Advanced methodology for spatial planning by high-tech

ADVANCED METHODOLOGY FOR SPATIAL PLANNING BY HIGH - TECH

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SUMMARY

Changes in approach in spatial planning resulting in emphasize on process planning caused an **increasing** demand for data. These data meant to reach better **decision** making, will force to shift to more advanced **methodology** for elaboration of data in terms of storage, **updating**, analysis and implementing in decision making **models.** Such a methodology supposes the use of computer equipment.
After a description of the state-of-the-art about hardware and software, some statements about computer applications at the municipal level in several western countries will be put forward.
Next some spatial planning applications for mainframe and microcomputer are described, in particular the Model Plotborough, and Design, as typical examples for so-called CAD/CAP.
Another important kind of application on behalf of spatial planning concerns (spatial) information systems, which is more and more related with concepts like decision support systems, and expert systems.
We live in a fast changing society. The consequences for spatial planning and organization will be stipulated, with some attention to networking and telematica.
Finally, some conclusions will be made with regards to the future integration between computerisation and spatial planning.

CONTENTS

INTRODUCTION

Attitudes to the planning process have changed. This is true for planning in several countries. For example under United Kingdom circumstances Legislation and Acts from 1968, 1971, 1974 and 1975 are relevant. "Traditionally, planning thought and practice had emphasised the land-use based 'master-plan' concept. Legislation required a change of emphasis away from the 'end state' view towards the 'continuous' approach to planning where the authority is required to be more sensitive to its environment" (Mason 1978, p. 2).
The last mentioned approach is known under the label of 'process planning', in fact an awareness that forecastings about the future consists of a lot of uncertainties. This means that we have to follow developments in reality very closely. Next we have to confront them with intended spatial policies, to reach a situation in which continuous adaptations, or even changes, of planning intentions become possible.
But under such circumstances "there is fundamentally a need to consider data as a prime resource" (Mason 1978, p.2). The quantity of data relevant for spatial planning is almost always impressive, maybe even abundant. The need for adapted methodology is obvious. Developments in high-tech, that is high technology, offer possibilities for advanced methods to handle that problem thoroughly and suitable.
For that reason I will give an exposee about the state-of-the-art in hardware, and software. Next an overview of the use of computer equipment for spatial planning goals by municipal governments in several western countries is given. To get an impression about possibilities of computer application on behalf of spatial planning the model Plotborough for mainframe, and the model Design for microcomputer, will be described and explained. These both models are of the so-called CAD/CAP type, that is Computer Aided Design/Computer Aided Planning.
Another important part of in particular CAP concerns the workings of data and information in the form of 'Information Systems'. (Spatial) information systems take care for the collection, storage, and analysis of data and information. The use and implementation of the data and information is a next step. With reference to advanced methodology I will give attention to concepts like 'decision support systems', and 'expert systems'. Because the high-tech offers possibilities of connections for communication over long distances, networking and telematica are important issues at this moment. They have a strong influence on society, spatally as well as in terms of human activities and relations. They are described, but also the opposite, namely the consequences for spatial planning and spatial organization in a changing society.
At last, some conclusions are made. Particularly, they concern the further integration of computerisation and spatial planning in the future.

HARDWARE

Hardware is equipment, technological products, among others computer equipment. Our attention is focussed on computers and allied apparatus.
Computer history is apparently short, from about 1945. That is not quite true, because in fact the 1945 results have been based on efforts and inventions during the past centuries. I mention: abacus, pascaline, Leibnitz counting machine, Jacquard's loom, difference and analytical machines of Babbage, electrical counting machine, and electric typewriter.
Computers invented and developed since 1945 have been subdivided in so-called generations of computers. The first one contained very hugh machines with valves, taking a lot of energy, and resulting in relatively unreliable calculations; interesting characteristic is that each computer got a name, like EDVAC, ENIAC, etc.
The second generation used in stead of valves, transistors, which means that the computers decreased in size, and became more thrustworthy. This type of computers meant production for the market also. They became smaller, but still such machines needed extensive (office) space, with a lot of related facilities like air-conditioning, and high voltage energy supply.
However, in the next stage the reduction in size carried through. Therefore the so-called LSCI-technology, that is Large Scale Integrated Circuitry, the first round of chip technology, has been the necessary invention and development. The size of the third generation computers dropped incredible, with the fourth generation microcomputers as a remarkable result. Capacity and reliability increased during the developments of both generations. It has been encompassed by an important fall in price for the third generation computers, and a dramatic fall for the fourth one.
Introduction of the microcomputer, in particular the all purpose, personal computer, available for really, but also relatively, low prices, caused an almost revolutionary break-throught and above all acceptation of computerisation in all levels and sections of society. The first microcomputer produced for a wide market concerns the Apple computers, invented by Steven Jobs and Stephen Wozniak in 1976. It is true, that is not long ago. However, since that moment a lot of types of microcomputers made by an increasing amount of industrial companies have been produced. An extra resulting price drop followed during the last years, in particular because an extremely cheap production of high-tech chips.
The microcomputer is seen as the 'second industrial revolution. Perlowski(1980, p. 105) quoting J.S. Webb, states that 'it multiplies man's brainpower with the same force that the first industrial revolution multiplied man's muscle power'.
If one speaks about a computer in these generations of computer development, than an electrical device is meant which is capable to work data and programs, in terms of

input and storage of those data and programs, execution of programs while data are included and elaborated, and results may be output. Program elaborations include mathematical and logical operations, as well as steering of peripherals. Important in that relation is a minimum humanly intervention activity during program execution and data handling, but also that program execution and data handling are caused by the program in a direct way, that is program statements ascertain what will happen and intermediate interventions and adaptations of the program during execution are impossible.
The fifth generation computers are still not there; scientists are very busy with its development. In particular the Japanese are in the running to be the first nation having a computer "which users will be able to speak with in every day conversational language, or show pictures to, or transmit messages to by keyboard or handwriting, to penetrate every level of society. They will assume no special expertise or knowledge of arcane programming languages. They will not even require the user to be very specific about his needs, because they will have reasoning power and will be able to tease out from the user, by questionings and suggestions, just exactly what it is the user wants to do or know. Finally, these new machines will be inexpensive and reliable enough to be used everywhere, in offices, factories, restaurants, shops, farms and fisheries, and of course, homes' (Feigenbaum and McCorduck 1984, p. 20).

Another subdivision in computers mainly concerns their size, namely mainframes (the biggest ones), minicomputers and microcomputers (the smallest ones); also supercomputers exist but that are special ones for number crunching, in fact very fast calculators. Generally, except certain forms of networking, microcomputers are so-called stand-alone machines, minicomputer may be of a stand-alone type but that is not necessary. Mainframes consisting of one or two (parallel) processors, connected to a variety of input, storage and output facilities, possess terminals for communication and human intervention also. Time-sharing and multi-tasking are important issues concerning the way in which such systems may be used; but also, recent possibilities of networking and other technological advances from the concept of telematica are relevant and obviously, they will show serious influence on society. A society which we call an 'information society' already.

For the first coming years microcomputing will influence society further, and thoroughly in any case. Microcomputers will get a wide application , generally because it already got a relatively high popularity and because its procurement and use does not cause financial troubles. Also of importance is its all purpose character by which its applicability knows almost unlimited possibilities.
Technologically, the last few years brought several new relevant products to raise its potentials. I mention: more extensive and extremely cheap memory chips, increased storage capabilities on Winchester hard drives, faster and more reliable central processor chips, co-processor chips for faster mathematical calculations, and a lot of better adapted peripherals, like plotters, printers, digitizers and

high-resolution graphic displays, including display intervention facilities like mouse and touch screen.

SOFTWARE

To use hardware well one needs suitable **software,** or the capability to develop own software by writing **and** input of programs into the computer's memory. In **that case** it is necessary to have knowledge about programming, that is a methodology of understanding, structuring and solving of certain problems. Such knowledge is teached in computer science. In principe, it has nothing to do with writing a program in a computer language. But in case one wants to run the program by a computer it will be necessary to use a language which is understand by that computer. That means that a programmer can write his program in a so-called machine language, that is language of figures, directly understood by that special computer (type); but it is possible also to use more elaborated languages. One of them is called 'assembly' which is a language very near to machine language, and still the programmer needs a high standard knowledge about the built-up of the computer and the structure of its memory.
'Easiness' and further working-out of languages resulted in so-called higher computer languages. Such languages use english for their syntax, and can be understand easyly because of that.
A user capable to program his computer is capable to solve computer suitable problems in that way also.

Not everybody is interested and/or capable to develop his own programs. In case there is still a wish to use a computer software has to be bought. Generally one speaks about 'packages'. This kind of software has been developed by a software house, a group or an institution of specialized computer programmers. They write the programs, they test and debug them, and they sell them. The prices for software are very high, but in case of multitude of buyers prices become reasonable. That means that all kinds of general packages like textediting and spreadsheet are relatively cheap, while specialized software particular made for one or two clients is extremely expensive.

COMPUTER USE IN SPATIAL PLANNING BY MUNICIPALITIES

Knowledge about the use of computer equipment by municipal governments, in particular for spatial planning tasks, is an important piece of information concerning the state-of-the-art about the integration of computer use in society and spatial planning (and other tasks).
In several countries researchers did such inquiries, namely in Ausralia in 1980, in Great-Brittain in 1977, 1978, 1980, 1981 and in 1982, in United States of America 1973, 1975, and in 1984, and in The Netherlands in 1983.
From these inquiries it appaers among others:
1. since the sixties (local) governments use computer equipment;
2. During the seventies we see a remarkable increase of equipment and the use of it. Also during this period we recognize a shift from 'visible' record computers to 'disk-based' computers;
3. during the first years of the eighties an ecceleration in inquisition and use of computer equipment takes place, caused by the cheaper microcomputer and adapted peripherals. From a recent study in the USA (Hysom and Ruth 1984, p. 125) we can learn that (local) governments use microcomputers in an increasing degree. "This pattern of use varies from offices which were hoping to have microcomputers added during the next few years to those who are in the process of installing micros now". Besides, the preference is for Apple II/Apple III, Radio Shack-TRS80, and IBM-PC.
A not unimportant support for this development is given by the more recent developments regarding storage memories. So, the implementation of hard disks means better opportunities for word processing and for topographical systems of automated cartography.
4. the researchers got the information about the presence and the use of computer equipment in (local) governmental offices by means of questionnaire.
5. the governments use equipment of its own at one hand, at the other hand the governments instruct commercial service houses to program and elaborate software and they buy computer (processing) time form (external) computer centers.
6. reasoning the use of computer equipment and computer (hardware/software) services they mention:
   1. an expected increase of efficiency;
   2. the extend of the (routine) workings.
7. as general categories of use are mentioned in a more or lesser degree:
   1. bookkkeeping
   2. personnel
   3. taxes
   4. salary administration
   5. real estate tax
   6. elections register
   7. (spatial) planning
   8. utilities like electricity, water, etc.
   9. land-engineer department activities.

8. in the beginning governments installed computer equipment on behalf of their financial administration, and that a change appears in the seventies by which also in an increasing degree the non-financial workings are done with the aid of computer equipment.

More in particular it appears that:

9. regarding cadastral databases "in most (local) governments, computers are used only for the non-graphic portion of the land records ... The spatial dimensions (...) are found on a set of maps, i.e. physical graphics, maintained separately in a manual mode. This approach has become fairly standard practice in the US and Canada" (Barr and Meyer 1984, p. 112).
10. in a research held in the USA in 1983 about 90 percent of the local governments "are committed to computerized planning systems", and merely 2 percent of the questioned governments announced that they (for the time being) did not intend to do so (Hysom and Ruth 1984, p. 120).
11. the majority of the local governments questioned in that USA research, said that they aspire to a "complete decision support systems repertoire" (Hysom and Ruth 1984, p. 126).
12. there is an enormous need in (f.e. Great-Brittain) for " a summary of perceived applications of micro-computing, based on the individual opinions of potentials" (Information Technology 1982, p. 14). A priority list with needed applications show the next ones:
    1. record systems
    2. statistics
    3. modeling
    4. word processing
    5. budgeting
    6. stock control.
13. the components that form together computerized information systems for urban planning, according to an american questionnaire, and placed in a relevant sequential order, appear to be (Hysom and Ruth 1984, pp. 123-124):
    1. inventory of parcels (describing each parcel of land in terms of location, value, land use, zoning category and structure;
    2. building permits (in terms of location and type of structure);
    3. building inspection (in terms of location, type of structure, and each inspection made);
    4. rezoning applications (that have been submitted for approval in terms of location, projected structures and estimated date of completion); and,
    5. builder plans (that have been submitted for approach in terms of location, projected structures and estimated data of completion).

In total these systems show "what the current land use is and the types of buildings that exist today, and what is likely to be added in the near future (from the pipeline data). In addition, most jurisdictions with complete systems have the capability of including various kinds of census data, local survey data and other government generated data such as police, fire, employment, demographics as well as residential and non-residential descriptions and geographic identifyers" (Hysom and Ruth 1984, p. 124).

SPATIAL PLANNING APPLICATIONS

Martin and Norman (1972, p. 230) state that 'in the running and (transportation) planning of cities the computer will help in at least three ways', namely: 'first the computer will be used in a real-time fashion to control air and rail traffic, regulate vehicle flows, plan and book journeys, organize cargo movements, and perhaps arrange door-to-door transportation facilities. Second, it will collect and dissiminate the vast quantities of information needed for planning and control in cities... Third, computers will be used to build "models" of city facilities which will anable planners to observe the effects of alternative plans...'.
Computer applications may be subdivided into:

1. statistical applications;
2. CAD/CAP, that is Computer Aided Design/Computer Aided Planning by which graphical and cartographical use of the computer and allied apparatus like digitizer, plotter and graphic display are made;
3. CAP, in which several kinds of non-graphical applications in spatial planning take place;
4. wordprocessing and spreadsheet applications; and,
5. other relevant, including system software, applications.

Another relevant subdivision is one into the used computer type, that is if we have to do with mainframe or with (mini or) microcomputer use.
In the next I will describe from both types an example; those two examples belong to the CAD/CAP category. Examples of non-graphical software are plenty available; in the next paragraph one of them, relevant for spatial planning, will be explained in some detail.

The first CAD/CAP example concerns the so-called Model Plotborough ('Plotterdam' in dutch) for mainframe application; however, a limited version is available for the use of a (IBM-PC) microcomputer.

During the decision making process of a plan design, spatial planners produce one or more alternatives of a quantitative program which consists of a list with amounts of land use needed for the future. These needed land uses or plan categories have been expressed in spatial entities, like hectares or acres.

'City planners are much better served by maps than they ever good be by tables and lists ... Backing the map with mathematical models allow authorities to make short-range decisions as well as long-range plans' (Martin and Norman 1972, p. 263). The Model Plotborough has been based on such (and other) assumptions.

For planning goals it is necessary to tell where the plan categories find space in the plan area. If there is any available space depends of decisions about the most suitable places in the plan area for each plan category, and about

the sequence in which sites are chosen regarding staging and priorities fixed in the quantitative program.
In the Model Plotborough, conceptualized for structure planning, the suitability of a site in the plan area for a plan category depends of two kinds of quality, namely of a series of characteristics of the site, called 'site characteristics', and a series of characteristics describing the environment of the site, called 'situation charateristics'.
The general concept behind the model has been based upon:
1. the assumption that the allocation of any planned land use or plan category within a given planning area depends of the quality, or better, the suitability of certain parts of the plan area. Generally, allocation takes place at the most suitable and available sites;
2. the assumption that the suitability of a site for any kind of land use within the plan area depends of certain characteristics of the 'site' and the 'situation';
3. the assumption that planning decisions, and maybe political decisions also, have been made about:
a. the availability of the sites within the plan area (for example: militairy terrains can be part of the allocation process if they are available; generally, this is not the case);
b. the thresholds in the value range of the characteristics (for example: swamps are excluded for allocation of housing, perhaps it is too expensive; but you will understand that such a threshold is just artificially); and,
c. a quantitative program for a planning period which contains statements about program staging, planned land use priorities, and the way of combining the characteristics for calculating the suitabilities. Of course, the quantitative program may contain several alternatives.
The characteristics are connected in a special (mathematical) way by which the influences of the characteristics on the suitability of a certain plan category is expressed.
The sequence of allocation of the plan categories from the quantitative program of the plan , depends of political decision making.
If the allocation process has been completed, a chart, that is the plan map, is drawn.
For the afore mentioned workings the Model Plotborough has been transferred in a computer program, using a (Burroughs 7900) mainframe computer, and several allied apparatus, like: a (Tektronix 4016) graphical display terminal, a (Calcomp 2000) graphical tablet or digitizer, and a (Benson) drumplotter.
The model has been used for planning practice,namely among others the structure plan of the municipality Ede, a 45000 hectares counting territoir which has been studied and elaborated at the level of a hectare.

The second CAD/CAP example using microcomputer equipment, called Model Design, is a graphic and cartographical model like the afore mentioned one also. Contrary to the Model Plotborough it does not contain modules for suitability calculations and allocations. Design offers a relatively simple opportunity of data input by a digitizer or directly on the screen with aid of a cursor driven by the keyboard, data and information storage facilities, drawing modules for

using the screen as well as a (micro) adapted plotter. To draw stored information the program possess a facility to read files (from floppy disks). Images like polygons, lines, etc., as well as positioned text strings may be drawn; polygons will be filled-in by a raster, which type is optional. A simple drawing is included in illustration at the next page.

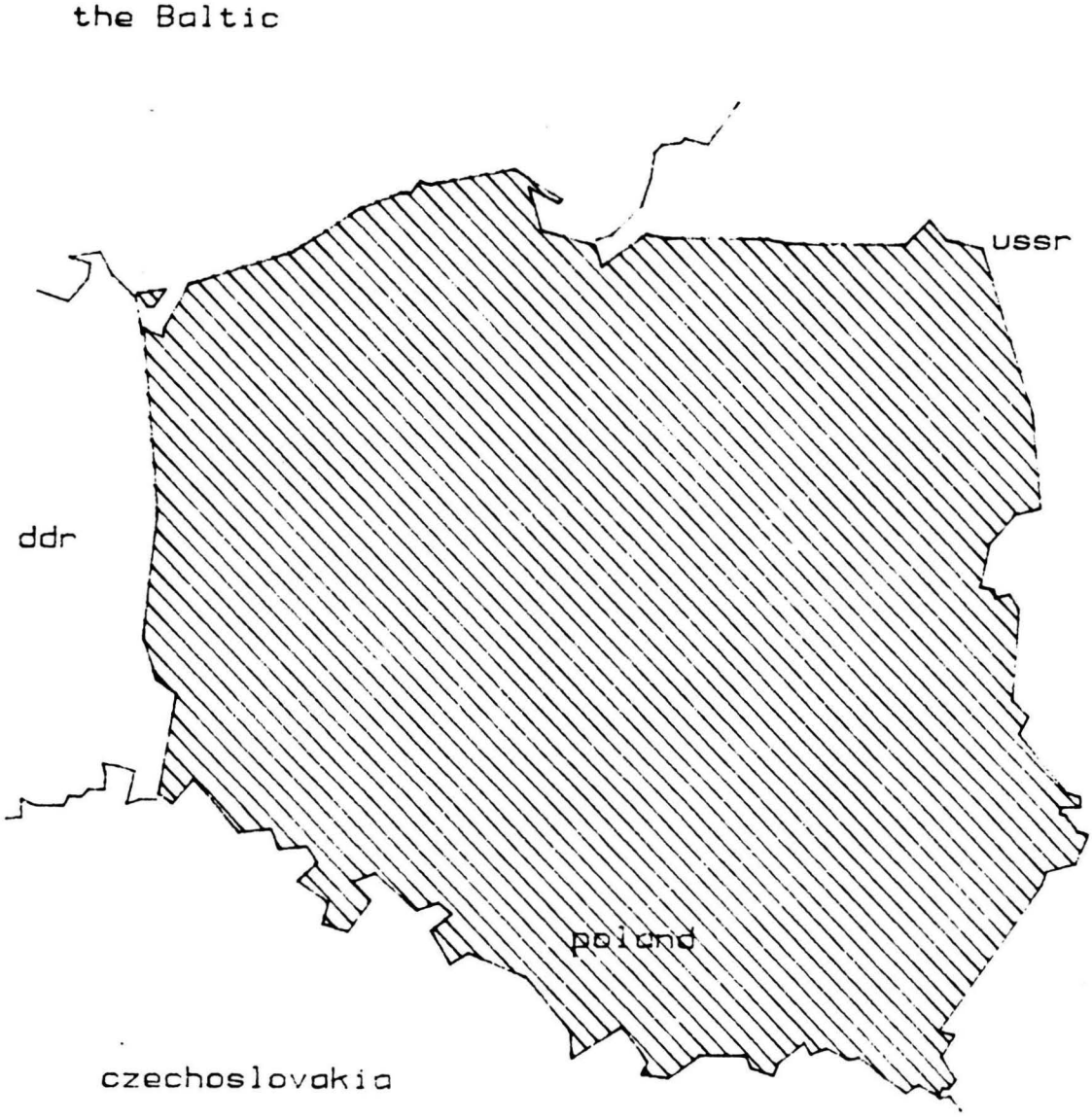

Chart: Poland digitized and plotted with aid of DESIGN

INFORMATION SYSTEMS

Data and information elements consist of figures and letters. Figures are quantitative items, letters and figures may express qualities. One speaks of data in case it concerns 'raw' material, and of information after a certain elaboration and reduction of data, that means information is more comprehensive.

'Good planning .... requires accurate, up-to-date information organized for easy access and evaluation. City data banks are therefore being developed for the accumulation of departmental files in a form that allows all agencies to draw on them for their planning' (Martin and Norman 1972, p. 261).

Generally, spatial planners work with hugh amounts of data, and because of that the use of computers is plausible and evident. Data and information are stored in auxillary memories like tapes, floppies, packs and disks. One may speak about an information system in case such data and information are not only stored, but also analyzed, continuously updated, and output in a certain condensed way. It means that there is a data handling part, a part which contains possibilities for analysing (what kinds of analysis will depend of the kind of information system and its usability), and a part for structured, and probably protected, output.
Spatial planners develop such information systems to help them with their planning tasks and with preparing and upgrading of spatial decision making. This statement contains an implicit assumption, namely to reach better decisions we need data and an adequate information system. Evidently, it is a good planner's desire, but we have to be aware that there is no automatic, causal relation.
However, availability of adequate information may help in the decision making process.
There have been developed several kinds of information, such as geographical or spatial information systems, and management information systems. For planners, a relevant one is (among others) the so-called monitoring and early warning system.

A monitoring system is an information system because it possess all characteristics of such a system. The differnence between both systems is caused by the emphasis on updating in a monitoring system in comparison to the other one. Updating means following developments in reality as a main goal which will be analysed by the system to be aware of the pathes that those developments pursue, in particular to be aware of deviant pathes in comparison to fixed spatial policies.
Such a system has been developed for monitoring of processes concerning a structure plan, like demographics, housing, and schools. For such a structure plan several

goals are fixed on behalf of forecasting calculations, using a database from the past ten or fifteen years. Also all relevant other quantitative conditions are known to the system. Because of the emphatic updating task of a monitoring system a continuous input of new data takes place and periodically an analysis of the updated database in relation to the fixed policy will be elaborated.
Result of these elaborations is a quantitative whole of statistics, tabulations and charts. This output may be extended by indications for polycy and decision makers about wished actions, like policy adaptation, plan revising, execution or construction prohibitions, or in case everything goes well a remark as such. If a monitoring has been extended with that kind of warning facilities, on speaks about an 'early warning system'. Of course, politicians and decision makers are forced in that case to formulate and/or to quantify the degree of deviance they accept and which causes no harm regarding the intended spatial policies.
It will be obviously that because of the repeated calculations of the same type, that will take place in such systems, the use of computer equipment is self-evident, but above all very accurate and time-saving.

Another important extension of an information system would be if it consists of also algorithms which work data and information in such a way that proposals for decision making will be put forward as a result of several kinds of included analysis at one hand. At the other hand an interactive, that is communicating with the computer system, system will be offered by which the decision maker can search his own pathes of analyses to get results and to achieve his decisions; sometimes such a system includes possibilities for evaluation also. In this case one speaks about a DSS or 'decision support system'.
As a consequence of the activities of 'artificial intelligence' there is a desire to instruct a decision support system with data and results put forward by experience, and from scientific manuals, reports and articles. An 'expert system' will be the result. Examples of expert systems for medicical treatment exist already. For spatial planning and spatial decision making they do not, partly because of the more serious complexity of this society related field of attention , but also because spatial planners did not reach that state-of-the-art until now. A lot of spatial planners did not be aware of the importance of computerisation for a long time.

That awareness is crucial also for an understanding of future developments in high-tech, and the consequences for spatial planning as an activity to handle and maintain of urban and non-urban space and use, as well as for society in a substantial view on behalf of spatial planning.

About the future developments in high-tech special attention is needed for 'networking' and 'telematica'.
Networking points at a physical relation between different computer systems and its communication possibilities. There exists local networks (f.i. within one building), and even long distance networking which transfer information via satellites. To manage all different systems and all

different system charateristics a lot of (intermediate) software is needed, the well-known Kermit communication software. Data, information and even software (programs) can be transferred from one system to another one, just using a telephone cable or in case of satellites by adapted waves.

In a wider context one speaks about 'telematica', in fact a french issue to ask attention for a range of developments to be expected for the future caused by the computer revolution in general. It will cause (and partly it did already) the creation of a system in which one gets its money from the bank by using a money-automatic-machine with aid of plastic cards, in which one pays money by computerized banking by telephone from a home location, in which group discussion is organized by telephone and television connections, in which an airplane ticket will be bought by making reservations at a telephone related home terminal, in which data and information coming from the other side of the world do not be squared up by amounts of used time but in terms of quantities of data and information, and in which images or photo pictures are sent to places all over the world in a few seconds by using facsimile facilities. That is, a transmission of a standard 21 cm x 29.7 cm document from one place to another.
Also of importance will become the 'electronic mail', by using terminals connected by telephone to send a 'letter' or message, which will be received in a dedicated piece of memory at the receiver's location.
But, there are more. In the new town of Tama in Japan an effort for distributing newspapers by connected teleprinters has taken place. Perhaps of greater influence will be the whole range of telecommunication based on computer and television systems, such as Viewdata and educational broadcasting.
'Operationally, computers use telecommunications to collect data for processing and to distribute results; and telecommunication systems use computers to control the switching centres (exchanges) that direct the routing of channnels and messages. Communicating and computing are thus complementary functions in automatic information systems' (Laver 1980, p. 12).

A CHANGING SOCIETY: CONSEQUENCES FOR SPATIAL PLANNING

It is evident that information and information technology has been influenced society thoroughly, and that process will go on (probably) faster in the future. Garrett and Wright(1980, p. 489) describe four such developments, namely:
1. the emergence of the cheap programmable (micro)computer;
2. the 'domestication' of computers, i.e. the use of standard household devices for input, storage and power supply;
3. the development of computer networks; and,
4. the decline of the idea of centralized computer power, in particular caused by introduction and overwhelming production and use of (personal) microcomputers. Especially, the implementation of microcomputers as 'intelligent terminals' will cause important consequences. And quoting Garrett and Wright (1980, p. 493) 'ironically, what was designed for the defence of the state could become the communications structure of a decentralized society.... A decentralized society needs a very fast and efficient decision-making system involving all those who might be affected'.

Inherently, it will cause several spatially related phenomena. Perhaps it will even cause dramatic changes in land use and activity patterns, because of the irrelevance of location of all kinds of activity. There is just one condition that has to be fulfilled, namely to possess a connection to needed computer and telephone networks.
Perhaps it means a change in urbanization and concentration conceptions also. Anyway computer revolution and the so-called information society are issues which will influence planner's conceptions drastically.
Lefevre(1980, p. 483) states that the related 'telecommunications seem to accellerate the decentralization of employment in metropolitan areas but not necessarily to lead to any transfer of activities to other urban centres', and 'will transform the role and the form of places of communication in economic and social activities or will call for the establishment of new ones. At home, the telephone will become a terminal....' (p. 484).

CONCLUSIONS

Developments in high technology during the last decades show thorough influences on several societal processes, in particular caused by innovations in chips and computer technology, and in communication technology.
These developments will be encompassed by changes in land use and activity patterns as well as in the way of thinking about spatial processes, and about urbanization in particular. It will cause a changing attitude of spatial planners resulting in conceptions in a drift.
Because of changed land uses and activity patterns as well as the scientific possibilities coming forth from high -tech innovations like the use of computers, there will be created a demand for new and advanced methodology for spatial planning, a beginning step has been set by the construction of a great number of analysing and decision making models suitable for the use of computer equipment. Partly it concerns little models, partly it concerns very extensive and comprehensive models. But still their conceptions are mainly based upon a traditional view and methodology of spatial planning and decision making.

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