SCIENCE EXPERIMENTS FOR PARENTS AND YOUNG CHILDREN – MAKING DATA-LOGGING FUN

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Abstract
This interactive poster presentation shows ideas for making data-logging activities with sensors fun for young children. The approach uses *iLOG Junior* data-logging software with a target audience of parent volunteer helpers in primary schools and children who have no previous experience of data-logging. The user interface aims to give intuitive access to the program facilities, allowing simple experiments to be performed. The built-in library of resources contains on-screen instructions for experiments, and a range of animated cartoons which may be controlled by sensors or by reading data from graphs.

1. Introduction
Computers are used in a variety of ways in primary schools in the UK. In general there is widespread practice in giving children direct access to the computers, and there now exists a whole generation of children who are confident users of computers. The challenge to teachers lies less in training pupils to acquire operational skills with computers, but more in framing tasks and motivating pupils to engage in useful learning activities with software.

Despite many years of national investment in curriculum development, resources and training in primary schools, the use of computers for physical measurement and data-logging activity still has a fairly low profile compared with communication and presentation activity (Ofsted 2009). Data logging is often regarded by teachers as demanding a high degree of technical skill, and to have dubious learning benefits. To developers and teacher trainers such as myself, neither of these perceptions are justified; sensors, data-loggers and software have become greatly simplified in design in recent years and the learning benefits have been well reported (Rogers 2005). Nevertheless, teachers' concerns and doubts have to be taken seriously, and informal feedback to the publishers of *Junior Datalogging Insight* software (Logotron 2005) indicated the most pressing factor that, because teachers were typically very busy, they sought time-saving aids to set up the software and ready-made ideas for classroom tasks. The subsequent development of *Insight iLOG Junior* software (Logotron 2009) responded to these issues by providing a built-in library of tasks, and by redesigning the user interface with much more onscreen help to assist learning about the system and make navigation as intuitive as possible. The publisher set a target for the new design that it should also be understood and usable by volunteer parent helpers who are sometimes invited to assist teachers in primary schools and who implicitly would be untrained in the use of data-logging resources.

2. Setting up Experiments
To meet the need for useful ideas for experiments and for making the program quickly ready for gathering data, a library of set-up files is built into the program.

Figure 1: Selection of files available in the Experiment Set-ups library

When a file is selected, it automatically configures the data collection parameters, presents a suitable graph display and provides on-screen instructions for setting up the experiment and collecting data. Since a data-logger and one or more sensors need to be connected, the program shows warning messages offering advice if the connections are absent or incorrect. When data has been collected, the instruction window also provides ideas for analysing the data. Thus the program facilitates practical experimentation with the minimum of fuss and models the sort of analysing activities useful for interpreting the data.

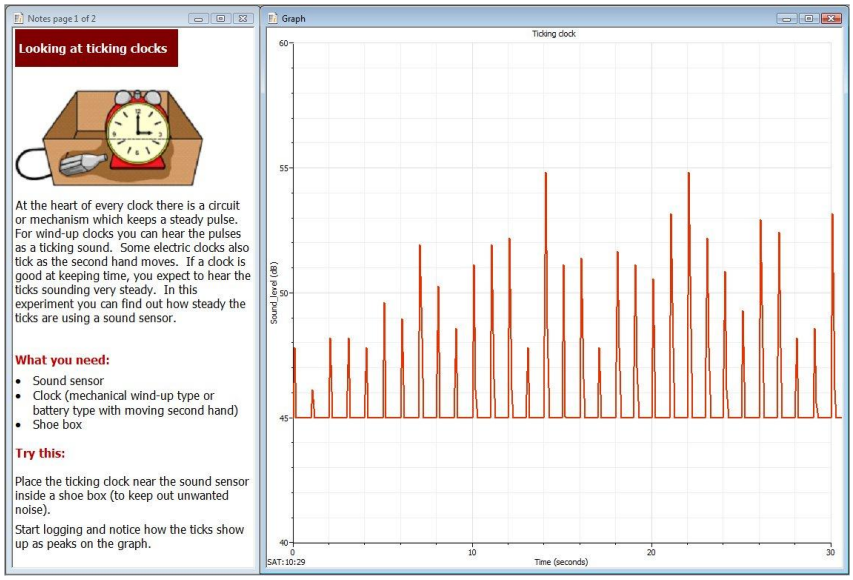

Figure 2: Example of experiment instructions with collected data

3. Sample data and virtual logging

For every experiment in the library, the program also offers a set of sample data. This has a variety of uses:

1. The data may be viewed in advance of the experiment to provide reassurance about what sort of graphs to expect.
2. The data may be viewed after the experiment for comparison with the results obtained.
3. If sensors and a data logger are not available, the sample data is useful for practising graph analysis and interpreting the meaning of the data.
4. The *Virtual logging* feature offers a simulation of logging by displaying the sample data as a sequence of collected items in real time, so the effect on the graph is for the data to gradually accumulate, just as in a real experiment. Again, this is useful if sensors and a data logger are not available.

4. Cartoon Movies for motivation

A unique feature of the *Insight iLOG Junior* program is a further library of cartoon movies. In each movie, one or more characters may be controlled using the signal from a sensor. For example, an elephant can be made to walk across the scene in a window, using a light sensor; the brighter the light falling on the sensor, the further the elephant walks across the window. By waving a hand in front of the sensor, the elephant can be made to do a sort of dance of forwards and backward movements. Alternatively, using an ultrasonic motion sensor for measuring the distance of a pupil walking towards or away from the sensor, the elephant appears to mimic the motion of the pupil. Simultaneous with the movement of the elephant, a graph gradually builds up in the normal way as the data from the sensor becomes recorded. When recording is finished, a complete replay of the movements of the elephant can be achieved by moving the cursor across the graph to take readings. Manipulating the sensors or the cursor across the graph offers valuable opportunities for pupils to associate the graph shape with changes in the readings from the sensor.

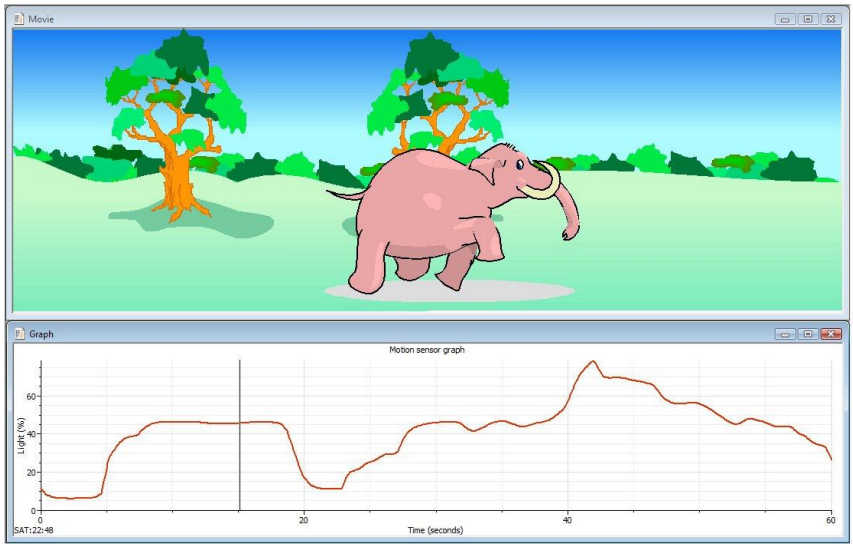

Figure 3: Example of cartoon movie in which the elephant moves according to the light level

In another example, two temperature probes are used to control the motion of two dragons in a race between each other. Two pupils can each hold a probe and, according to the temperature of their hand, their dragon will run faster and move ahead. If the probe is rubbed in the hand, the heating effect of friction will raise the temperature and advance the dragon still further. The competition between two pupils doing their best to heat the probes as much as possible is played out on the screen as a race between the two dragons. Again the graph contains a complete record of the race which can be replayed by tracking the cursor across the graph to take readings. Pupils learn to interpret features of the graph shape; for example a rising graph indicates speeding up whereas a falling graph indicates slowing down; at a point where the two graph lines cross, the speeds of the dragons are the same.

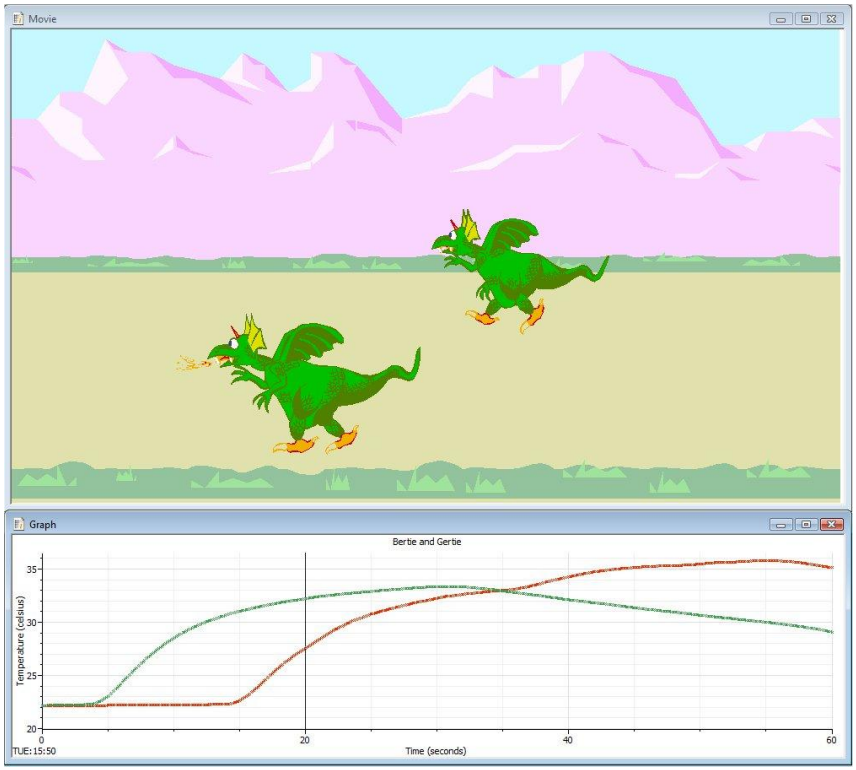

Figure 4: Cartoon movie showing a race between dragons controlled by two temperature probes

In a final example, a number of manually drawn graphs are used to control the boy Jack, who in the nursery story climbed a beanstalk. As the cursor is dragged across the graph, the values of the data on the graph line are used to control the height of Jack on the beanstalk. Thus a rising straight line results in him climbing up at a steady speed. A falling line shows him climbing down. The steepness of the line determines his speed. Again, the various features of the graph shape have clear relationship with the movement of jack up and down the beanstalk. After a few observations pupils can look at the graph and from it predict the movement of the character, Jack.

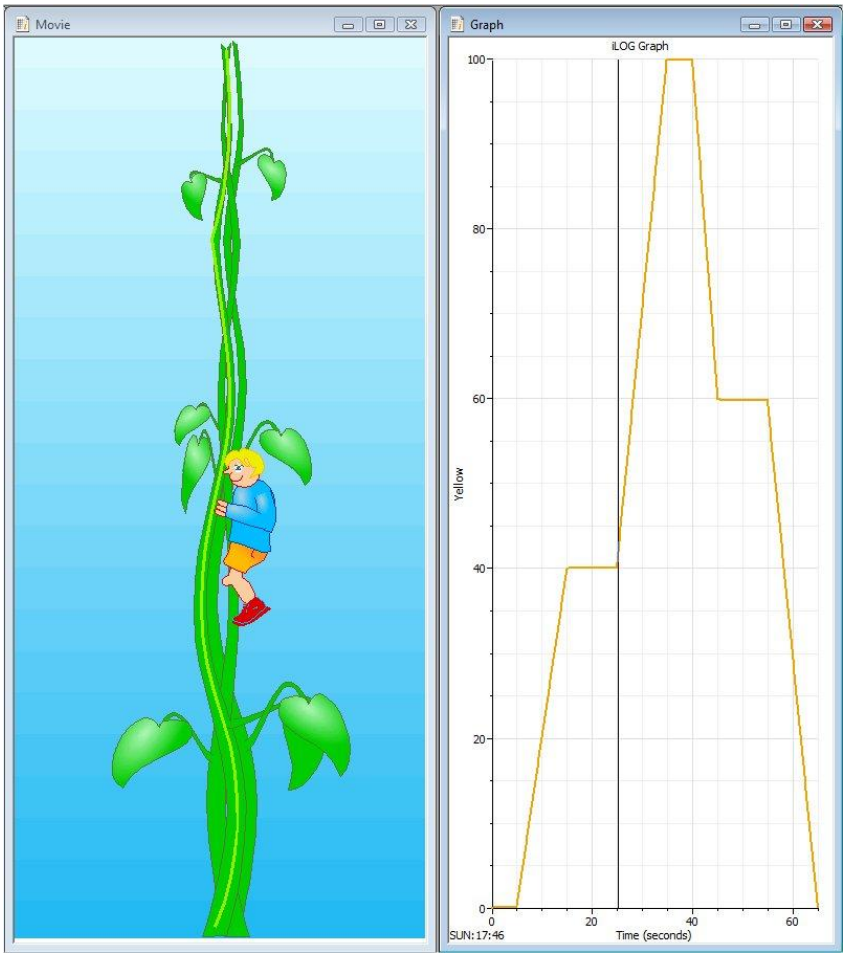

Figure 5: Jack and the Beanstalk movie: Jack's climbing is controlled by the data on the graph

5. Learning benefits: using sensors and interpreting graphs

The contexts provided by the movies allow pupils engage with the use of sensors and graphs in an informal manner which can appeal to their imagination. Stories are often used in primary education to provide themes for stimulating the interest of pupils and teachers contrive activities connected with such themes to develop skills related to the learning of language, mathematics, history and so on. In the context described here, pupils learn about the properties of sensors, their potential for measurement and how data is represented and interpreted from graphs through fun activities with the movies. Pupils discover that the graph is a versatile tool for understanding the meaning of data.

References

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