



Computers ease a planner's burden

Dr John Brotchie regards the Club of Rome's study of the earth's resources and the limits they impose on population and economic growth, published in 1972 as *The Limits To Growth*, as a milestone. The researchers devised a mathematical model of the things happening on the earth that they considered most significant and used a computer to study interactions between them. The complexity of the problem was such that the results obtained could not have been derived in any other way, Dr Brotchie believes.

In 1968 the CSIRO Division of Building Research set up a systems research group headed by Dr Brotchie. Concerning itself with not quite such all-embracing problems, the group has devised a number of very useful planning models. One of these, TOPAZ (short for Technique of Optimal Placement of Activities in Zones), is now being used in major projects around Australia, including studies of:

- ▶ the future growth of Melbourne, in collaboration with the Melbourne and Metropolitan Board of Works (M.M.B.W.)
- ▶ the Gosford-Wyong growth centre north of Sydney, in collaboration with the New South Wales State Planning Authority
- ▶ the future development of Darwin, in collaboration with the National Capital Development Commission
- ▶ land use in the Western Australian Murray Valley, in collaboration with Dr David Bennett of the Division of Land Resources Management

It is also being used in an urban and regional planning study at Blacksburg, Virginia, U.S.A.

TOPAZ, developed by Dr Brotchie and Dr Ron Sharpe, is a very useful collection of equations. It can help people plan buildings, groups of buildings, parts of cities, and cities. It can look further afield and help them decide where towns, dams, roads, ports, and so on should be sited in regional and even national plans. Broadly, it helps planners cope with complexity.

Take city planning, for example. Working with specialized sub-models dealing with such things as electricity, water, and sewerage networks, TOPAZ can be used to assess the advantages and disadvantages of alternative city layout proposals. It can be used to improve these proposals, and it can help planners decide when development or redevelopment should start in an area.

The planner feeds into the computer goals he wants to aim for. The model then allocates the things he's dealing with to sites so that the goals are approached as closely as possible. It can also allocate them to time slots.

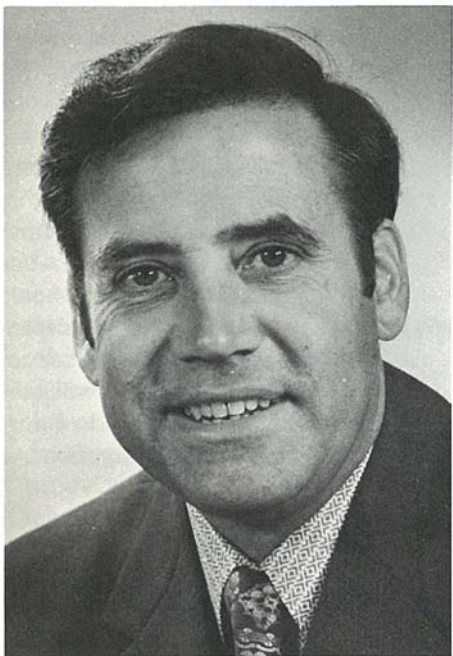
The goals the planner sets could include low costs in building and supplying factories, schools, or houses for example. He will also set goals concerned with interactions such as those between industries and housing—the distances people have to travel to and from work, the effects of industries on the living environment, and so on.

Of course goals in city planning, based on assessments of community wants and needs, are not always clear. TOPAZ, by showing the impacts different levels of achievement of particular goals have on the prospects for achieving other goals, can help sort out people's ideas on what to aim for.

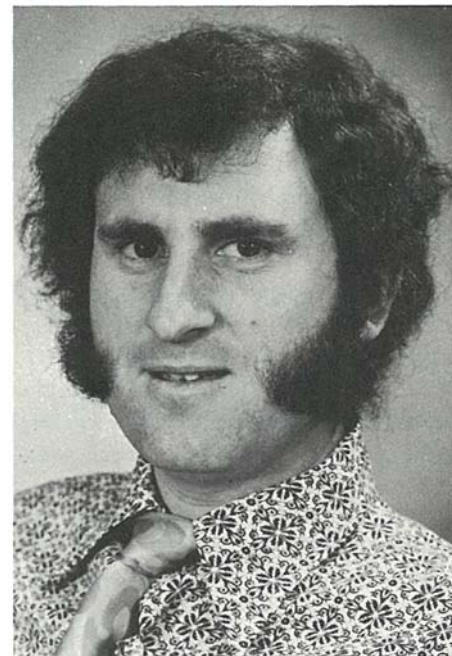
Dr Brotchie suggests that planners, when dealing with a problem concerning an area, invite spokesmen for residents of the area to see the model being run on the computer. The spokesmen would be asked to say how much weight they thought should be attached to goals and to modify those weightings in the light of the solutions obtained.

Similarly, TOPAZ can be used to test the consequences of possible future changes in community attitudes or behaviour. These may relate to the density of housing people prefer or the kinds of transport, public or private, they favour.

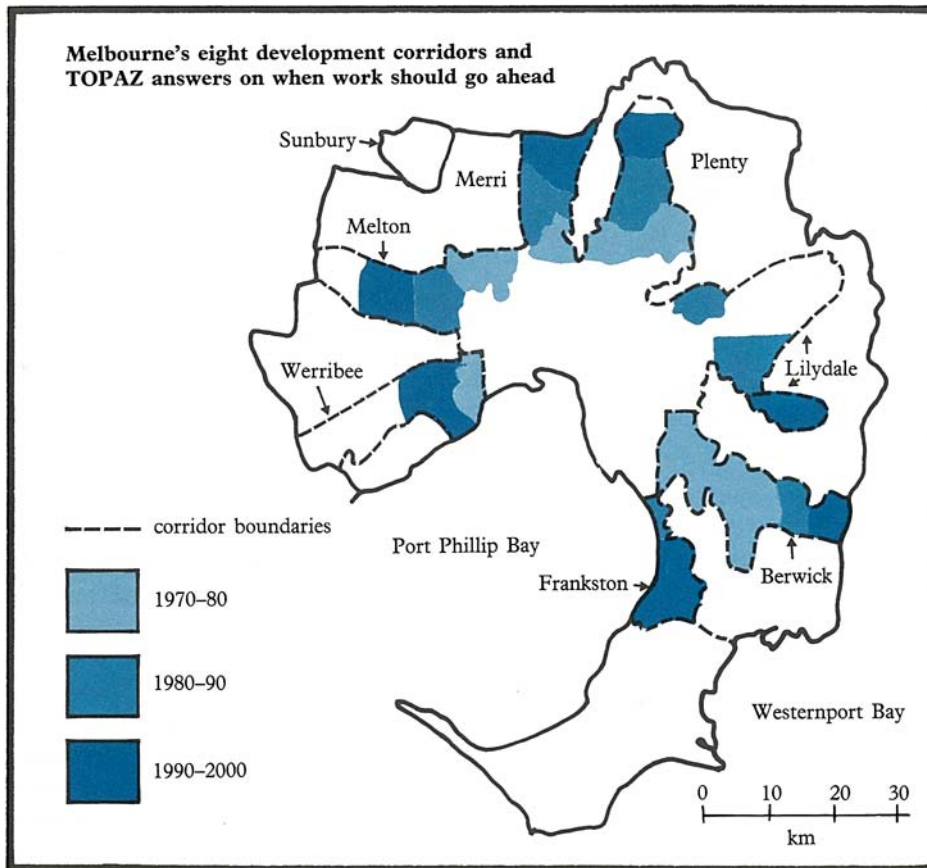
Dr John Brotchie



Dr Ron Sharpe



The quality of life in the next century is extremely dependent on the planning decisions made today.



Melbourne study

An evaluation of alternative corridor growth patterns for Melbourne over three periods, 1970-80, 1980-90, and 1990-2000, is one of the problems the model has been put to work on. Dr Brotchie's group primed the computer to look at the siting of housing and job opportunities. The interactions examined were the flows of people between work, housing, and shopping and business areas, and flows of goods from industrial to living areas.

The city was divided into 40 zones. The corridors looked at were eight that the M.M.B.W. proposed in 1971 as the locations for any outward extension of the city. They radiate from the fringe of existing development. The general goal adopted was minimum total cost of services, buildings, and interaction over the 30-year period.

The early output from the computer shows, among much else, that the strongest pressure for development is likely to be in the south-eastern Berwick corridor (see the map). It indicates that a levelling of transport cost across the city can be expected as development spreads outwards, with the city centre losing some of its economic advantage. The Melbourne study is continuing, with greater precision in output being obtained as the data input grows.

TOPAZ deals primarily with economic costs and benefits and not so directly with social and environmental aspects of urban planning. However, measures of suitability of an environment can be included along with economic benefits and costs. Things like air pollution problems and minimization of fuel consumption can be considered, as drawbacks and advantages of living close to factories for example. Also, the opportunities offered by access to a wide range of jobs, schools, shops, and recreation can be assessed.

The group has devised or is working on sub-models for TOPAZ dealing with various social and environmental matters. One sub-model covers the generation and diffusion of air pollution from industry and traffic. Another will deal with the benefits and drawbacks—from a variety of viewpoints including environmental impact, travel time, and cost—of different forms of public and private transport.

TOPAZ can, of course, answer only some of the city planner's questions. It is a simplified model of an extremely complex system. Further development and the gathering of more information on communities and their needs will increase its usefulness.

National development

At the national development level, planners can use TOPAZ to help them decide

where urban development, primary and secondary industries, ports, airports, and so on should be sited. Interactions considered include flows of materials, goods, and people by road, rail, air, and sea.

Regional planning with the help of TOPAZ involves consideration of the activities that have to go on around a city, such as supplying water, food, energy, and timber, as well as the problems of building the city itself.

At the inner-city or section-of-a-city level, the model can be used to help decide, for example, whether land should be zoned for commercial or industrial use, where car parks should be placed and how big they should be, and where railway stations or bus stops should be located. The group's models can also help planners design residential street networks, building complexes, and multi-storey buildings.

TOPAZ has aroused considerable interest overseas—to the extent of already being put to work on urban and regional problems in the United States—as well as in Australia. In June this year it was discussed at a symposium on planning models held at Reston, Virginia, U.S.A., arranged under the U.S.-Australia Science Agreement.

Dr Brotchie does not see the systems approach as a substitute for creative human planning. He believes it provides, instead, a framework and set of techniques enabling decisions to be made at a comprehensive level with the general good of the community in view rather than just at lower levels and based on narrower goals.

'The earth and its resources are finite', he wrote recently. 'With the increasing population and industrial growth, the usage of many of these resources is already at a critical level or will be in the next 30 years. Energy is already critical in this regard, and it has been predicted that petrol supplies will be exhausted near the end of the century.'

'Most urban plans have design horizons of 30 years or more and should therefore allow for these effects. The implications for transportation are considerable. The quality of life in the next century should also be considered and is extremely dependent on the planning decisions made today. The systems approach provides the key to better living now and in the future through the intelligent management of these resources.'

More about the topic

Planning for better living using systems techniques. J. F. Brotchie. *Archetype*, 1973, 3, 18-21.