MODEL LAUNCHED ON THE BAY

Suppose we want to know, now, how far a body of water like Westernport Bay would be polluted in, say, 10 years if nothing were done to prevent it?

Does this call for the seer or the prophet, the oracle or the soothsayer, for crystal gazing or horoscopy?

According to modern investigators like Dr. Jon Hinwood, senior lecturer in Monash's department of mechanical engineering, it calls for prediction by means of a mathematical model.

For some purposes a scale model would do, but scale models must conform to certain rules which set limits to the kinds of problems they can represent.

But the digital computer (or sometimes the analogue computer) and a properly written program of instructions make up a mathematical model that can take us beyond the limitations of the scale model.

The mathematics of physical events, taken one at a time, or point by point, like the flow of water, the mechanics of movements or of stability, the forces in members and structures, have been known for a long time, usually as a fairly simple statement or equation for any element, telling us how the element changes when things are done to it.

It is therefore possible to represent a composite physical thing, and the changes it may undergo, by a series of moving mathematical statements or simultaneous equations—a mathematical model. Such a concept only became possible through the modern electronic computer, whose speed enables it to solve a great number of simultaneous equations within seconds perhaps, or minutes.

So now we investigate a changing situation not on the real thing, nor on a scale model of it, but through a mathematical model represented by a computer program on tape.

In collaboration with Dr. W. T. O'Brien, of the University of Melbourne's Centre for Environmental Studies, Hinwood is applying these methods to an investigation of the waters of Westernport Bay on behalf of the Westernport Bay Environmental Study.

They were concerned not only with the waters as water—its depth, velocity, acceleration, turbulence, at any instant and at any place; they were also concerned with water as a solvent for chemicals and nutrients (especially oxygen), as a vehicle for bacteria and suspended solids, and as a medium for conveying heat.

Hinwood and O'Brien therefore had to extend the current notions of a mathematical model to take in concentrations of chemicals, and changes in concentration.

For this they released into their (mathematical) system "computational particles" so as to simulate a discharge of effluent. The number of particles introduced at each time interval would represent the rate of discharge being simulated. Hinwood and O'Brien claim that this notion of computational particles is new in simulations.

At any time after the release of particles into the model, the resultant spread or density of the particles would determine the local concentrations, and so would allow lines (or contours) of equal concentration to be drawn over the area of the bay.

A similar method of simulation can be applied to other things carried in the
Removing Gallstones Without Surgery

Stones in the gallbladder have bothered man and a number of other animals for a long time.

According to a team in Monash's Department of Surgery at Prince Henry's Hospital, there is evidence that gallstones are more common in the affluent, Western-style societies, and that in places like Australia the incidence may be increasing. Professor James Watts, leader of the team, suggests that perhaps 1 in 8 of the population is likely to be affected.

For the last 70 years or so, the standard treatment has been surgery—cholecystectomy—removing the gallbladder and the gallstones with it.

After such an operation the liver will continue to secrete bile, but now directly into the small intestine instead of into the gallbladder for between-meals storage. We seem to manage very well with the new arrangement, although we have lost the capacity to release a large volume of bile into the small intestine by contraction of the gallbladder when stimulated by eating.

In an attempt (with others around the world) to avoid cholecystectomy, Dr. Jim Touffl and biochemist Dr. Paula Jablonski are working with Professor Watts on a scheme for dissolving the stones—in situ.

They point out that in Western man 90 per cent of gallstones are composed of cholesterol; that cholesterol is one of the three constituents of bile, the other two being bile salts and phospholipid (another form of which is lecithin); and that cholesterol is not easily dissolved in water, but the three constituents together, making what is known as a micelle, can dissolve in water. (This is analogous to the way that soap removes...
The grease is not soluble in water, but with soap it forms a micelle that is soluble.

If the proportion of cholesterol in the bile increases relative to the others, the solution eventually becomes supersaturated in cholesterol, which then comes out of solution as crystals. Crystals saturated in cholesterol, which then is soluble. The solution eventually becomes supersaturated in cholesterol.

If a stone is immersed in a solution of the bile salt solution, it will gradually dissolve. Our observers have done this in the laboratory. If in the test tube, then why not in the body? Why not indeed, provided you have access—between solvent and stones.

Indirect access is possible. Bile salts, given by mouth, will be absorbed in the small bowel and carried to the liver via the bloodstream. The liver will secrete this extra bile salt which reduces the relative concentration of the cholesterol in the gallbladder, thus allowing slow dissolution of the cholesterol stones.

A world-wide effort along those lines has been organized by a drug company; Monash, the Australian participant, is applying the technique to those patients at risk from surgery.

The team at Monash has also used bile salts as a solvent in patients where gallstones were found in the remaining ducts after the gallbladder had been removed. In those patients, a temporary drainage tube required for the operation provided direct access to the area; a solution of bile salts was dripped into this tube so that the stone was bathed in the solution. The stone was completely dissolved in 80 per cent of the patients within three weeks.

**Next: Prevention?**

For the team, a greater challenge remains—not cholecystectomy, not cure: prevention.

They have noted, as have others, the increasing incidence of gallstones in the well-to-do countries, and the continual ‘refinement’ of foods in those areas, particularly in the cereals.

By inference, they wonder whether lack of roughage, specifically the roughage of cereals, bran, could be a modern ‘affluent’ deficiency tending towards gallstones.

They are now inquiring into dietary habits of people with a family history of gallstones. They are also thinking in terms of modifying the diet by increasing the daily intake of roughage, for example a cupful of bran—without additional sugar or milk!

It will be some time, they say, before we can report the result of that inquiry.

**PHYSICS: UNPOPULAR SCIENCE?**

The number of enrolments in high school physics in Victoria fell in 1971, and again in 1972 (though 1973 showed a very slight rise).

Apparently, interest in physics has declined in spite of the revamping of school science courses in the mid ‘60s, specifically aimed at increasing the pupils’ interest and participation in science, including physics.

The situation is not unique to Victorian schools, nor is it new. It happened about ten years ago in the UK and the USA, and led to a decline in the numbers taking science and engineering in the universities—the revolt against science.

The situation worries many people in the schools, on the campuses and in the professions.

One of the worriers is Dr. Paul Gardner, senior lecturer in education at Monash, whose special interests are the art and science of teaching science, and the evaluation of curricula.

Several explanations may be offered, he says: the poor image of physics and physicists, a modern distaste for science and technology, omission from the curriculum of the social aspects of science.

But he believes that the classroom and the people within it are still the central arena for study when we seek to explain pupils’ attitudes to science; so he set out to investigate those attitudes and the factors that affect them.

He studied a sample of those who, in the second last year at high school (form V), began physics after four years of junior science. His sample was 1014 pupils, from 58 classes in 34 schools in the Melbourne metropolitan area.

He used three measuring instruments, in the form of questionnaires: one for measuring various aspects of pupils’ personalities (for example, motivation for achievement); one for measuring pupils’ descriptions of the presentation of physics in the classroom, in effect the teachers’ behaviour; the third for measuring various aspects of the pupils’ attitude to physics as a subject (the physics attitude index).

The questions were of the kind that required one of five answers. In the style strongly agree... agree... disagree... strongly disagree... or not sure.

Such ranked answers lead to the giving of scores, and such instruments lead to objective measurement rather than to subjective hunch and opinion.

The most striking result of those measurements, Gardner says, was that, “throughout the course students expressed a high level of enjoyment in learning physics, eight months later their
attitude had declined sharply".
This decline was shown not only by those who dropped physics after form V: it was also shown, though less markedly, by those who continued with physics into form VI.

Gardner also found that the decline in interest or enjoyment was much worse in his survey (1971) than his colleague Lindsay Mackay found in a study using the same attitude scales three years earlier. (Mackay is also a senior lecturer in education at Monash.)

Gardner’s detailed measurement enabled him to relate the decline in interest to some pupil/teacher characteristics.

The most important of these, he found, was the teacher’s skill in organising his material. But other factors turned up in the analysis.

Teachers who were serious and who stressed the importance of work tended to maintain enjoyment in pupils who were themselves serious; but in less serious pupils, the same teacher behaviour produced a sharp decline in enjoyment.

Comparing his work with Mackay’s earlier work using a variety of curricula, Gardner is able to say that the effects of teacher behaviour on pupils’ enjoyment of physics are much greater than the effects of introducing new instructional materials.

"It is therefore naïve to believe," he says, "that simply changing the curriculum will bring about dramatic changes in pupils’ attitudes."

Although it is probably more difficult to change the teacher than to change the curriculum, Gardner’s work suggests that, if we wish to bring about more enjoyment of science subjects, we ought to concentrate more heavily on the education of the teachers.

RESEARCH ON THE RECORD

Monash has recently published a full survey of its research work in all departments.

Under the title "Annual Research Report", this covers the year 1973, and is the first of an annual series.

The main purpose of the report is to "put on record" so that, at the least, Monash will know what Monash does.

In due course it will be found in the libraries of other universities and research centres—in Australia and overseas—and, no doubt, in the departments of friends and competitors all over the world.

The entries range in size from 5 column cms for Indonesian and Malay and for philosophy, to 80 column ems for electrical engineering, 100 for medicine (at the hospitals), and 180 for chemistry in the faculty of Science.

The entries for each department show first the areas of research interest in the department, ranging from a few lines for some of the smaller departments in Arts to two pages or more for each of chemical, civil and electrical engineering, and six for chemistry.

Thirty-seven books, from slim volumes to substantial tomes, were published during the year with Monash academics as authors or co-authors, editors or co-editors. Twelve came from the arts faculty, 10 from economics and politics, four from education, four from medicine, and one from engineering.

Professional papers

But reputation in research depends not on the writing of books (a book crystallises the present state of accepted knowledge) but on the writing of professional papers for the learned journals.

It is those papers, not review articles or restatements of old themes, that establish priority in research and the advancement of knowledge.

The present report makes no distinctions between these writings, lumping them all as “articles”: 333 from the faculty of medicine, 275 from science, 133 from engineering, 127 from arts, 88 from economics and politics, 39 from education and 22 from law.

In the humanities, most papers represent the work of a single author. But in the sciences, so much work is done by teams that it is fashionable these days, and correct, to list as authors all those professionals who shared in the work.

In the list of more than 1000 articles, two and three co-authors are common; four and five not rare (70 with 4 co-authors or co-editors, 23 with 5). Six articles had six co-authors, diminishing numbers for 7 and 8; three had 9 co-authors, while one (in chemistry) had 10.

The remaining entries, under each department, list the theses accepted for higher degrees: 72 for masters (nearly half of them in economics and politics), and 95 for doctorates, all but two being Ph.D.s, nearly half in science.

Copies of the report may be obtained from the Publications Officer, Monash University, Clayton, Vic. 3168.