

Science & Technology Equipment News

Number 20
Autumn 2000

For Primary Schools and Teachers of S1/S2 courses

STS National Support Services in
Science, Technology, Safety

Helpline: 0131 558 8180 Fax: 0131 558 8191
Email: sts@sserc.org.uk Web: www.sserc.org.uk

SSERC 2000 ISSN 1369-9962

After the somewhat 'hi-tech' approach to control in the last issue, News 20 introduces some simpler ideas. Perhaps we should have produced this first! We intend to look at control in a wider context but one still in keeping with the 5-14 guidelines for both science and technology. There the latter is about designing, making and problem solving. All is done to produce goods or systems to satisfy a variety of human needs. If technology is about the manufacture of goods and systems to make our life and environment more comfortable, enjoyable or sustainable, then we must have some means of control to make sure machines or systems do what we want them to do. This is our starting point for this Newsletter on Control Technology. We all use some form of control in our own environment from making a cup of tea, to driving through a busy city street. Children from an early age exercise control, (sometime to manipulate their parents or some hapless teacher) from a baby with their rattle to a primary pupil setting up the video recorder or riding their bicycle around the park. These are the kinds of simple ideas on control we explore here.

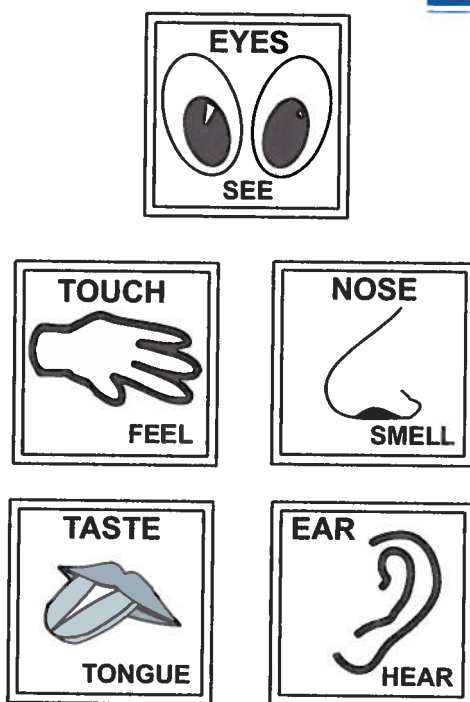


Figure 1 "Senses" cards

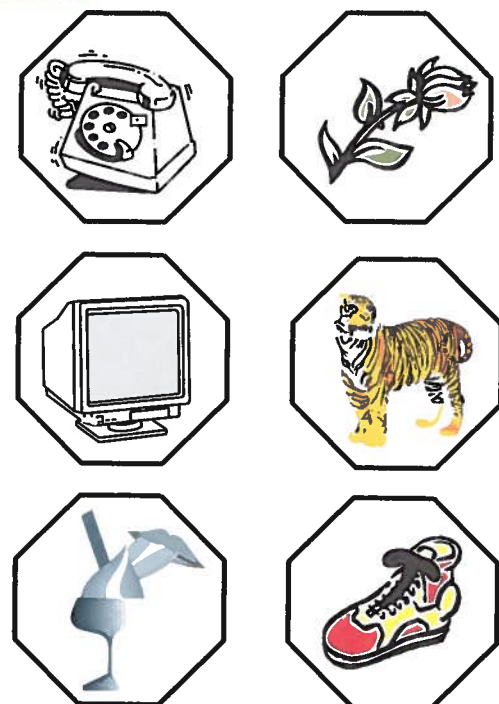


Figure 2 "Doing" cards

Making sense

The most basic type of control is probably that which concerns the senses. How do we control our temperature? If we 'feel cold' at home we put on a woolly jumper or turn up the heating. We use our senses to control much of what happens in our lives. Which sense do we use to answer the telephone, to know when the toast is burning, when our food needs salt? We react to all of these situations by in some way controlling our environment:

We sense, we think, we do.

Figures 1 and 2 above show a selection from a card game we found to be successful with P1 to P3 classes. In our version children were asked to choose cards showing a sequence of events:

sense - think - do

For example, if they chose a drawing of an ice cream they would sense with their eyes, taste ice cream then eat it. Our drawings are only examples, the format and application of the game could well be improved by basing it on the childrens' own ideas and drawings.

Have you the energy?

This is a tried and tested idea for P4 to P6 pupils with resources that are readily available. A torch is the first item needed. We would then ask:

"What makes the bulb light up?"

"Is it the switch, or is it something else?"

"Where is the energy stored that works the torch?"

When such questions have been answered we could now take the opportunity to model the workings of a torch or of a lamp.

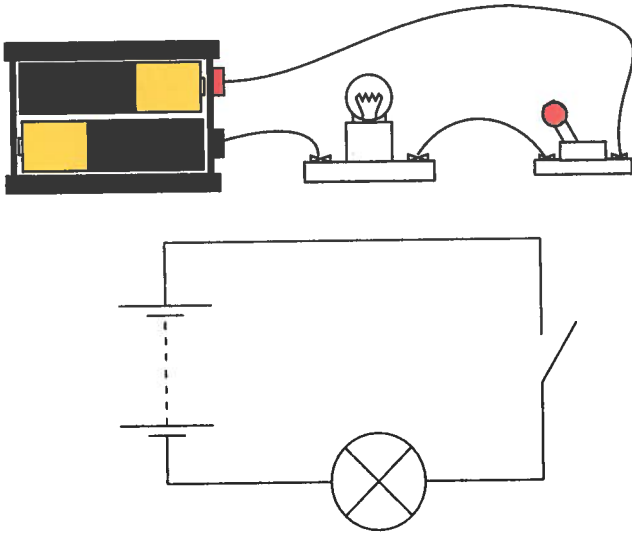


Figure 3 Pictorial view and circuit diagram for lamp/switch system

One way is to collect together: a battery holder; 2 AA batteries (cells); a length of wire; a bulb holder and a 3.5V bulb. If wired together, as shown in Figure 3, below left, the bulb should light. Now for the interesting bit, ask the children to design a case for their lamp/torch from plasticine or modeling clay. They should make sure when designing that they include some method of controlling the light. One answer could be a simple, DIY, switch eg the drawing pin and paper clip trick or use folded foil covered card.



Figure 4 Picture of 'fun' lamp modelled in plasticine

Where the bee sucks

Designers use a particular mechanical system to give predictable movement in one direction only. It is known as a 4-bar linkage. Ask P4 to P6 pupils to design a system that will take a bee in a straight line from hive to a flower. (Could this be a beeline? Groan!). LEGO, Meccano or similar kits all provide routes to solutions. If you haven't any of those, linkages can be made up from card and paper fasteners. Modelling of bee and flower in plasticine makes for a bit more fun and may result in some interesting designs. (Figures 5 and 6).

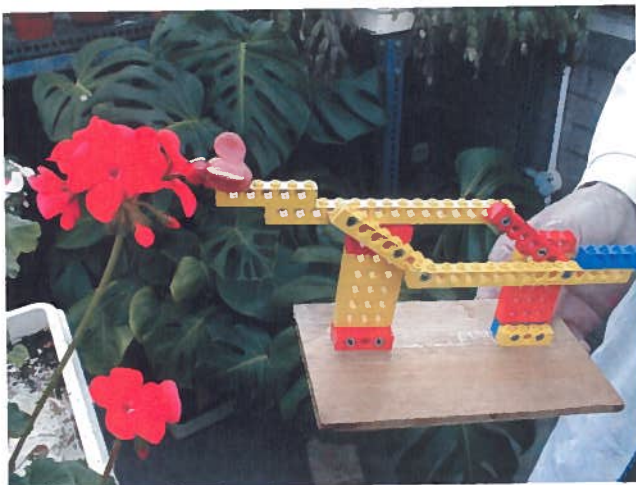


Figure 5 Lego beeline model, an example of a 4-lever linkage.

The aim is to control both movement and direction.

Once a Lego or Meccano model is made and working - ask pupils:

"What do you think will happen if you change the position of the fixed pivot points?"

"Can you predict the beeline?" A simple way to model the beeline is to put a pencil in place of the bee and a piece of paper/card behind the linkage.

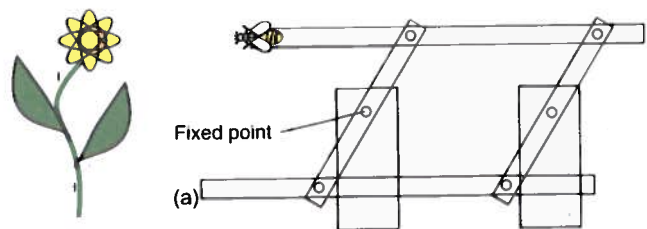
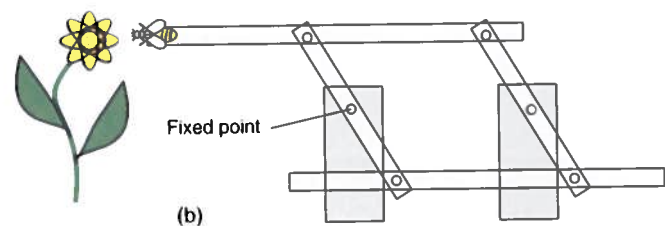


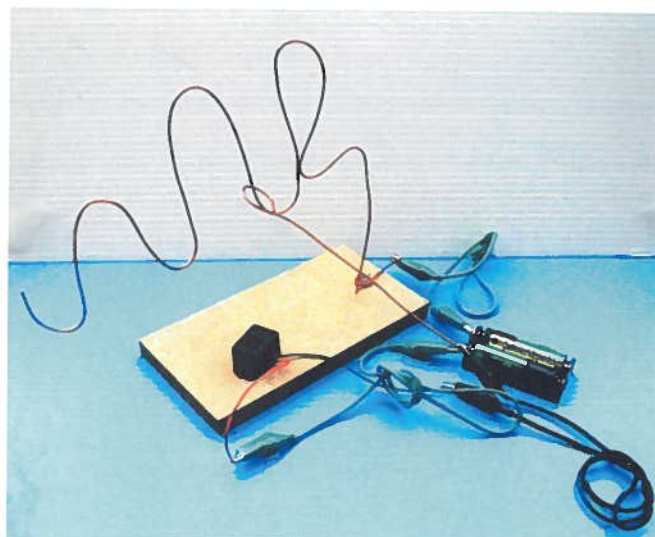
Figure 6 (a) Bee on its way to flower (b) at the end on the beeline



Ready, steady?

And finally, two fairly well known projects, one on human co-ordination the other on control of temperature. Our first is an old game currently being highlighted on the BBC's TV licence campaign. The idea of the game is quite straightforward. Pupils try to pass the loop around the wire without the buzzer sounding or lamp lighting. This simple game helps to reinforce the concepts of a circuit and switching (probably at about Level D). Components and material needed are two AA cells with holder, a 3V buzzer or 3V lamp and holder, a length of copper wire (100cm) or perhaps a wire coat hanger, a wooden base, two wood screws and a pair of crocodile clip leads.

Figure 7 (Opposite) Wire and buzzer game a test of hand/eye co-ordination



Cut off about 20cm of wire and make a loop in one end about the diameter of a pound coin. This can be modified if it is found to be too difficult or too easy to move around the wire. Bend the rest of the copper wire into a wavy shape, or any you desire, make a small loop and screw to the base. Clip one of the crocodile clips from a battery terminal to the wire loop, the other from the battery to the screw on the base. Tips - make sure the copper wire is not insulated with varnish and if using a buzzer with red and black leads ensure the red lead goes to the positive (+) side of the battery. Pupils and others use the system to explore hand and eye coordination.

Hot and Cold

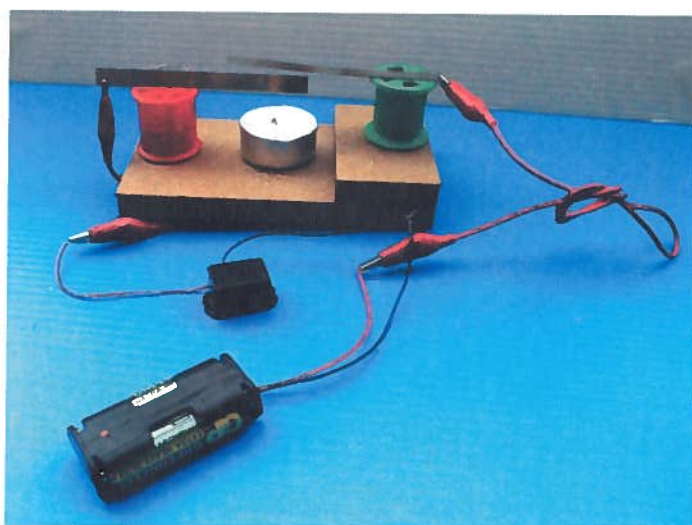


Figure 8 A model thermostat with an alarm buzzer

This method of temperature control can be found in domestic irons, some forms of toaster and room thermostats. Many of these temperature control mechanisms are based on a *bimetallic* strip. This is a 'sandwich' of two different metals. Metals expand when heated but at different rates for various metals. If we heat a bimetal strip the difference in rates of expansion of the metals cause the strip to bend. We can make use of this to make a simple thermostat to model a fire alarm.

Components needed:* Two AA cells with holder, a 3 V buzzer, one night light (candle) two metal strips, one of which is of a bimetallic type, two cotton reels, a pair of crocodile clip leads and some scrap wood.

We use double-sided tape to fix the cotton reels to the wooden base and to fix the strips to the reels. The bimetallic strip will bend about 12 mm so a little experimenting is needed before a classroom demonstration. This is well worth while - but you would do that anyway. When the strips meet (after about 10secs) the buzzer sounds - remove the heat source and it stops.

***Note:** Many of the components needed to build the models illustrated are available from the Centre. See listings overleaf.

Components & Materials

Item	Description	Price
593	Miniature motor, 1.5V to 3V, 2mm dia. shaft	30p
614	Miniature motor, 3V to 6V, 2mm dia. shaft. Both motors above can be used for project work but they run at fairly high speeds, some gearing will be required. See worm/gear, item 811.	45p
621	Miniature motor, 1.5V to 3V, now with 8 tooth pinion. The open body of this motor makes it ideal for showing how such a motor is constructed	25p
798	Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia. 15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel	£2.00
798	Pack of 24 gears, 6 each of 12, 20, 30 or 40 teeth, dia. 15, 22, 32 and 40 mm. 12 tooth gear fits motor shaft and 40 tooth gear push fits in cotton reel	£2.00
799	Pack of 24 cams, 6 of each of 4 shapes	£1.00
800	Pack of 100 wheels, 39 mm dia., assorted colours, 3 mm axle hole	£5.25
811	Worm and gear, 34 to 1 speed reduction	35p
817	Axles 3 mm dia., nickel plated, round ends, push fit on SSERC plastic wheels, gears and pulleys: 70 mm long, per pack of 4	40p
818	As above but 95 mm long, pack of 4	40p
819	As above but 12 mm long, pack of 4	40p
820	Worms to fit 2 mm electric motor shaft, pack of 5	£1.00
821	Reducers 3mm to 2mm enables gears, pulleys and wheels, to be fitted to motor shaft, per 5	25p
867	Reducers, 4 mm to 2mm, as above, per 5	25p
868	Reducers, 4 mm to 3 mm, as above, per 5	25p
710	Sonic switch. Clap your hands, the motor starts, clap again the motor reverses and on the third clap the motor stops. Needs 4 AA cells.	85p
723	Microswitch miniature, lever operated	40p
822	Plastic toggle switch, low voltage	40p
688	Crocodile clips, red, miniature, insulated	5p
759	As above, but black.	5p
788	Crocodile leads, assorted colours, insulated croc. clips at ends, 36 cm long.	£1.35
835	2 x AA Cell ('battery') holder	15p
845	2 x C Cell ('battery') holder	20p
789	MES (miniature Edison screw) bulbs 3.5 V	10p
691	MES battenholders for above.	20p
866	Lens end lamps, 1.2 V MES. Ideal for use where a narrow, concentrated beam of light is needed. Bargain pack of 100	£3.50
508	LED (light emitting diode) 3 mm, red, per 10	50p
761	LED 3 mm, yellow, per 10	60p
762	LED 3 mm green, per 10	60p
790	3V buzzer (works with solar cell see Item 838)	55p
846	Sound module with 'melody' chip	£1.00
838	Solar cell, 100 x 60 mm, 3.75 V per cell, max.	£2.10
839	Solar motor, body 25 dia. 12 mm long with shaft 2 mm dia 6 mm long	£1.70
840	Solar pack : one of each solar cell, solar motor propeller (801), and 3 V buzzer - with notes.	£3.75
836	Motor mounts, plastic, push-fit with self adhesive base pad for SSERC motors 593 & 614, 10pk	£1.95
801	Propeller, 3 blade, to fit 2 mm shaft. Blade 62 mm long	35p
792	Propeller kit with hub and blades for ten 3 or 2 bladed propellers	£3.50
794	Cotton reels (for making buggies, rubber powered tanks etc.) pack of 200.	75p
796	Pack of 20 pulleys, 5 of each of 10, 20, 30 and 40 mm diameters.	£2.50
837	Ring magnet, 40 mm o.d., 22 mm i.d.	35p
815	Ceramic square magnet, 19 x 19 x 5 mm	15p
823	Ceramic magnets, poles at ends, 10 x 6 x 22mm	12p
824	Ceramic magnets, poles on face, 25x19x6mm	35p
861	Bimetallic strip, 10 cm length	30p
882	Quartz clock movement, dimensions 56x53x17mm, with wall hanging bracket, Suitable for dial thickness up to 10mm. Includes plastic hands suitable for dial diameter to 200mm. Requires an AA battery. Ideal for classroom made Christmas presents, see CD Clocks, Newsletter 18.	£1.75

An interactive, web page version of this Newsletter has already been posted on the SSERC site : www.sserc.org.uk

Prices do not include VAT which will be charged at the ruling standard rate. Cash with order only when total value is less than £5 and please add £1 for carriage solely to these small orders (except where an inclusive price is indicated eg kits, etc). For orders totalling more than £5 please do not send payment etc but await delivery and then pay on our advice note or invoice.

**SSERC, St Mary's Building, 23 Holyrood Road, Edinburgh, EH8 8AE Tel. 0131 558 8180 Fax 0131 558 8191
Email : sts@sserc.org.uk Web : www.sserc.org.uk**