Papers in Planning Research

80

Information Technology in Planning Education

by Michael Batty

UWIST
Department of Town Planning
Athrofa Gwyddoniaeth a Thechnoleg Prifysgol Cymru
University of Wales Institute of Science and Technology

PAPERS IN PLANNING RESEARCH.

80.

INFORMATION TECHNOLOGY IN PLANNING EDUCATION.

by

Michael Batty.

MAY, 1984.

Department of Town Planning, University of Wales Institute of Science and Technology, Colum Drive, Cardiff, CF1 3EU, Wales, UK.

ABSTRACT.

This paper discusses the role of information technology (IT) in planning education. The dramatic impact of IT in terms of the computer revolution and its social effects is first sketched as context to the way planning education might respond to the new technology. A brief review of the recent history of planning practice and planning education complements this context and provides a forum for discussing the implications of IT on practice and education. It is concluded that the demands for expertise in IT in planning are practice-led and that schools of planning are at present ill-equipped to respond to these. Moreover as planning education has many different goals and as there is wide diversity with respect to expertise and resources in various planning schools, it is argued that there will necessarily be many different responses by planning schools to the adoption of IT in course curricula, ranging from the raising of awareness to the detailed cultivation of specific skills. Assumptions with respect to the role of IT in general education and in planning education are stated but it is argued that a grand design for IT and planning education is neither feasible nor desirable. IT in course curricula in a typical planning school are discussed,and this is concluded by a sketch of the way the new technology might affect the physical organisation of the school itself.

AUTHOR'S NOTE.

The Royal Town Planning Institute's Course Development Panel have set up a working party to examine the effects of information technology on planning education. This whole question of the impact of IT is fraught with difficulty because as with any revolution through which we are living, we have few prior examples and certainly no clear body of experience on which to draw. Thus any debate which we begin is bound to be tentative, sometimes painful and perhaps inconclusive until we get a feel for the problem. I have written this paper primarily to focus debate in the RTPI's working party but also to set my own thoughts on paper, laying bare the assumptions we might make, and to initiate some debate in the wider community of planning teachers and practitioners. The paper is necessarily preliminary and therefore cannot represent conclusive thoughts on the matter.

THE AUTHOR.

Michael Batty is Professor of Town Planning in the University of Wales Institute of Science and Technology, Cardiff, CF1 3EU, Wales, UK.

INTRODUCTION.

There is now a broad consensus that the late twentieth century marks a time of massive social change, change so rapid and deep-rooted that it threatens many of the values and assumptions which have been comparatively stable over the last two hundred years. Organisation theorists and managers speak of the increasing uncertainty and turbulence in the environment; politicians speak about the collapse of work and the idea of an automated, or in James Martin's (1978) terms, a 'wired society'. There is much talk of the leisure society, the post-service society and a world in which information exchange and communication generally is relatively effortless. Explanations for these forces are varied and diverse. In radical politics,this age of discontinuity represents the collapse of capitalist economies due to their internal contradictions while more conservative views suggest that the major force for change is technological innovation.

Information technology is central to this debate. The revolution in storing and processing information which has come from the development of computers over the last 40 years has yielded a technology of universal applicability which is making inroads into all areas of modern life. In this context, there appear to be two views of the effects of information technology which are worth stating at the outset of this paper for they precondition any approach to the subject area. The first view argues that the development of information technology (or IT as it will be variously referred to hereafter) represents only a quantitative, not qualitative change to the way society might organise itself. According to this argument, information technology enables us to do existing things better - more efficiently,

rather than to do radically different things. Its development represents a change of degree rather than kind. We are able to do things more quickly and possibly more clearly but not necessarily any differently. In short, IT is just more of the same, possibly progressive but also having the characteristics of a mixed blessing.

In contrast, the more radical view of IT suggests that its development is significant because of the qualitative changes it is bringing, rather than any quantitative changes which will be wrought. According to this view, IT will not only change the way we do things but also change the way we think about things. IT provides a new medium for thinking, new opportunities for thinking and thus the implication is that new messages will emerge from the new medium. This view is consistent and complementary with more radical views of social change which suggest that modern societies are undergoing a change as profound as that begun some 250 years ago when man moved from the land to the cities, and that begun some 10,000 years ago when settled agriculture emerged. The high priest espousing this view is Alvin Toffler who conceives these revolutions as waves of change (Toffler, 1980). Of particular importance to the present 'Third Wave' of change is its speed and it is this rate of change more than anything else which makes the discussion of IT and how to react to it in all areas of social life so urgent today. Toffler sums it up best when he says:

> *"The First Wave of change - the agricultural revolution - took thousands of years to play itself out. The Second Wave - the rise of industrial civilization - took a mere three hundred years. Today, history is even more accelerative, and it is likely that the Third Wave will sweep across history and complete itself in a few decades. We, who happen to share the planet at this explosive moment, will feel the full impact of the Third Wave in our own lifetimes."* (Toffler,1980, page 10).

The central assumption of my argument in this paper is that our response to developments in IT and how we choose to react, adapt to and use IT depends upon the broad world view we take, upon our view of the historical and social significance of these developments as encapsulated in the two viewpoints alluded to above. In terms of the first, more conservative viewpoint which emphasises the efficiency aspects of IT, the predominant responses seem to be to let IT pervade social life in an *ad hoc* manner. Within this view, many clearly accept the more radical developments in computing which allow pictures, words and sounds as well as numbers to be processed but the emphasis is on new ways of storing and processing, not new ways of thinking about information and its use. In a sense, this view is concerned with day-to-day improvements through information technology rather than radical changes in tasks, roles and activities which might emerge.

In one sense, this more conservative view is the predominant one in that most who react to IT do so in terms of its day-to-day significance. In the more radical view, it is the development of IT in terms of the new opportunities it provides which is of major concern. Computers do not just store and process, they can be programmed to design. Indeed, even at the most modest level of word processing, there is a sense in which computers are being used in a design context. In the area of innovative programming, the development of artificial intelligence and expert systems is built upon new views not only of how we might process information but of how we might theorise about such information. Behind every expert system, behind every computer picture, behind every computer accounting system lies a model of the task. Sometimes as in conventional information processing, the model is no more than a simple and widely known set of

rules of a non-controversial nature but even in these modest contexts, the fact that the problem has been represented artificially and explicitly in computer terms enables us to develop new and innovative ways of thinking about it.

Before we outline the more prosaic purposes of this paper, let me present an example where these two views of information technology are most at variance. This is in the area of computer art. Traditional artists when confronted with the idea that a computer might generate art, think of the computer as an aid. They consider that the computer can be used as a 'paint box' or at best that the computer can be used to provide them with some instructions about what they, the artist should paint. This is the idea that computers act as the medium through which the artist works. However, in the development of computer art, most of such art has originated by developing the art process artificially, by designing computer models of how pictures might be produced. To a working artist, this idea of formal abstraction in programming the computer to produce art is often outrageous. As Leavitt (1976) so eloquently says: "Computer Art challenges our traditional beliefs about art: how art is made, who makes it, and the role of the artist in society" (page vii).

Although these two contrasting views of IT are important to how we react to such developments, in fact most of the speculations in this paper will present ideas consistent with both views. This is because the role of IT in planning education will be explored largely in terms of existing practice and education, and in terms of the influence of IT over the short and medium terms (to the end of the century). Nevertheless as may already be apparent, I believe that it is the more radical prospects

in the development of IT which will be of most importance in not only planning but in all education and practice in the longer term. Although these longer term developments will be dramatic, this paper will concern them only indirectly. But to preface the debate, the development of computation and information technology and its broader influence on social affairs will first be sketched to provide a context.

It is important to be clear about the meanings ascribed to information technology and therefore as in so many recent discussions of the area, it is useful to begin with definitions. Literally, information technology is any form of technology which enables information to be handled. This definition would include everything from the telephone to the slate and chalk but it is clearly too broad for our purposes. Moreover it is misleading because IT has come to mean *that technology based on digital computation which involves the processing of information in some manner.* This excludes the telephone, the television and suchlike. Moreover, these technologies cannot be changed or manipulated in a programmable way. In short then, IT as it is defined here concerns computer-based technologies which are programmable to perform given tasks , and thus in principle at least, reprogrammable to perform other tasks. Of course, there is a blurred boundary to IT where such technology is linked to others but to fix ideas, it is useful to think of the technology as computers and systems formed from linking computers. In the context of planning at least, this definition will suffice.

In this paper, I will first sketch the recent development of computing and IT to set the context. The main conclusion emerging from these sections concerns what Nora and Minc (1980) have called 'the computerization of society'. Then a brief review of developments in planning

practice during the last 20 years will follow with an emphasis on the demands for IT from practice. In contrast, developments in planning education have diverged from practice and this identifies the central paradox for planning education: that this education is particularly ill-equipped to respond to demands for IT education from practice because planning education is no longer skill-based. These implications for education are then elaborated and it is argued that how one responds educationally depends in the short term on existing course structures, staff resources and attitudes towards what planning education is about. Broad guidelines do emerge with respect to IT education in planning but the diversity of such education and lack of consensus over its form inhibit any grand design with respect to the role of IT in such education.

To provide a little firmer sense of how IT might develop within planning education, I will then sketch the various decisions with respect to course curricula which we are debating at present in my own planning school. I will also provide some ideas as to how we are 'automating' the school, and finally draw these threads together through some general guidelines. One central message of this paper is that IT will not suddenly happen everywhere but that there are many crucial choices to be made with respect to how IT should be developed. This is particularly true in planning education where the ability to respond and the kinds of responses to these developments varies dramatically between different people and different places. Finally, this paper will only indirectly address the question of the most appropriate IT education for planning for a more direct attack on this question involves questions of planning education generally.

THE COMPUTER REVOLUTION.

The digital computer was invented independently in several different places between about 1937 and 1945. It represented a synthesis of the very simple idea that decisions and objects could be represented in binary fashion - as yes-no symbolism - with the prevailing electronic technology. In one sense, the computer was idea-led, rather than technology-led but its subsequent development from the development of the transistor in the late 1940's in the Bell Labs to Silicon Valley and the micro-revolution, has been very definitely technology-led.

Although the growth of the computer industry has been like most others in terms of its profile - a slow, gradual start, then explosive growth, and presumably a dampening down in time as the market is saturated, there is a sense in which it is different. The computer is the first, perhaps only general purpose machine and thus its universality means that it has an all-pervasiveness which other technologies have never had. This universality was realised from early days but its all-pervasiveness is a much more recent phenomena, a product of the micro-revolution. We now all have experiences of the power of microprocessors with the same machines being used to perform many tasks. The micro-computer I use to run my planning models is that used by my secretary to type my papers and that used by my son to run his games, and so on. Both this universality together with its massive social diffusion to all areas of modern life which has occurred in the last 7 or 8 years was never anticipated, even by those close to computing. Alvin Toffler (1970) never mentions the possibility in his book *Future Shock*, while Donald Michie (1971),the doyen of British artificial intelligence writing in 1968 said: "For many years, only the rich will be able to install terminals in their private houses...".

Although the universality of computers in terms of the tasks they can be programmed to perform is the essence of such machines, the changing distribution of major tasks performed by computers during the last decade is quite dramatic. A recent estimate (Jones, 1983) concludes that 90 per cent of computers are now engaged in word processing. A decade ago, number crunching in both scientific and business activities was the major role. If the present growth of graphics continues, in a decade a major role could be in picture production. Indeed in the future a balance might emerge in which the predominant uses of computers would still be word processing but with picture and sound processing highly significant. In fact, the eventual use of computers could reflect the distribution of tasks and activities (in terms of the mediums through which they are conducted) in the pre-computer age, most people working with words, less with sounds and pictures, least with numbers.

Yet even this balance could change for the computer does not simply offer a new medium. As implied in the introduction, the medium throws up new messages, computers are not just simply storage and processor devices for existing information, they can generate new information. This does represent a real break from the past in that the computer provides a formal medium for thinking in terms of words, pictures, sounds as well as numbers in ways not possible a generation ago. These possibilities find their clearest expression in the development of artificial intelligence, and it mirrors the view that the real frontier in the computer revolution is in software, not hardware. Although there are always hardware barriers to the development of new machines such as robots, many of these new machines in themselves are computers and their operation is through programming.

A decade ago, talk of robots seemed fanciful. Indeed, artificial intelligence appeared a large spender with little immediate payoff. All that could be done was to program robots to do the simplest of tasks. Moreover, the mathematics involved was unconventional and the whole field had an ethereal quality which conflicted with establishment views of science. Since then enormous strides have been made in artificial intelligence. The use of robotics in factories has changed the intellectual climate but it is now also clear that the way the field is developing intellectually is dominated by thinking about qualitative issues in formal terms. The field is mathematical only in the sense that it builds on logics, it is certainly not quantitative and thus it has all the potential to yield the long sought after extension of scientific thinking to human affairs.

In the design professions and in management, there are already many dramatic possibilities for this kind of innovative computing. The development of expert systems - computer-based protocols which enable systematic interactive problem-solving to be developed by non-expert users - is proceeding apace. Expert systems involve setting up information or data bases based on qualitative and quantitative information describing any system, and developing rules which synthesise the information with respect to finding solutions to problems posed for that system. The rules are based on artificial intelligence methods and languages. Of course, these methods do not necessarily *guarantee* any better solutions than those found by traditional methods but the ability to synthesise diverse qualitative information, to present this intelligibly, quickly and concisely in an interactive context, and to develop solutions under different assumptions are factors which have traditionally been difficult to guarantee.

There are some dramatic demonstrations of expert systems in areas such as

medical diagnosis, geological prospecting and chemical synthesis where problems are relatively well-defined, but in many more modest contexts, these ideas are appearing. For example, in the teaching of statistics using computers, students now use packages such as SPSS or MINITAB which are accessed interactively, and which enable the student to explore the capabilities of the packages in almost conversational mode. If you switch on any terminal to our VAX computers at UWIST and log in (USERNAME and PASSWORD), typing MINITAB, followed by HELP will give you access to an expert system which gently aids you in your problems involving statistical analysis. This will not teach you statistics but it will help you to learn how to apply statistics and some insights which you could not get from lectures and books would emerge. The same is true of many general purpose business accounting and word processing packages. For example spread sheets such as VISICALC or LOTUS 1-2-3 are like all-purpose expert systems which enable you to frame a variety of problems which involve some accounting, calculation and information storage.

More specific types of expert system are now entering the planning and design fields. In architecture, computer-aided draughting systems and design systems are being adopted in practice and are forcing architecture schools to develop expertise in their use. But as implied earlier, such systems are not simply new mediums for existing activities, for contained therein are new ways of thinking about design, of doing design and of articulating the process of design and reacting to its products. The fact that such systems and the demand for them seem always to emerge from outside the immediate educational context is a worrying feature of the computer revolution for it suggests that education is often ill-equipped to adapt to such developments. A year ago I saw a television documentary about computers in a Swansea school. It showed children using some software on

a micro-computer to design or at least layout houses on an estate, and then to use the design system to view the result in 3-D. How many architecture and planning students have ever used such a program? How many teachers and researchers in these subjects are developing this type of software? How many in architecture and planning want to do it this way anyway? There may be all kinds of reasons why one should *not* develop such uses of the computer in design but my point is that the challenge comes not from within education but from without. The computer revolution has influenced practice much more than education, demonstrating the massive liberating force which the computer offers and presenting a major challenge to more conservative, professional education.

THE INFORMATION REVOLUTION.

The distinction between computers and information very crudely marks the distinction between individual, professional-scientific roles for computer-aided problem-solving, and the use of information technology in a broader social context. Emphasis on the information revolution rather than on computers *per se* shifts the debate to more prosaic and less controversal questions primarily associated with using computers to store,retrieve and communicate informations. Although somewhat of a caricature, it could be said that practice based on day-to-day management is much more concerned with the information revolution while education should be more concerned with the computer revolution with the two themes closely permeating one another through the influence of education on practice and vice versa. Nevertheless, notwithstanding my argument that the uses of computers to process information is less controversial than using computers to engender new ways of professional-

intellectual thinking, the impact of the information revolution on society can still be controversial and dramatic in general terms.

At the core of using computers to handle information lies the idea of an information system. Such a system is a set of principles for the efficient storage and retrieval of the given set of information in the first instance, but is also influenced by ways in which data must be related which depends on the reasons for handling information and the way the information is to be communicated. There exists a general body of principles associated with best data base design but every problem, every set of information has its own characteristics which affect the way the information is stored and processed. For example, numerical storage and processing has very different requirements from text and graphics storage and processing which often require special attention to the way the information is configured and related. At present, ways of merging differently configured data bases and ways of communicating such data are major problems being addressed by the systems analytic community.

Three major uses of information systems seem to be emerging. First, there are those systems which are largely designed for *professional-scientific* use. These might range from systems of medical records to specialist library uses and in virtually every area of professional life such systems are appearing. In our own field, census-based data systems and special software to process such information has recently appeared following the 1981 Population Census (see software packages such as SASPAC and GIMMS), while remote-sensing systems using LANDSAT data are of obvious relevance. These types of system are now universally available in that all that one requires to access the system is a computer terminal, a telephone and a modem, and of course access to

the computer on which the system is available.

The second type of information system involves the day-to-day *management* of work tasks themselves. These first appeared 15 or more years ago concerning the scheduling of activities in manufacturing processes but in more public view, in airline booking offices, banks and such like. At the personal level, accounting systems such as those based on spread sheets, word processing systems and other financially-orientated software represent a similar thrust. The third form of system which is making its appearance is the *public information system.* The best known of these in the UK are the view data systems such as PRESTEL, ORACLE and CEEFAX but others dealing with travel information, tourist information, teleshopping and such like are on the way.

There is a sense in which all these types of system merge into one another. Clearly library systems range from the most private and specialist to the most public and general, while management systems such as those in banks can have both professional and public access and uses. Then each of these types of system involves the idea of an expert system. The ability to synthesise diverse informations quickly and intelligently, and the presumptions programmed into such systems that users may need to be "helped" are all emergent features of this technology. There is also the feature that the growth of such systems does not lead to less tasks but to more; not to less or the same information being processed but to more. This occurs due to the efficiency of processing, the fact that users see new ways of linking unlike information, and the fact that users have more time to think about how to use the information they are interested in. In this way,

the developments hinted at in the previous section are part and parcel of the information revolution.

Barrett and Leather (1983) in their excellent report on information technology in planning practice argue that the real importance of the information revolution lies in much greater accessibility to information which involves the networking of computers. Once computers were designed in the late 1960's for interactive use, the possibility emerged of linking one user to several computers as well as several users to a single computer. Combined with notions about linking computers together directly to enable different tasks to be implemented, and using the same computer for many different tasks, the prospect of a society based on a formal network of electronic linkages has emerged. This is the "wired society" (Martin, 1978), a society in which any individual can access any other individual through any computer. This image is someway off but local developments, for example in terms of office automation, and the concept of the personal workstation where any user can generate a variety of tasks, are now well-established.

At present (May - 1984), there is a proposal in my own college (UWIST) to establish such a local area network which would provide everyone with access to a workstation from which many types of task could be undertaken (Turk, 1983). For example, at the level of day-to-day behaviour one could have a paperless office in that all mail could be electronic and personal interactions at least on a pairwise basis could be through the network. Professionally, research and teaching could be managed in this way as well as using the workstation to access external information systems. Already these behaviours are possible

and exist for a few. In some US universities, notably Carnegie-Mellon in Pittsburgh, all students have to purchase an IBM-PC (Personal Computer) on joining which then becomes their workstation during the time they attend the university. Of course, there are major questions of cost, equity and relevance but the prospect is very close in many large institutions such as universities, governments and some firms.

Nora and Minc (1980) in their report to the French President in 1978 forcibly argue that these developments "...will alter the entire nervous system of social organization". This is already happening in the low-key, all-pervasive way in which it is bound to happen. We all have homely examples of these changes. At a recent meeting of the RTPI (Royal Town Planning Institute) Research Board which I attended, we discussed office automation within the Institute offices themselves, and the way in which information flows within the Institute involving officers and members could be enhanced and costs lowered through new technology. Some wordprocessors and computers had already been introduced and it was already clear that the roles and responsibilities of officers and members alike were beginning to change in response to these developments.

As Toffler (1980) amongst others argues, the impact of these changes will be dramatic. The implications for how we engage in professional tasks in planning will surely be altered by the development of information and expert systems. There will be major changes in the way people behave, the way economic systems are organised, and the way settlements are developed. Clearly planning practice and education will have to respond to the subject matter of their concern - cities and regions - and the

effects the information revolution will have here. As yet, it is quite unclear as to what these effects will be. The conventional wisdom supported by much contemporary but mainly anecdotal evidence suggests that cities will continue to spread out, but recent trends also suggest the reverse. Naisbitt (1982) argues that high tech means 'high touch' - that the alienation of technology forces people to compensate by increasing personal contact, and this does not suggest that 'working from home' will ever become a major activity.

The view that quantitative change does not bring qualitative change seems too simple an interpretation of present trends. There is evidence that the most obvious and mundane of these changes leads to qualitative change in roles, in organisation and in ways of working. Moreover, it is also clear that the future is neither determined nor determining, that there are crucial choices to be made over how information technology is to be developed. This is as important to planning practice and education as any other area of modern life. The rest of this paper will seek to address these issues.

THE EVOLUTION OF PLANNING PRACTICE: AN ACADEMIC PERSPECTIVE.

Having sketched the context in terms of the development of information technology, it is now necessary to sketch it in terms of planning, of developments in planning practice, and then in education. The previous argument emphasised the point that demands for information technology seemed stronger from practice than from academia, and this has certainly been true of planning practice. Yet planning practice and education have both evolved rather dramatically during the last thirty years.

Schon (1983) sums up the dilemmas facing modern town planning when he says:

> *"The institutional context of planning practice is notoriously unstable and there are many contending views of the profession, each of which carries a different image of the planning role, and a different picture of the body of useful knowledge"* (page 204)

This has certainly been the case in British planning although within this instability there has been a steady growth in the demand for information technology which parallels the growth in other professional areas.

When the British planning system was established in the immediate post-war years drawing together a century of *ad hoc* planning legislation, there was a clear consensus over the role of the town planner as a professional. Town planning was essentially about the physical betterment of town and country, albeit in a social context and for social ends. Education was essentially professional in orientation and there was little motivation or aspiration for any intellectual aggrandisement in academic terms. Planning was conceived of as a technical skill-based activity, akin to architecture and civil engineering. To say that practice and education were in harmony is perhaps too strong but both were close in spirit and had common goals.

Since then planning education has diverged from practice, in search of a better understanding of cities, of how planning as a technical and political activity might be pursued more effectively, and latterly in search of a better understanding of planning itself. Practice has been much more responsive to the national mood and to the priorities of the state. From a concern for design in its social context, practice took on the more ambitious aims of strategic thinking which involved a

flirtation with scientific enterprises. The systems approach which dominated practice in the late 1960's gave way to more local issues in the late 1970's and today practice is characterised by a concern for the small-scale and a concern for economic development set within a concern for efficient management and resource allocation. Planning has become more short term, and has retreated from its strategic focus. In Breheny's (1983) terms, it is now characterised by an 'insular pragmatism'.

The original change from a design-based activity to a more strategic focus was spurred on by the inadequacy of the traditional design approach in getting to grips with the obvious urban complexity which has characterised cities since World War 2. The retreat from strategic thinking which began almost as soon as this model had been articulated can be traced to national economic circumstances, the collapse of the world boom, and a more evident concern for questions of social equity and distribution which the systems approach found it hard to cope with. *Planning as Civic Design* which characterised the 1950's evolved into *Planning as Strategic Design* in the 1960's. A shift to *Planning as Strategic Management* characterised the 1970's becoming *Planning as Local Management* in the 1980's. But during this period, there has been a continuing blurring of styles, and an increasing variety of approaches within the predominant model. During this period too,professionalism in planning has dramatically weakened. Planners see their role much more as managers and bureaucrats,rather than ascraftsmen or designers. Nevertheless, the profession and practice has never embraced the drift to the social sciences engendered by planning education to any degree, and a skill-base still exists in practice.

Since the postwar years, there has been a steady increase in the concern for IT in planning practice. Questions of efficiency in the management of the planning enterprise have been to the fore, and as Long (1984) so cogently points out, planning practice has always been in the vanguard of such change in local government. The use of computers in planning practice came originally and is still largely devoted to the efficient storage and processing of survey/census data. However, during the 1960's, the new fervour for a systems approach to planning extended the traditional role of analysis to more complex techniques of modelling and forecasting. Combined with the recognition that land use and transport were a function of each other, planning practice during the 1960's became more like engineering with its concern for system and function. From afar, this wave of forecasting in planning using the computer gave way to the traditional more mundane uses in the 1970's in terms of information systems, but this too continued to grow in importance.

In the 1970's, research began into comprehensive information systems for planning practice. GISP (General Information System for Planning) and LAMIS (Local Authority Management Information System) were two of several attempts to design and implement such systems in a highly centralised fashion. The experience with these systems was mixed, inevitably dated by technology change but nevertheless represented the key focus of information technology in planning practice during this time. Planning authorities also found that it was they who had the expertise to aid the wider interest of the local authority in IT, and the Research and Intelligence Units which emerged separately from the planning function, were often spawned by the planning section. More recently there has been a growth in interest in practice for development

control systems, graphics and mapping but it is now clear that the interest in practice is much more with information than with plan-design and forecasting, the traditional concerns of the 1960's.

The issues in adopting information technology in planning practice do not relate just to the types of task involved but to the way these tasks are organised within the authority. Indeed, Barrett and Leather (1983) argue that such organisational questions involving the degree to which the new technology is used to centralise control in an authority are as crucial to planning practice as are the uses of the technology for particular planning tasks. The organisation of practice is thus influencing the way IT is developed. As computer use becomes more pervasive, it is clear that the degree to which information systems are centralised, is weakening. Moreover, local government reorganisation in 1974 separated authorities into strategic and local functions, with most IT located in the higher level authorities. There has thus been a natural growth in interest and application at the district level, and as planning has retreated from its interest in strategic questions, the emphasis has changed towards the adoption of IT at the district level. Barrett and Leather (1983) sum up this history rather well when they say:

> *"Overall, we can see that the present pattern of new technology applications in planning still remains dominated by computing and the analysis or manipulation of* data. *But within this, the focus has shifted from large scale property data-base approaches and integrated forecasting and modelling towards more detailed monitoring of key issues.....The most recent area of growth is in applications related more closely to operational and management requirements....."* (page 20).

Articulating the demand for IT from practice is further confounded by the present attitude towards planning in government. The present prospect for a major reorganisation involving the demise of the metropolitan

strategic level is bound to change the picture with respect to IT. Barrett and Leather's (1983) point that IT is likely to grow most dramatically at the district level for local tasks is likely to be enhanced further by such developments. Bardon and Stothers (1982) also show that there is enormous latent potential for the introduction of IT into planning. Together with a dramatic change from centralised to de-centralised computer systems and from main frame to micro, there is bound to be a massive demand by practice for planners who are computer literate. The estimate that only 5 per cent of professional planners have such literacy is one index of the problem facing education while anecdotal evidence from job advertisements suggests up to 50 per cent of all new positions require some interest/facility in IT.

From current practice, it would appear that the greatest demands are for planners with some experience in computing in general, across the range and with particular expertise in data base design and information systems. Such planners would be able to design development control systems, use standard information system packages, and process census data. There seems less demand for more specialist knowledge of mapping and graphics because these areas have not been affected by IT as yet. But it is in these areas that the greatest change will come in the next two decades. Lastly, in the traditional areas of modelling and forecasting, there is less demand for expertise although it is likely that computer literacy in planning would embrace such areas anyway. Unashamedly, this is an academic's view of practice culled from secondary sources. Quite clearly, what is urgently needed are the views of practitioners with respect to the profession's need for skills in IT to supplement this paper and to complement the report by Barrett and Leather (1983).

THE EVOLUTION OF PLANNING EDUCATION: A DIVERGENT PATH FROM PRACTICE.

To produce designers, scientists, social theorists and managers is the divergent aim of planning education. Donald Schon's point about 'many contending views of the profession' quoted at the beginning of the previous section says it all but this divergence and ambivalence has developed over the last 30 years. How has it come about and what are its implications for IT in planning education? At the beginning in the late 1940's when town planning first became institutionalised in practice and in higher education, there was a consensus that education should be professionally orientated. However the changes in practice combined with the quest for intellectual aggrandisement meant that education and practice began to diverge. The first major change was forced by the recognition that cities were complicated sorts of places not understandable as physical artifacts alone. Such views had been part and parcel of planning education since the turn of the century but only began to force the pace in the late 1950's when planning as design became an increasingly controversial activity.

The shift from planning as design to planning as science, or systems science which was the result in the 1960's, was rather short lived. Although planning in this view was still skill-based, the subject area was firmly set along the road to the social sciences, and during the 1970's, the view that planning was applied social science became firmly established. Planners thought of themselves as social theorists and advocates articulating problems of equity rather than efficiency, and the importance of the physical-spatial dimension became less. Some argued that as physical form was only an outcome of social process, the

concern of planning should be primarily with social process despite the instruments which society had devised and approved for physical-spatial control.

The systems approaches of the 1960's injected some concern for computing and data-base systems into planning education but the attention given to planning techniques under whose umbrella such concerns lay, decreased in importance during the 1970's, despite their continued presence in practice (Bardon and Stothers, 1982). This reaction against technical education coincided in the UK with severe national economic problems and more generally with the end of the world boom. Systems planning and computer modelling was part of planning in an era of growth, so the argument went, and as growth had now gone, it was no longer of any importance. In its place, planning in practice moved towards more local issues, towards management, towards a concern for the local economy, and towards a concern for the development process. Planners were conceived of as agents of change in facilitating development, no longer as designers, forecasters or social advocates. In a sense, this concern for more local rather than strategic, more comprehensive issues represented a move full circle back to the concerns of the designers in the early 1950's but without the technical apparatus of design. New techniques of financial management are now required and planning education, inevitably ill-equipped for this, is beginning a painful transition in this direction.

A number of features stand out in terms of the evolution of planning education during the last three decades. First, there has been a progressive deskilling in terms of traditional design and analytical skills. One has to be careful about pushing this argument too far

because new, less obvious skills have possibly taken their place. Planning is taught as a much more reflective activity, and there is a much greater methodological awareness. Nevertheless planners are now less 'obviously' useful to practice in the immediate sense and find it surprising to think of themselves in traditional roles. In this sense then, education and practice have diverged (Batty, 1983a).

The second feature of the experience relates to the breadth of material facing any student of planning at present. As the roles assumed of planners and by planners have diversified, the educational experience has expanded to embrace at least a little of all the associated subject matter. Keeble's (1959) discussion of town planning education in which he defends the case for planning education in which a range of material and disciplinary perspectives are synthesised seems a little amusing in the light of the massive breadth now encountered. It is extremely difficult not to think of the present education as superficial in the light of what is presently taught. A good analogy to the evolution of planning education is the layer cake. As planners have diversified their roles, layers have been added. Figure 1 presents my version of the evolution in terms of the structure of education which existed, exists and might exist at the mid-end years of each decade since the 1950's. The last of these profiles which characterises the late 1980's gives local management the predominant role and the arrow in that diagram indicates a sense in which this evolution has come full circle. In fact, a spiral might present a better geometrical illustration but I will not pursue the analogy.

A third feature relates to the difficulties of making sense of such

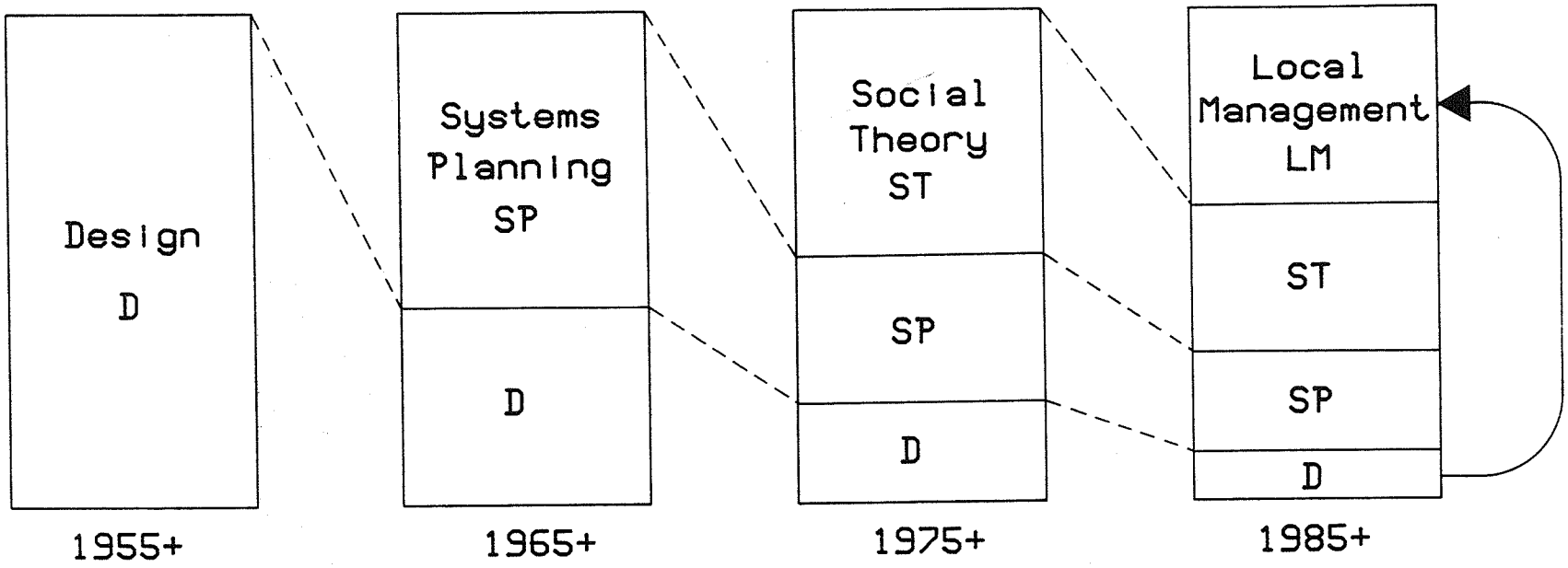


Figure 1: Styles of Planning Education.

diversity, of synthesising the layers. There is the obvious point relating to the superficiality which must be more significant than in a narrower, deeper form of education but besides this, there is the difficulty of absorbing different and sometimes contradictory approaches. Education in which so many points of view compete for pride of place can be an ideological battlefield. Some would argue that all vibrant academic environments should be like this but there is a limit in that it requires the very best students to benefit. Most education cannot aspire to this possibility and in the general case, many conflicting viewpoints can lead to confusion.

The interesting feature of the layer cake analogy is that the model can be used to describe the interests and expertise of staff within schools, to define differences between schools, to define the views of the profession to education, even to define the way schools have evolved. Because the RTPI require all accredited planning schools to incorporate each layer in some measure, each planning school will have at least one representative of each viewpoint. The profile of each school will also vary, dependent largely upon the date at which the school was established, and upon historical chance. Although each of the four profiles in Figure 1 represents what I consider to be the typical profile at that point in time, there is also substantial variation around each type. As the evolution of this education has occurred during a period of growth, the incorporation of new viewpoints has not been particularly problematic although the present pressure to extend competence to management and development is proving to be extremely difficult in a time when schools are contracting. The same general difficulties are encountered in the growth of information technology.

There are several immediate points which emerge from this discussion with respect to IT and planning education. There is the obvious danger that IT will be established as yet another layer and this would be particularly inappropriate given the all-pervasive nature of the issues. IT is not something to be added, it is something to change existing ways of doing things. Then there is the obvious difficulty that schools will be unable to respond intelligently if they lack staff expertise, and other resources. Lip-service to IT is not an appropriate response because it inevitably increases the degree of superficiality in planning education in general. There is also the tendency to incorporate IT in areas of social science expertise concerning futures studies, industrial restructuring and the social effects of automation which are of course relevant but at the expense of the skill-based focus on IT which is the dominant demand from practice. Finally, there is the problem that few if any schools will be able to respond with the right blend of IT education due to the lack of staff expertise in certain areas. There is little tradition of IT in urban design, and there is little expertise in planning on data base systems and information systems generally. There is little on mapping but a good deal on modelling and forecasting. The distribution of this expertise then does not really match the demands from practice and even in schools where the technical skill base is quite significant, there is a substantial reskilling to be done among staff before a balanced range of skills can be introduced into the curricula.

This discussion suggests that there is no single best strategy for the introduction of IT into planning education. Such education is so diverse that it would be foolhardy to insist on a single diet of IT.

There may be certain elemental units of training which all schools could adopt but it is likely that each school will have to respond according to its present expertise, its aspirations and its potential. The main criterion will involve an intelligent response designed to achieve the needs of practice (and research perhaps) in the most appropriate way.

Although the key driving force to developing IT in planning education is emerging from practice, this in turn is being forced on practice by the widespread dissemination of the technology in society-at-large. It could be argued that practice is as ill-prepared for these developments as education, at least in the conceptual sense. A decade ago, few in planning could have anticipated that the technology of the 1960's style planning would reassert itself in such a dramatic way. Barrett and Leather (1983) indicate this element of surprise when they say: "In many ways, the current wave of interest in IT has a 'deja vu' feel to it..." (page 5). Recent reports on planning education have barely referenced the phenomenon. For example, the report produced by McLoughlin (1982) and his colleagues for the Social Science Research Council, never once mentions IT. Indeed, in so far as it is even hinted at, the predominant view seems to be that IT is a distraction; at best it will enable planners to retrieve and analyse data more efficiently.

Planning education is therefore particularly ill-equipped to embrace IT, largely in my view because of the present confusion over its goals. The major block of time spent in planning courses concerns reflective pursuits, reading, esssay-writing, listening to lectures and it is difficult to see how enough time could be made available for skill-

based education in IT. A consequence of any skill-based education involves the need to accept that long periods of time need to be spent polishing approaches to relatively small-scale problems, in contrast to more reflective education in which bigger, more 'important' problems can be addressed in a more leisurely way.

A basic assumption of this paper is that planning education will not dramatically change in the near future and thus the suggestions to be made will refer to the short and medium term. During this period, planning education may change course in directions which have not yet been anticipated, and IT may influence this, but I will assume that whatever IT education develops, it will make use of currently available technology. In short, I will not assume that the drama of fifth generation computers will have any effect on the proposals made here. I will also base suggestions on the identifiable needs of practice and the present structure of education. The strong pressure from practice on education to make it less theory-based, to make it more skill/ management based will I assume be countered by the other pressure which seeks to make such education more academically respectable. These two forces combined with the constraints formed by the present expertise of staff are such that the professional orientation of planning education is unlikely to change radically in the near future.

There are obvious dangers that planning shcools will opt out, that they will argue that IT is a distraction, that the real problems relate to industrial restructuring rather than using IT to develop new approaches. There is the danger of the technological fix in that some schools will get hung up like many areas of modern society on the new technology

itself. Then there is the danger of a weak response by simply layering IT on top of the existing rich but poorly structured diet of existing education. Nevertheless the all-pervasiveness of IT will force all schools to react in some way and thus the following section will be concerned with charting some of these possible reactions and judging their appropriateness.

THE EDUCATIONAL IMPLICATIONS OF INFORMATION TECHNOLOGY.

The revolution brought by information technology is likely to represent a major social upheaval, not only in attitudes towards work but in ways of thinking. As Toffler (1980) points out it is the speed of the revolution which is its most daunting feature. Young children of the mid-1980's and beyond will have an entirely different attitude towards the use of computers than any previous generation and this will surely alter social mores. Young adults in the year 2000 will consider any type of day-to-day management which does not involve computers as bizarre. Their attitudes towards getting things right or wrong will have been influenced by learning with computers through trial and error and learning using interactive games. Computers producing pictures will seem entirely commonplace and the demand to use these mediums for such activities will be total. In this sense then, at the end of our short-medium term future for IT in planning education, it is the students who will be making all the running, not the present structure of education or practice, or our own attitudes. In fact, during the next 15 years students will increasingly affect our responses to these issues.

Consider a child born in 1966. His or her formative years of primary education were unaffected by computers or video games. The child would

be about 14 before there was any sense that a revolution was occurring in information technology and by that time, their educational responses would have been formed. Nevertheless, these students are sympathetic to IT and hungry for skills in its use. These are our 1st and 2nd year undergraduates. Contrast this with those born in 1956. In 1979 when we held an *ad hoc* course in FORTRAN programming for our graduate students (aged then 22/23), there was a near riot. "What had this to do with planning education or society-at-large?" they said.

The child born in 1976 however will already have experienced computers if he or she is part of the middle-classes. Indeed, most schools now have computers and although their use is minimal, such children are being made deeply aware of the potential of these mediums. It will be 1994 before these children enter the university system. By then, they will be so steeped in the use of IT that even if the courses they are taking do not use IT in diverse ways, they will do so. The child born in 1986 will be typical of those thereafter for by the year 2004, the micro-revolution will have run its course, and computation will no longer be an issue. These students will wonder what all the fuss was about and papers such as this will be curios from the past.

Of course there is always a twist in the tail. Papert (1981) speaks of an information-rich and information-poor society, of those who are computer-literate and those who are not. Development is inevitably uneven and there are grave dangers of these types of inequalities becoming rife. Moreover, the future is in no way determined. Educators have a choice and in certain areas of intellectual life, the idea that such machines may be of any relevance whatsoever is abhorrent. Art is

the fascinating example introduced in the introduction to this paper but even in this hallowed area, it has not been possible to contain and restrict the use of the computer. Nevertheless, there are crucial choices to be made, and the development of information technology is already pretty uneven. In the professions, some automation has already been restricted by social choice. For example, in medicine, the general diagnoser software developed nearly 2 decades ago has made little impact. In architecture, there is much less use of automated draughting systems than their advantages might suggest. In manufacturing industry generally, many firms have been forced to 'go easy' on robot control and automation.

Universities and other institutions of higher learning are also beginning to react to IT in unanticipated ways. Harvard have already made it mandatory for all their students to have graduated in simple programming, whatever their area. This is a little like the 'Use of English' certificate required by British Universities. I have already mentioned the 'hard-wiring' of university institutions such as Carnegie-Mellon, and MIT. New groupings of subject areas are emerging around the computer. Computer-aided design, the systems sciences, graphics and most professions concerned with problem-solving are receiving a major boost and reorientation from the development of IT. All these present the general background against which planning shcools have to react to the adoption of IT.

As I have indicated earlier, I do not believe there is any single strategy or model for how IT should be adopted within planning education, although there are a series of assumptions relating to IT and education which are likely to affect any form of response. To proceed, I will list these assumptions, beginning with a set pertaining to IT generally,

and then a set pertaining to planning in particular. To give some firmer proposals for IT and planning education, I will present the discussions we are beginning over our course curricula at UWIST in the next section. Thus these assumptions listed here reflect those issues which I consider to be a combination of the most likely and the most desirable affecting the development of IT and planning education during the next 20 years.

General Assumptions.

1. Generally IT will permeate all professional work arenas but there will be an uneveness in adoption, dependent on attitudes and resource constraints. There will be both positive and negative decisions made concerning its development.

2. In education, there will be dramatic bursts of increased interest at specific times. At present, there will continue to be a growing interest and sympathy to the area among students which will dramatically increase in the mid-1990's as a generation brought up entirely around the computer enter higher education. By the year 2000, demands for IT in higher education will be student-led.

3. The present emphasis on training scientists and technologists will continue for the foreseeable future, and will be tied to national economic priorities in terms of IT.

4. The growing demand for CPD (Continuous Professional Development) will be more muted than presently anticipated due to the fact that it is easier to train new people in new ideas, due to the collapse of work and due to changing attitudes towards a life-time of work.

5. There will be increased pressure to validate all courses in terms of their adoption of IT (The CNAA paper 2a/27, 1982 suggests this trend).

6. A debate concerning the amount of time to be spent on labour-intensive subject areas such as IT will begin in schools and universities, in a variety of subject areas not previously considered as science/skill-based.

Assumptions Specific to Town Planning:

1. IT will be adopted very unevenly, between departments/schools of planning, between different areas of planning education, and between different staff members.

2. All courses will adopt an elementary stream involving IT but there will be a recurrent debate as to the need for developing *IT awareness* or *IT skills*.

3. IT awareness will consist of introducing ideas through access to package programs, such as statistics and census-based systems.

4. IT skills will involve introducing students to computer programming and possibly computer-aided design.

5. The development of basic awareness and skills will in a sense be a short-lived phenomenon in that students in the year 2000 will already have these skills from their previous education. Thus in 15 years time, the debate over IT and planning will begin again, this time involving how planning as an activity should be improved using IT.

6. IT education in planning is all-pervasive and should be treated as a separate stream, not simply added, evolved or incorporated as part of planning techniques.

7. Additional time should be allocated for IT education, and this means certain areas of existing teaching should be reduced.

These assumptions reflect my own biases and intentions and I would not expect there to be agreement about them, given the very divergent views of planning education. Nevertheless, they do provide a basis on which to begin discussion as to precisely how IT should be developed in planning education. Moreover, these assumptions do admit that IT will be adopted quite differently by the various schools, but that schools will find it extremely difficult to decide which areas to reduce in importance given existing constraints on expertise, and staff attitudes. To take these ideas further, I will now sketch how these points are being used to direct discussion on course curricula in my own school, UWIST.

ON COURSE CURRICULA.

A typical planning school in the UK has both undergraduate and graduate course programs which are designed to produce professional town planners. The undergraduate course is usually 4 academic years in length while the graduate course is 2. At UWIST, the undergraduate course is a 3 year degree programme followed by a 2 year diploma, the first year of which is taken in practice. This so-called 'thick' sandwich is successful in that it enables a separation to be made between more

academic pursuits in the first part of the course from the professional ethos which is asserted in the later years. There is little pretension in the program to developing research abilities except in the most general sense although there is specific emphasis on forecasting skills and social science theory. There is some design teaching in the early part of the course, and management during the diploma years. The coordination between various skills is difficult to effect and implement through projects and there are the usual problems facing such courses as to the balance between competing interest. The course is under continual review and there is plenty of scope for introducing IT at various stages of the 5 year package. All in all the course is deemed successful in that most areas are covered in the 5 years and this length of time gives great scope for students to mature within the program.

The graduate course in fact is quite different. Although still a 'conversion' course in professional planning terms (a course designed to 'convert' first disciplines such as architecture and geography to town planning), the ethos of the course is social science research and the development of methodological awareness. The course is reflective rather than skill-based and most students entering the program do not have highly developed technical skills in that their first degrees are mainly in the social sciences. Social theory and planning administration are the main focii of the course. There is hardly any design work and no pretence at educating students in technical skills. As in the undergraduate program the course is under continual review. There is a stream to the course for students from the Third World which is slightly more skill-based but because of pressure on time, there is

little scope to introduce IT into the program.

In summary then, there are clear differences between the two courses, which have major implications for IT. IT is a skill-based activity and it is clearly easier to introduce it in the undergraduate program. Moreover, students are more receptive to new ideas at this stage and less likely to see their options being closed by the development of material in which they may not be centrally interested. Staff expertise and interest is also a crucial factor in the development of IT. At UWIST out of 16 academic staff, the largest group have expertise in quantitative analysis, 5 are concerned with this area while 3 others have worked with quantitative methods and/or are sympathetic to planning as a technical activity. 2 staff are designers - architect-planners, 3 are social theorists/social planners while 2 are managers. This does not add up to 16 which shows the arbitrariness and difficulty of such classification. In fact, one of the major common interests is in transport but this is not an identifiable activity area in the alignments within the department.

At this point, it is worth digressing a little to consider the areas of any planning course where IT could play a major role. In one sense, this has already been anticipated in previous discussion of IT and planning practice. Bardon and Stothers' (1982) survey and Barrett and Leather's (1983) analysis suggest that data-base/information systems, modelling and forecasting, and graphics/mapping represent the major areas where IT can have an impact, with development control systems representing a major outgrowth of the interest in information systems more generally. Mapping this distribution of IT activities onto the structure of planning education is reasonably straightforward in that

the model of the technical planning process, the so-called rational decision model, represents the general order in which these tasks are introduced in planning schools. In fact, these stages - survey dealing with information, analysis dealing with forecasting and modelling, plan-design, and implementation with monitoring and control, are elaborated in some considerable detail in planning courses. In fact, some of these tasks concerning information systems design imply more general courses in information *per se*, while the use of IT in urban design very much depends upon the extent to which physical design is conceived as part of professional planning education. Graphics and mapping too might be considered as background skills to be acquired as part of general planning education.

These activities are fairly easy to fit into existing curricula although it is more difficult to see how related areas of IT can be developed. For example, ideas about the 'wired society', about networking and communication emerge from both skill-based education and more substantive courses, and it is doubtful if much formal emphasis need be placed on them. That is, such ideas should emerge spontaneously from the general emphasis on IT. In terms of the impact of IT on urban society, on cities and regions, such ideas will make their appearance in relevant courses - location theory, urban planning, spatial development, retailing and so on. In terms of planning practice, office automation and organisation can be included here. There is however a more general point as to whether or not planning courses should contain a course on *Futures* which would synthesise many of these developments and set them in context: this is an important area worthy of explicit development.

In UWIST, we are responding to these developments by both raising awareness

and imparting skill in IT. In the undergraduate course, we are attempting to achieve both whereas in the graduate program, we are really only raising awareness at present. In both courses, we are developing such skills as part of a separate stream entitled 'Computing', and as yet we have not really been able to configure our IT education along the lines of the mapping just indicated. In the computing stream, undergraduate students are introduced to information systems and planning analysis through packages and programming. The basic information system used is the Census which is accessed using SASPAC (Small Area Statistics PACkage). Statistical analysis techniques are developed using MINITAB while our course on BASIC programming introduces simple forecasting techniques which complement the planning methods courses. The most elaborate exercise our undergraduates are involved in is an accessibility to health care clinics problem which makes use of computer programming, ideas from planning methods and locational analysis, and techniques from statistics.

An important area we have not yet developed due to lack of time is a formal course on information system design which would relate knowledge acquired from package programs to programming knowledge and would enable us to develop ideas about IT in development control and monitoring. We have no course as yet on graphics/mapping or on using computers in design but we hope to combine both these areas in a rudimentary way in first year. However all that we feel we will be able to do is to demonstrate packages in this area unless much more time is allocated. From our limited experience so far in which one session a week (2 hours) for nearly 2 years (the first 2 years of the undergraduate course) is given over to IT education, we are acutely conscious of the time involved in

such instruction for staff and students alike. To move on to developing expertise in computer-aided design and graphics will involve much more time, not just in these new areas themselves but in extending our students basic knowledge of computers and programming.

With respect to the third year of the undergraduate course, students have enough knowledge then to use computers fairly easily for analysis purposes. As yet students get little instruction on ideas about networking but this is gradually coming through exposure to the UWIST computing environment. Office automation is introduced more in their year in practice than from the course, thus this occurs during the first year of the diploma. In the final year of the diploma, the students' fifth year, there is now an optional course *Microcomputing and Planning Techniques* which at present reintroduces BASIC programming as well as introducing students to micro-computer environments. One obvious point is that as our students all come to have programming expertise on entry to the course, we will be able to build on this and our courses will change to reflect this. Indeed, for the next 15 years, IT courses in planning education will be in a continual state of flux.

What we are developing is by no means an optimal model of IT education in planning, and thus it is worth reflecting briefly on a more suitable structure, time, technological resources, attitudes and staff expertise permitting. As a general principle, my preference is for streams of like activity to run throughout the years of any course, and in terms of our undergraduate program, this would imply that a computing stream would run through all four formal years of the course and would link closely to design, planning methods, projects and the year in practice. Programming

would form the essence of the first year instruction with the second year involving introduction to packages - statistical techniques and information systems. Third year would appear to be the place to introduce CAD and more elaborate forecasting, while in the final year of the diploma, concern for the implementation of IT in practice - the design of development control systems etc. - would appear to be an appropriate focus. During the course, a formal course on *Information Systems Design* should be developed, probably in second year, as an outgrowth of programming in first year, and a course on *Futures* would appear relevant in third year or the final diploma year. Much stronger linkages between computing and planning techniques as well as more general statistical methods would be assumed in such a structure. Indeed, these methods-based courses might be taught through the medium of computing.

Our graduate course poses much greater problems. The set of skills our graduates have on entry are quite variable but at present few have much knowledge or experience of IT. At present we are developing a course to raise awareness on entry to first year, and there is a course in BASIC programming. The students are able to pursue the optional course *Microcomputing and Planning Techniques* offered to the final year diploma, but there is no intention of introducing any stronger integration with respect to IT into the graduate program at present. It is clear there is much more interest in IT from students from developing countries at the graduate level. We are aware of this and beginning to adapt the appropriate stream of the graduate course to take account of it.

There are two areas of education I have not addressed so far and these

relate to specialist programs in IT and planning, and in CPD. With respect to specialist courses, there is clearly scope for one year graduate programs which would avoid the dilemmas alluded to above. A Masters style program might be desirable in selected places, notwithstanding the present depressed state of graduate education in the UK (Batty, 1983b). Such a course could be entirely technically orientated and would have to run on both a part- and full-time basis. There is also the possibility that a specialist stream to the final diploma year could be introduced which would build on the practical uses of IT. With respect to CPD, courses in both raising awareness, and imparting skills ranging from one day affairs to 3/6 month diplomas are all possible. An analysis of what has emerged so far suggests that most courses are at the level of raising awareness in practitioners and are one/three days in length. For example, the RTPI course/conference at South Bank Polytechnic in October 1983 is an example. Birmingham and Oxford Polytechnics amongst others have also organised similar conferences. Bristol Polytechnic have organised slightly longer, more skill-based courses, and we at UWIST have offered a couple of short 3 day courses on Census-based information systems. PTRC (Planning Transport Research and Computation) organise one week courses which mix skill acquisition with raising awareness, while SAUS (School for Advanced Urban Studies) at Bristol University offer courses in the impact of IT on practice. There is clearly enormous scope for developments here but much will depend upon finance for CPD and the extent to which practice can articulate its demands for IT education. (Barrett and Leather, 1983).

Finally, although IT has the potential to integrate areas of planning education, its nature - a mix of quite formal skill-based pursuits and

more informal project-based activity in an educational context - could mean that it becomes divorced from other activities in the planning school. This is a danger that must be kept in mind, and consciously avoided as schools repond to the pressure to adapt course modules to the various elements of IT.

THE AUTOMATED PLANNING SCHOOL.

The suggestions alluded to earlier with respect to how planning schools might respond to IT have important technological repercussions which involve questions of cost, appropriate technology and the wider environment in which planning schools find themselves situated. Furthermore,the extent to which any school might respond is often determined by constraints and attitudes outside the control of the school itself. There is a remarkable uneveness in terms of the computer environments which different universities have developed, reflecting not only differences in subject balance between universities, but the degree to which the university has been active in embracing new technology. Again, the same differences exist within the polytechnic sector and between universities and polytechnics.

As in the previous section, I will discuss developments in my own department so that the critical issues can be aired in as practical a way as possible. The key distinction any school has to have regard to is the distinction between central and departmental resources involving the provision of computing equipment. In general, larger main and mini-frame computers, programming advice, computer operations and large software packages which require a high level of user support will be

provided centrally. This is in contrast to more local computers (micros), lines to main computers and terminals, and other peripherals such as printers which usually have to be acquired by departments. This latter point is critical because it makes the difference between gaining 'free' access or not, and it depends on how much equipment money any school can command. This too can vary dramatically within and between institutions.

In UWIST, there are very good central computing facilities based on 5 linked DEC-VAX interactive mini-computers. These computers are organised for specific programming tasks - CAD, research, teaching and development. There are about 230 terminals most of which can be online and these are distributed all around the college. UWIST is a small university institution with about 2200 students and 16 departments. Most of these departments are IT orientated, or at least computer technology orientated due to the technological orientation of the Institute. Thus student access to terminals is reasonable - on average a student would have at least a 1 in 10 chance of access to a central computer at any time. Of course, this is too crude an index of availability for it takes no account of the uneveness of requirements between students, courses and departments but it does indicate that the college is well-provided for with respect to central facilities.

The nature of the computer environment at UWIST is interactive, that is, punched cards and traditional batch-style processing are a thing of the past. For teaching purposes, there are terminal classrooms in which the teacher can direct the work of students directly through the terminal system. The 5 computers are networked through a campus package

switching exchange (CPSE) while it is possible to access most other equivalent computer systems in the UK through British Telecom's package switching service. Teaching demands on the system are very large and increasing all the time. There is need for several additional terminal classrooms and some additional VAX computers at present. Locally the Town Planning school has 2 direct lines to a VAX computer and 7 lines to the CPSE, thus to all the computers. 4 of these lines are shared with other departments. Most of the teaching at the present time with respect to Census-based information systems, and BASIC programming is accomplished using the VAX machines.

With respect to micro-computing, there are 3 types of system in the school. Our original entry into micro-processing some 4 years ago involved the purchase of SUPERBRAINS, 64K CPM-based micros which we used for a variety of purposes mainly scientific but then also word-processing. We added graphics capability to our 4 machines, which also enabled these machines to be used as graphics terminals to our VAX systems. The machines are not networked and although a good deal of graphics work in research terms has been done with these computers, in the future they are likely to be used mainly for word-processing. In their place, we are developing a network of BBC micros which will form the basis of our micro-computer laboratory. These machines will all act as stand alone micros, will act as terminals to the VAX system and in time, we will consider networking them to develop a terminal classroom situation. Each machine will act as a workstation to VAX and enable us to run both central and local software and interchange the two. We intend to use this network to complement our statistics teaching in the undergraduate program and to enable us to develop graphics use and CAD projects.

The third development in the department relates to office automation. We made an early decision to indulge our expertise with SUPERBRAINS in developing a general word-processing capability using this system. We have a network of 4 linked SUPERBRAINS - a Compustar system - supported by a Hard Disc Data Storage Device. We have one free standing terminal not linked to this network, and we will acquire one other to complete the system. The system performs reasonably well and should last another 4-5 years before it becomes obsolete. Indeed, its obsolescence is likely to depend upon more general developments with respect to the 'hard-wiring' of UWIST. A picture of the way the School of Town Planning relates to these computer facilities is presented in Figure 2.

Our development of IT in this literal way has been very much based on a 'learn-as-you-go' strategy, and it is hard to see how these developments might have occurred any other way. It is likely that the proposed Local Area Network for UWIST will also develop in piecemeal fashion due to differential interests and constraints on resources. What is desparately needed in our school is more terminal classrom space - more terminals, and graphics-based teaching facilities. Central provision of these facilities is of course desirable but we are reaching the point where we might consider a 'terminal studio', especially if it could be equipped for graphics use. The provision of central software is also changing. More and more can now be provided for micros, and it is a topic of continuing debate as to the degree to which computing can be entirely decentralised, thus putting the role of the central computer service in doubt. Finally, our technician support is beginning to change in character as more expertise in operating and servicing our IT is required.

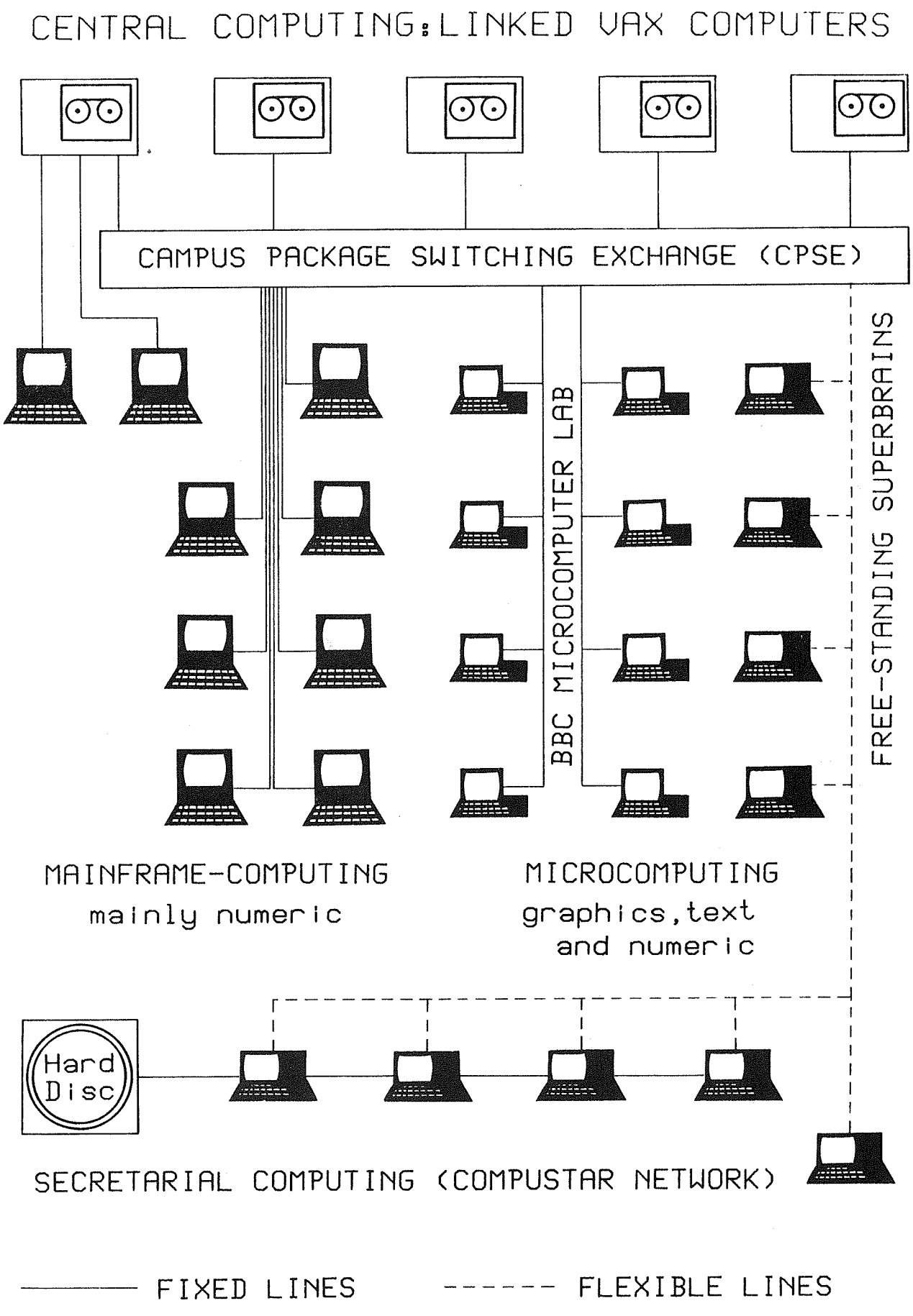


Figure 2: 'Hardwiring' the UWIST Planning School.

WHERE DO WE GO FROM HERE?

Like all revolutions, the transition is painful and like all futures the picture of what is likely to happen is murky. Neither positive nor negative responses are easy and mistakes are surely being made. By the year 2015 (the end of my life-time), a 'wired society' of sorts will have emerged. It is likely to reflect present distributional inequalities and perhaps reinforce others such as the information-rich, information-poor, computer-literate, computer-illiterate scenarios. There is bound to be a very different organisation with respect to work by that year, and in this, the role of the professions may be very different.

There is one major point above all others, obvious in hindsight but frequently forgotten in discussions such as this. The role of IT in planning will influence the nature of planning of course, but the state of planning and IT within it in the year 2015 will have been determined very largely by social attitudes and our view of politics than by any technological determinism. There is a sense in which present trends in planning are suggesting a more local concern, a drift to pragmatism and a reaction against long term thinking. But it is by no means certain that this 'insularity' will continue much longer than this decade. At another level, societies are engaging in much longer-term, strategic thinking which is consistent with the need to think globally in economic terms, and it is possible that a return to strategic thinking in terms of physical planning may be upon us by the end of the century (Naisbitt, 1982).

To conclude, the impact of IT on planning education during the next decade can be comparatively straight-forward, notwithstanding the diversity of approaches which might emerge. I will list the key issues as I see them. It is likely that all courses will be forced to respond to IT at the awareness level, and many, perhaps most will attempt to inject some skill through programming. At least half the planning schools are likely to take IT more seriously and see the area as a provider of employment for their students. This might even lead some schools to develop CAD and real skill in forecasting. The ability to access the technology itself is likely to be important and there will be a fierce, continuing debate about the amount of time required for such education. The need to develop a separate stream of IT education, separate from techniques that is, will also promote a fierce debate, as part of the ongoing debate about the basis in skill of planning education. Finally, a clearer picture of the needs of practice with respect to IT needs to be articulated so that the relevance of IT education in planning might be ensured, and the danger of the technological fix avoided.

REFERENCES.

Bardon, K.S. and Stothers, N, 1982, Computer Use in Local Authority Planning Departments : Some Initial Findings, Department of Planning and Landscape, City of Birmingham Polytechnic, Birmingham, UK.

Barrett, S.M. and Leather, P., 1983, Information Technology in Planning Practice, School for Advanced Urban Studies, University of Bristol, Bristol, UK; also available from Economic and Social Research Council, London.

Batty, M., 1983a, The Reskilling of Planning, *EPA Newsletter, 12,* (March), 3-9.

Batty, M., 1983b, The Crisis in Planning Education, *The Planner, 69,* 127-129.

Breheny, M., 1983, A Practical View of Planning Theory, *Planning and Design: Environment and Planning B, 10,* 101-115.

CNAA, 1982, Implications of the Development of Information Technology for CNAA Undergraduate Courses, Publication 2a/27, Council for National Academic Awards, London.

Jones, B., 1983, *Sleepers, Wake! Technology and the Future of Work,* Wheatsheaf Books, Brighton, Sussex, UK.

Keeble, L., 1959, *Principles and Practice of Town and Country Planning,* Second Edition, The Estates Gazette, London.

Leavitt, R. (Editor), 1976, *Artist and Computer,* Creative Computing Press, Harmony Books, New York.

Long, M., 1984, Before the Computer, *Planning History Bulletin, 6,* 44-52.

Martin, J., 1978, *The Wired Society,* Prentice-Hall Inc., Englewood Cliffs, New Jersey.

McLoughlin, J.B., 1982, *Review of Research and Education in Planning,* A Report of the Working Party, SSRC, London.

Michie, D., 1971, Computer - Servant or Master, in J. Reichardt (Editor), *Cybernetics, Art and Ideas,* Studio Vista, London, pp. 191-195.

Naisbitt, J., 1982, *Megatrends: Ten New Directions Transforming Our Lives,* Warner Books, New York.

Nora, S., and Minc, A., 1980, *The Computerization of Society: A Report to the President of France,* The MIT Press, Cambridge, Mass.

Papert, S., 1981, *Mindstorms: Children, Computers and Powerful Ideas,* Basic Books, New York.

Schon, D.A., 1983, *The Reflective Practitioner: How Professionals Think in Action,* Temple Smith, London.

Toffler, A., 1970, *Future Shock,* Bantam Books, New York.

Toffler, A., 1980, *The Third Wave,* Bantam Books, New York.

Turk, C., 1983, The Electronic University, The University of Wales Institute of Science and Technology, Cardiff, UK.

RECENT PAPERS IN PLANNING RESEARCH.

1. R.S. Spooner: *Q-Analysis and Social Indicator Studies in Planning,* March, 1980.

2. Michael Batty: *Computers and Design: The New Challenge to Urban Planning,* March, 1980.

3. P.N. Cooke and R.V. Kemp: *Normative Structures: Their Role in the Analysis of Communicative Content in Public Policy-Making,* April, 1980.

4. Michael Batty: *A Perspective on Urban Systems Analysis,* April 1980.

5. Ian Bracken and David Hume: *An Analysis of Welsh Structure Plans,* May 1980.

6. Michael Batty: *Symmetry and Reversibility in Social Exchange,* May 1980.

7. R. Crouchley: *A Family of Tests for a Collection of Poisson Processes: An Application to Dwelling Tenure,* May 1980.

8. R. Crouchley: *Identification of a Frequency Distribution: An Application to Duration in Dwelling Tenure,* June 1980.

9. Patrick N. O'Farrell: *The Mobilisation of Indigenous Potential: Towards a Complementary Regional Strategy,* July 1980.

10. R.B. Davies, R. Crouchley and A.R. Pickles: *A Family of Tests for a Collection of Short Binary Series,* August 1980.

11. Michael Batty: *On Systems Theory and Analysis in Urban Planning: An Assessment,* August 1980.

12. Carole Rakodi: *Housing and the Urban Poor in Lusaka,* October 1980.

13. J.P. Ryder: *Bilingual Signs in Wales: A Review,* November 1980.

14. David J. Nicholson: *Vacant Urban Land in South Wales: A Comparison with the Literature,* November 1980.

15. Philip Cooke: *Dependency Formation and Modes of Integration: The Historical and Contemporary Case of Wales,* November 1980.

16. A.R. Pickles, R.B. Davies and R. Crouchley: *Testing for Cumulative Inertia,* November 1980.

17. Jeremy D. Alden: *A Comparative Analysis of Second Jobs in the USA and Great Britain,* December 1980.

18. Sheila Davies: *A Geography of the Aged,* December 1980.

19. R. Crouchley, A.R. Pickles and R.B. Davies: *Dynamic Models of Shopping Behaviour: The Linear Learning Model and Some Alternatives,* December 1980.

20. Michael Batty and Richard Spooner: *Models of Attitudes Towards Urban Modelling,* December 1980.

21. R. Crouchley, A.R. Pickles and R.B. Davies: *Heterogeneity and Non-Stationarity in Behavioural Modelling*, January 1981.

22. Gareth Rees and Teresa Rees: *Migration, Industrial Restructuring and Class Relations: The Case of South Wales*, February 1981.

23. Richard B. Davies and Patrick N. O'Farrell: *An Intra-Regional Locations Analysis of Second Home Ownership*, March 1981.

24. Richard Spooner and Michael Batty: *Networks of Urban Systems Analysis*, March 1981.

25. P.N. Cooke and Gareth Rees: *The Industrial Restructuring of South Wales: The Career of a State Managed Region*, April 1981.

26. Ian Bracken and David Hume: *Key Activity Forecasting in Structure Plans: A Critique*, April 1981.

27. Clifford M. Guy: *The Use of Models and Simulation Methods in Hypermarket Impact Studies*, May 1981.

28. P.N. Cooke: *Urban Redevelopment and the Local State: The Case of South Wales*, May 1981.

29. Carole Rakodi: *Monitoring and Evaluation in the Planning Process with Special Reference to Squatter Area Upgrading Programmes in Developing Countries*, May 1981.

30. John Keung: *Government Intervention and Housing Policy in Hong Kong: A Structural Analysis*, June 1981.

31. P.N. Cooke: *Local Class Structure in Wales*, June 1981.

32. Ian Bracken: *Classification and Analysis of Strategic Land-Use Policies*, June 1981.

33. R. Crouchley, A.R. Pickles and R.B. Davies, *Movers and Stayers*, June 1981.

34. R. Crouchley, A.R. Pickles and R.B. Davies: *Intra-Urban Migration Dynamics for a Heterogeneous Population*, June 1981.

35. J.D. Alden and R.S. Spooner: *An Analysis of Second Jobs in the European Community*, September 1981.

36. P.N. Cooke: *Inter-Regional Class Relations and the Redevelopment Process*, July 1981.

37. R. Crouchley, A.R. Pickles, R.B. Davies: *State Dependency and the Market Place*, July 1981.

38. R. Crouchley, A.R. Pickles, R.B. Davies: *A General Heterogeneous Binary Markov Model with an Application to Shopping Behaviour*, July 1981.

39. John Keung: *Urban Planning in Hong Kong - A Political Administrative Perspective*, July 1981.

40. Michael Batty: *A Model of the Battle for Tolmers Square,* August 1981.

41. Clifford Guy: *The Assessment of Access to Local Shopping Opportunities: A Comparison of Accessibility Measures,* September 1981.

42. C.J.L. Yewlett: *Inter-Corporate Planning: A Case for Competition or Co-operation?* October 1981.

43. Robert Crouchley,A.R. Pickles and R.B. Davies: *Factors Affecting the Sex of Children: A Preliminary Analysis,* October 1981.

44. Barry Cooper: *Transport Planning Practice: A Review,* October 1981.

45. Michael Batty: *The Evolution of Planning Models,* October 1981.

46. Andrew Pickles: *Residential Mobility Rates in Cardiff: A Model and Preliminary Analysis,* October 1981.

47. M.J.Bruton: *Strategic Planning in Malaysia,* November 1981.

48. C.J.L. Yewlett: *Polishing Practice: The Reconciliation of Scientists and Practitioners,* November 1981.

49. Clifford M. Guy: *Push-button Shopping and Retail Development,* February 1982.

50. Jean Walters: *Some Characteristics of Motorcyclists,* April 1982.

51. John Lovering: *Gwynedd in British Capitalism,* June 1982.

52. Jeremy Alden and Richard Spooner: *Dual Activity in the Agriculture Sector of the European Community,* June 1982.

53. Ian Bracken: *Flexibility in Strategic Land-Use Planning: Case Studies of Policies and Practice.* July 1982.

54. Jean Walters: *The Telecommunications Impact,* July 1982.

55. John Brookes and Joyce Halliday: *Current Standards of Accommodation in Dwellings built between 1889 and 1899 within South Wales,* July 1982.

56. Michael Batty and P.K. Sikdar: *Proximate Aggregation-Estimation of Spatial Interaction Models,* August 1982.

57. Michael Batty: *Linear Urban Models,*October 1982.

58. Michael Batty: *Cost, Accessibility and Weighted Entropy,* December 1982.

59. Michael Batty and Karmeshu: *A Theoretical Strategy for Generating and Testing Migration Models,* November 1982.

60. M.J.Bruton: *Bargaining and the Development Control Process,* April 1983.

61. M.J.Bruton: *Legislation and the role of the Town Planner in Society,* April 1983.

62. Gareth Rees: *The Political Economy of Rural Areas: Observations based on Welsh Experience,* May 1983.

63. J.D. Alden, M.Martin, L.Lehmann, V. Newcombe: *A Comparative Study of Regional Development Policy in Two Peripheral Regions: Mid Wales and Schleswig-Holstein: The Mid Wales Case Study*, December 1983.

64. J.D. Alden, M.Martin, L.Lehmann, V. Newcombe: *A Comparative Study of Regional Development Policy in Two Peripheral Regions: Mid-Wales and Schleswig-Holstein: The Schleswig-Holstein Case Study*, forthcoming.

65. J.D. Alden, M.Martin, L.Lehmann, V. Newcombe: *A Comparative Study of Regional Development Policy in Two Peripheral Regions: Mid-Wales and Schleswig Holstein: The Comparative Analysis*, forthcoming.

66. Michael Batty: *Technical Issues in Urban Model Development*, May 1983.

67. L.G. O'Brien: *Generalized Linear Models in Planning Practice*, September 1983.

68. Clifford Guy, Neil Wrigley, Larry O'Brien and Geoff Hiscocks: *The Cardiff Consumer Panel: A Report on the Methodology*, September 1983.

69. M.J.Bruton and D.J. Nicholson: *Local Planning in South Wales*, September 1983.

70. M.J.Bruton and D.J. Nicholson: *Strategic Planning and Development Plans*, October 1983.

71. Michael Batty: *Plan Design as Committee Decision-Making*, October 1983.

72. C.J.L. Yewlett: *Strategic Choice and Long Range Planning*, December, 1983.

73. Peter McCormack and Tony Gore: *HIPs and Housing Expenditure in Wales: Emerging Issues and Contradictions*, January 1984.

74. M.J.Bruton and D.J. Nicholson: *Local Planning in England*, January 1984.

75. Vernon Z. Newcombe: *Housing Policies for Ibadan*, January 1984.

76. Michael Batty: *Formal Reasoning in Urban Planning*, January 1984.

77. Richard B. Davies and Andrew R. Pickles: *Accounting for Omitted Variables in a Discrete time Panel data Model of Residential Mobility*, February 1984.

78. Roy Cresswell, Andrew Davies and Margaret Martin: *Bus Destination Indicators*, May 1984.

79. M.J.Bruton and D.J. Nicholson: *Local Planning and Development Briefs: A Case Study of Warwick District Council*, April 1984.

80. Michael Batty: *Information Technology in Planning Education*, May 1984.

81. John Lovering: *The "Success" of Bristol, the "Failure" of South Wales*, June 1984.