will also give advice.

If you are using the Nimbus for control work, a suitable alternative to *Contact* is *Controller*, also available from NCET.

Softlab and the Nimbus

Colin Watkins
Research Machines

The 'Watkins' view of primary science says that there are two very basic activities which form the extremes of what science is all about.

At one end of the spectrum is '**making things happen**'. This covers activities such as model making, experimenting, and – to bring it closer to what this item is all about – control.

The other end of the spectrum is '**observing**'. This covers activities such as collecting, recording, classifying, interpreting and displaying data.

So far in the IT world, computers in primary schools have veered towards the 'making things happen' end of the spectrum. The traditional 'control' activity might be constructing a model of a lighthouse, connecting it to a computer through some sort of interface device, and writing a simple program using something like *Controller* from NCET which then flashes the light in a fixed sequence.

Now this activity is educationally very powerful, but it is heavily biased towards 'making things happen'. We need to balance this out with activities which show computers being used for 'observing'. The major problem is that there isn't much software available which supports such activities. Those packages that do exist have usually been written by manufacturers of a particular device, and are often not as easy to use as one would like!

Well, now all that is going to change!

A package called *Softlab* written at Homerton College by a group led by Angela McFarlane, sponsored by Research Machines and funded by NCET is going to persuade people that **data logging** is where it's at!

Data logging, as the name suggests, is where the computer is used to collect information from the outside world. However it doesn't stop there. *Softlab* can be used to collate and display this information in a way that makes it easier to interpret. It can also be used to perform simple control functions in response to the data collected. But more of that later; first a brief description.

Softlab was conceived to be:

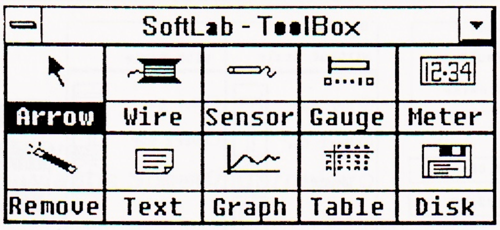
easy to use
graphically based
able to integrate to other packages
mouse driven.

Those of you who have read the sales information from Research Machines will recognise that these are the things that RM have been saying about Microsoft *Windows* since the launch of the Nimbus. So the first point about *Softlab* is that it's a *Windows* program. This means that you need a hard-disc-based machine or a network station to run it on. With the current price of hard-disc-based Nimbuses this is not too much of a problem, but if you want to run it on an older Nimbus, make sure it has a hard disc.

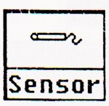
Softlab was also designed to use a number of different interfaces. Data logging requires something more sophisticated than the basic switching control interfaces that have traditionally been used in the past. The new type of data logging interfaces are connected to the computer through the serial port, so there is no extra hardware required when they are used with the Nimbus. NCET themselves have been working very hard to develop the 'Sense & Control' interface. *Softlab* supports this and the LogIt interface developed by DCP Microdevelopments and available from Griffin & George. *Softlab* can use the advanced features of these interfaces to interrogate them and find out what devices are actually plugged in.

Softlab is flexible enough to be able to use drivers for other interfaces, so it can be developed as new interfaces become available.

When you run *Softlab* it presents you with a clear 'benchtop' area and a box of tools.



It is up to the user which tools are used and how they are located on the screen. The tools are selected by the classic *Windows* 'point and click' system, and are then dragged to whatever location the user wishes. The tools are as follows:



Sensor

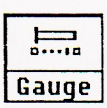
When this is selected *Softlab* looks to see which interface is selected and which sensor is currently plugged in. This is all automatic – the user doesn't need to know what the sensor is! *Softlab* then labels the sensor icon with the type of sensor (eg Light, Heat, etc).

If *Softlab* cannot identify the interface, it lists all the interfaces it knows about and asks the user which type of interface is connected and what type of sensor is attached to that interface.

The user could select a demonstration mode if there is no interface available. This will feed sample data into whatever system is set up on the benchtop.

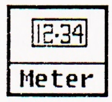
Arrow

Selects the pointing device which is used to control the package.



Gauge

Creates an icon which can be expanded to show a gauge. The gauge can then be 'customised' in all sorts of weird and wonderful ways. It could for example be configured as a vertical bar, a horizontal bar or a traditional gauge with a pointer. The key item is the calibration of the gauge.



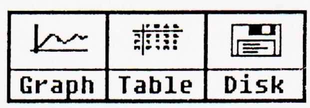
Meter

Creates an icon which can be blown up to show a digital meter which can be configured to show a set number of digits.

Gauge and meter form the main ways of showing data directly on the screen. They can for example show temperature in a large display for the whole class to see!

However to make this happen the output from the temperature sensor has to be connected to the meter or gauge. The concept used in *Softlab* will be well understood by most people. It actually has a tool marked 'WIRE'! When it is selected it offers the user an almost unlimited spool of wire with which to connect the various tools on the benchtop. Once a temperature gauge has been 'wired' to a gauge the *Softlab* can be switched on and the temperature will be shown continuously on the gauge. It is so simple it is actually fun!

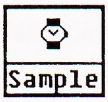
Data logging is not just about showing temperature in real time. The data needs to be made available in other forms. The 'DISC, TABLE and GRAPH' tools



can be used to store or display the data directly. Seeing a graph of data being drawn in real time on the screen really helps the user to connect the event to the graph. These tools can be used simultaneously. It is possible to graph temperature changes on screen at the same time as saving the same data to disc.

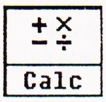
Other tools allow the user to delete an item from the benchtop and to type text onto the benchtop which could be simple instructions or explanations. The benchtop can then be saved away for future use. Therefore it is possible to create a number of benchtops which students can use as worksheets at a later stage.

So far I have described the standard set of tools. However there is an extended set which adds:



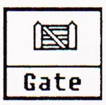
SAMPLE

This controls the number of readings and for how long the readings should be taken.



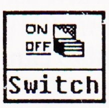
CALC

Allows the user to perform calculations on the data before it is displayed or stored. The conversions are done in real time.



GATE

Data is only allowed through a gate if it lies in a certain range. The user sets the 'working' range for the data.

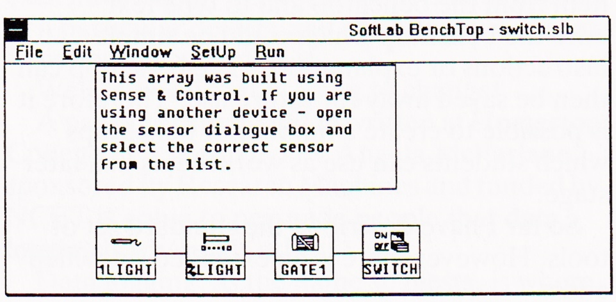


SWITCH

Operates one of four relays which may be on the interface. This could be used to switch on a fan if the temperature goes above a certain limit.

The following arrangement shows an experiment which is taking readings from a light sensor and displaying its output on a bar gauge. The output is then sent to a gate which only allows output to go further if it is below a certain limit. If output is passed on, it will cause the switch to go on. The switch will probably be connected to a light. To put it simply, the system will turn a bulb on if the light falls below a certain level.

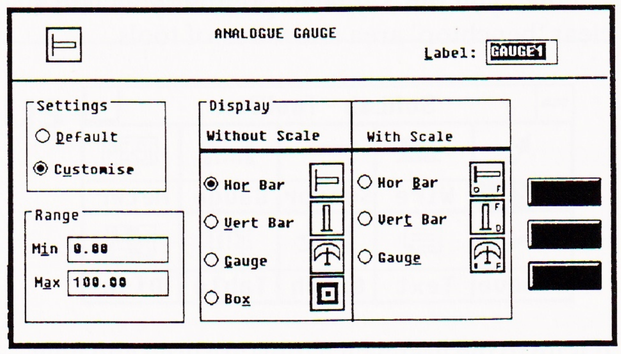
Now some of you might be saying that this was possible using the simple CONTROL systems mentioned above. However the new facility in *Softlab* is the ability to use varying (or analogue) data rather than simple ON/OFF data. The user can control how dark it must become before the



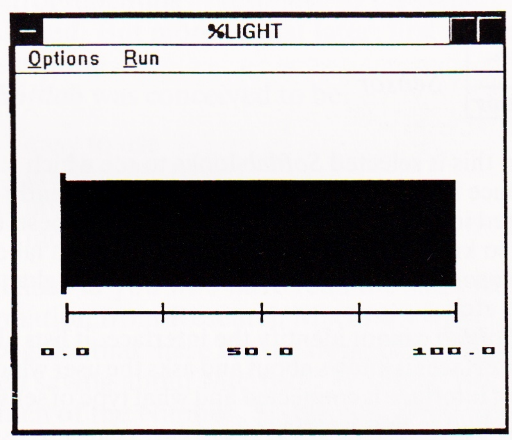
light goes on. A simple addition to the experiment would enable the user to log the changes in light levels over a period of time.

When a tool is placed on the benchtop, it is usually possible to configure that tool. By pointing and double checking, the configuration screen appears.

Items like GRAPH, GAUGE and METER can be configured by altering MAX and MIN readings and scaling.



When *Softlab* is run, the output (graph, meter etc) will be shown in a window on the screen. This window can be moved around or scaled as desired.



Downloading

Softlab has a mode which allows an experiment to be designed on the computer, but then downloaded into the data logging interface (if it supports such a mode) which can then be disconnected from the computer and run remotely. The data which has been collected can then be fed back into *Softlab* at a later stage for graphing, collating or printing.

Conclusion

So there we are! A piece of software which is easy to use, powerful, and which covers an area of science education which has not been adequately covered before. It runs on any Nimbus which has a hard disc, including the new NoteBook. So it will be possible to set up data logging experiments for use in the field.

It is not possible to describe *Softlab* adequately in words. You really have to try it out to see the full effect. So if you can, get someone to show it to you – I'm sure you will be impressed!

References

Softlab is available from NCET Publications, Sir William Lyons Road, University of Warwick Science Park, Coventry CV4 7EZ (contact Julie Bygate). The price is £77 for a single copy or £200 for a site licence (multi copy). Version 2 of *Softlab* will be available in January 1992 as a free upgrade and will be on view at BETT and the ASE Conference.

A new look at old bricks and mortar

H. Powers
Shawlands School, Barnsley

For the second half of the summer term, our topic was 'Castles'. As part of the topic, we visited Warwick Castle where we obtained a ground plan of the castle dated circa 1300. Back at school, the project got under way and we were well into it when we discovered *Designer Castles*. It hadn't been part of my initial planning and seemed like a topic in itself but it seemed such a pity to waste such an opportunity to integrate IT. Knowing we would be hard-pressed to get results by the end of term we gave it a go.

One good thing about *Designer Castles* was that for teachers such as myself, who don't feel very confident and lack time for thorough familiarisation in order to feel confident, this

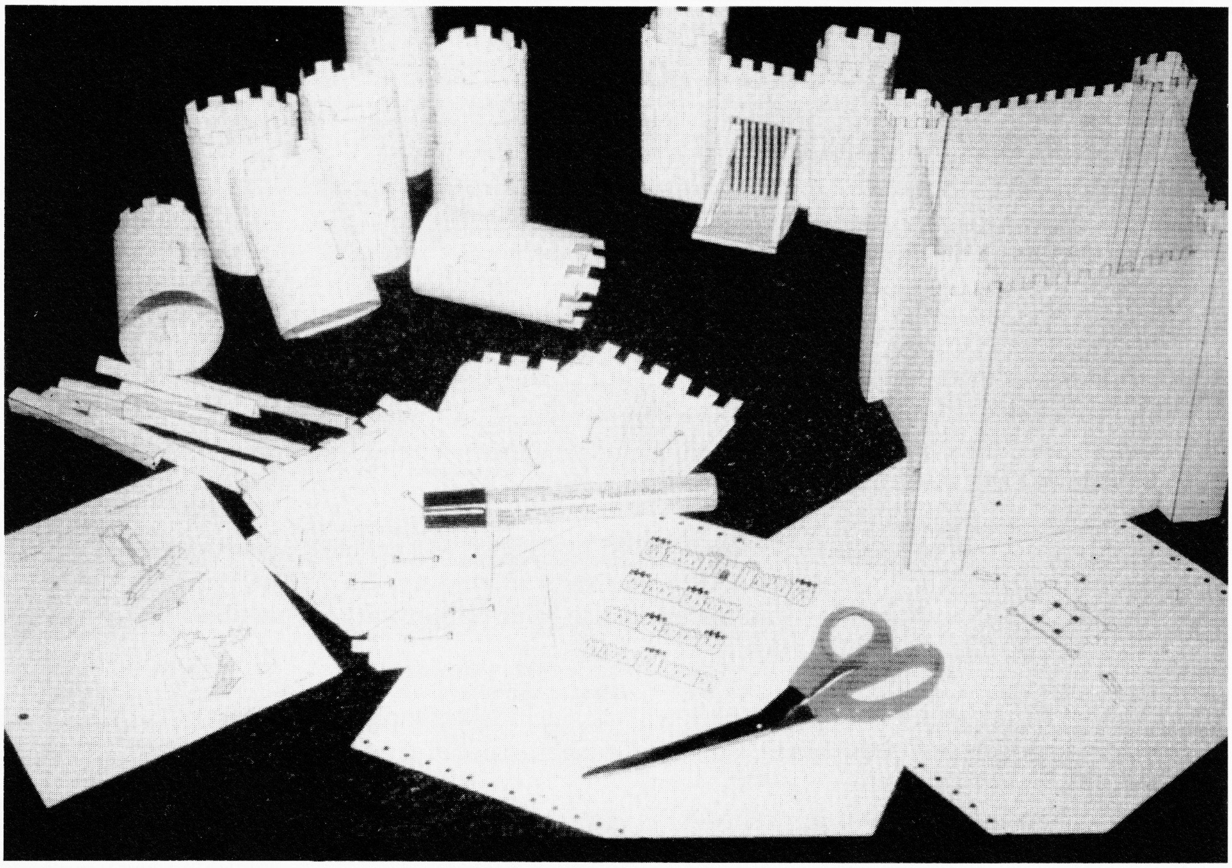


Figure 1 *From computer print-out to castle – it's a snip.*

program did not take over the topic but dovetailed neatly into the other activities.

The task of making the castle was made easier by splitting the class into groups, each group having a specific job to carry out. The ground plan of Warwick Castle was used by one group to work out a plan for the model. They recorded how many wall sections, square towers, round towers etc would be needed. Their results were passed to a group which generated the designs using the computer program. A third group cut these out when they had been printed and decorated them with painted stonework. The finished pieces were passed on to a construction group who made up the separate sections. One group had been working on a baseboard. They used papier maché and chicken wire to build the hill and form the moat. The group with the ground plan then arranged the sections in the correct order on the baseboard. With only one day to spare before the end of term we managed to complete the model.

The use of this program enabled the children to cover many areas of the National Curriculum. It facilitated collaborative working. Every member of the class felt that s/he was an important member of the team with a vital role to play. The children gained independence in organising their own groups and valuable skills in communicating and cooperating with the other groups. By the end of the activity they all felt a great sense of achievement. Not only could they take great pride in the product but they had all enjoyed the process.

Having seen the benefits of integrating this program, I intend to use *Designer Environments* in a future project on designing an ideal town.

References

Designer Castles is one of a range of programs from Data Design, Business Innovation Centre, Innovation Way, Barnsley. *Designer Castles, Designer Medieval Village* and *Designer Environments* are available for BBC machines and require a printware ROM to be installed. At present there is a special offer on *Designer Castles* and the ROM of £19.50. This is a saving of around £24 on the normal price. Archimedes users can obtain *Designer Castles* and *Designer Medieval Village* on one disc for £60. Coming soon is *Designer Boxes*, which allows different kinds of packaging to be designed, decorated and printed out.

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