

# Sixth Annual Symposium on the Application of Computers to the Problems of Urban Society – A Report

BEN SHNEIDERMAN

*Department of Computer Science  
State University of New York at Stony Brook*

The difficulty of implementing sophisticated technological solutions to pressing urban problems was the most frequently repeated theme of the Sixth Annual ACM Urban Symposium. The conference, held at the New York Hilton on October 29, 1971, was designed to attract computer oriented urban planners and engineers to consider and discuss the use of computers in solving the problems of urban society. The sponsorship of the symposium was by the Long Island, New York City, Northern New Jersey, and Westchester-Fairfield County Chapters of the Association for Computing Machinery with the cooperation of the Center for Urban Environmental Studies of the Polytechnic Institute of Brooklyn.

The morning plenary session was opened by Symposium Chairman, Gerald Sturman, who introduced the keynote speaker, Edmund N. Bacon, architect and city planner of Philadelphia. Mr. Bacon's initial thrust was to take issue with the fact that computers are given too much credence, "status they don't deserve," and "occult powers." He felt that city administrators and urban planners should be better acquainted with computerized techniques in order to help them restructure their thinking. Recognizing that "the key issue is fragmented thinking," Bacon argued for the application of system analysis techniques and celebrated the "re-emergence of binary thinking." The computer motivates the development of paradigms or model of thought and increases the feedback effect.

Finally, Bacon stated that one value of the use of computers in contemporary society was that it stimulated "new thinking and new processes."

Next, the panel discussion, chaired by Dean Bernard P. Springer of the School of Architecture and Environmental Studies of the City College of the City University of New York, met to consider the question: Must human values be sacrificed in automated urban decision-making? Dean Springer re-interpreted the question as: Does the computer affect values?, and then gave the question to the panelists. Abe Gottlieb of the Pennsylvania State Planning Board opined that computers don't create human values—they only freeze, fix, and solidify present practices. He felt that social institutions such as schools, hospitals, the army, and prisons are already devoid of positive human values and that computers could not make things worse. Taking hospitals as an example, Gottlieb made the point that institutions no longer operate to benefit the needs of those who are served.

James Beshers of the Graduate Program in Sociology of the City University of New York, felt that computers can produce change, but that the key to social change was politics. He stated that cities were in virtual anarchy due to the hundreds of groups vying for power in city government. Furthermore, the uninformed feedback, which Beshers labeled as "public flak," interfered with the efficient operation of social institutions. He remarked that the solution to urban problems was in decisive political action.

The luncheon speaker, Howard Samuels, President and Chairman of the Board of the Off-Track Betting Corporation, New York City, contributed to the arguments in favor of political action to produce social change. Believing that solutions do exist, he claimed that the country was immobilized and currently incapable of progressing. Samuels argued for the elimination of the seniority system in Congress, the restructuring of state and local governments, and for the application of modern management techniques to governmental operations.

In the afternoon, Program Chairman Gordon Gebert of the Urban Research Group of the School of Architecture of the City College of New York divided the participants into four workshop sections: Social Values, Public Systems, Planning, and Routing and Scheduling. The smaller groups met informally and discussed a series of papers in each area. Since the complete text of the papers was available in the proceedings each speaker gave only a short presentation of his work. There was active participation and lively discussion with ample opportunity for questions and argumentation.

In addition to the major speakers and workshops, the symposium

committee arranged to have a series of exhibits and displays of the applications of computers in urban planning.

Abstracts of the papers presented in the workshop sessions and the names and affiliations of discussants are given below.

The Proceedings of the conference containing the full texts of the technical papers is available at \$10 from ACM Headquarters, 1133 Avenue of the Americas, New York, N.Y. 10036.

Section A:       SOCIAL VALUES  
Chairman       Paul R. DeCicco  
                  *Polytechnic Institute of Brooklyn*

“Changing Social Values—Where Does The Computer Fit In?”

Abe Gottlieb, Research Planner  
*Pennsylvania State Planning Board*

This paper examines the shifts in social values that have surfaced in the second half of the past decade and relates certain computer applications to these trends. A clear divergence between the styles and values of a growing segment of the population and the directions indicated by computer technology becomes apparent. In the decade ahead this gap will exert significant pressures on how and to what extent the computer will be applied to scientific, economic, and urban-oriented problems.

“Functional Area Analysis”

David S. Alberts  
*New York University*  
Lawrence F. Young  
*The Center for Area Research*

Governmental decision-making in general and specifically planning and allocation decisions are made without benefit of clearly defined quantitative objective functions. Further, due to lack of an adequate means of treating the interrelated functions of government, planning decisions are normally made independently for each function (e.g., housing, education, and transportation). It was particularly in this context that the computer offered great promise due to its ability to store and manipulate huge amounts of information. In its application to social problems, the emphasis has been incorrect. Rather than use the computer primarily to store information about urban centers in greater detail by the establishment of functional information systems, the emphasis should be on pulling together less detailed information for a variety of functions. That is, to use this

highly precise instrument to put together “crude” pieces of information. This approach is more likely to result in better performance for two reasons:

1. The objective functions used to evaluate alternatives are *qualitative* and can only be transformed to very crude quantitative equivalents.
2. Performance of social systems is more likely to be sensitive to suboptimization as a consequence of ignoring the interactions of societal functions than as a consequence of approximate solutions using crude data.

Functional Area Analysis is an approach employing a computer which offers great promise in aiding the planner to make decisions because it:

1. Integrates the societal functions so that their interactions can be taken into consideration, and
2. Allows for the use of crudely stated objective functions.

This paper is meant to serve as an introduction to Functional Area Analysis as applied to the investigation of urban planning decisions.

“Urban Analysis and the Computer:  
A Strategic Approach for Urban Policy Analysis”

Samuel J. Bernstein  
*Baruch College, City University of N.Y.*

Proposing systematic means to analyze city problems and to evaluate policies for their resolution are the focal points of this paper. To accomplish this, a strategic approach employing two major components is developed. The first component is an urban growth framework through which current urban problems may be understood and alternative policies generated and evaluated. On the basis of the growth framework the urban scenario for analysis may be said to be characterized by the redevelopment of older neighborhood in central cities and “peripheral sprawl.”

The second component of the strategic approach is developed within these rubrics. It includes a set of linked computer-based models which:

1. analytically describes the urban system and the interrelationships of the central city and suburban entities in terms of common socio-economic, cultural, and other factors;
2. monitors change in the factors dimensioning the entities and traces the impact in terms of population shifts; and
3. derivatively, shows how to establish policy preferences for optimizing the benefits from public investment in urban areas.

Some of the advantages to this computer-based strategic approach are:

1. it forms a decision tool or intelligence system to aid urban policy-making—e.g., by interpreting information into intelligence;
2. in this regard, the models attempt to direct as well as to approximate the magnitude of changes to be induced by urban policy necessary for improving the quality of city living;
3. no single all-encompassing but rather specific solutions are aimed for; and
4. the applications of the models are predicated on a realistic framework of the present and proximate future urban scenario.

“Public Access To Computerized Record Systems”

Maxwell E. McCombs

*Associate Professor, School of Journalism*

*University of North Carolina at Chapel Hill*

Computer technology increasingly is being used to manage public and administrative records. As this information vanishes inside the computer, a basic question arises about what actually is the public record. Is it only a facsimile of the input, or is it any possible manipulation of the data? If the latter, then what provision will be made for public access to government-owned computers? The press, and other professionals, will increasingly raise these questions in coming years. Public administrators of these records should establish an access policy which provides both public access and insures the confidentiality of private individual data.

“Responsive Democracy: Just Pick Up a Phone and Vote!”

Peter Bock

*Dept. of Electrical Engineering and Computer Science*

*The George Washington University*

Utilizing today's sophisticated data processing and communications technology, a computer-assisted national vote acquisition system (CAN-VAS) is proposed. Every voter possesses a unique voting number which he may assign anonymously to any one of several Members of an Executive Council, which replaces the current office of the President and his Cabinet. At any time, and as often as he wishes, the voter may switch the assignment of his vote from one Member to another by placing a toll-free telephone call to a central computer. This computer accepts his voting number, checks its viability, credits the designated Member (or candidate), and debits the Member who had previously been the recipient of that voting number. Whenever the Executive Council makes a decision on any

proposed executive action, each Member votes in proportion to the total number of popular votes that he possesses at that time.

“Computers, Values, and Air Pollution Decisions”

Seymour Schwartz  
*Division of Environmental Studies*  
*University of California, Davis*

Advocates of a rational-scientific approach to improving decision-making believe that bringing “proper information” to decision-makers is the answer to the irrationality of politics. This paper considers the technical means of improving decision-making in air quality management within the context of how conflicts over values and goals could and should be resolved in a democratic society. A model for calculating the benefits of reduced pollution damage is presented. The information and computational requirements of a rational decision process and the adequacy of the methodology for evaluating benefits of pollution control are examined. It is shown that the rational process suffers serious shortcomings—required information is unattainable and methodology for evaluation is inadequate. More important, it is argued that resolving conflicts over how different individuals value the benefits of pollution control by benefit-cost techniques is anti-democratic. Having dismissed the rational-scientific approach, several possibilities for using simulation models in a more democratic decision process are considered.

Discussants: Robert Mayhawk  
*Robert Mayhawk Associates*  
Robert Cushman  
*Regional Editor, EDN-EEE Magazine*

Section B: PLANNING  
Chairman: Robert West  
*Tri-State Transportation Commission*

“Simulating Conflicts of Interest Over the Location of Public Housing  
With the Aid of a Computer-Aided Space Allocation Technique”

Donald P. Grant  
*Associate Professor, School of Architecture*  
*California State Technical College, San Louis Obispo*  
Barbara Thompson  
*Research Assoc., Center for Planning & Development Rsch.*  
*University of California, Berkeley*

The points of view of several community groups and authorities are simulated using a computer-aided space allocation technique. Numerical indices representing relative power or priority in decision making are estimated and used to create a composite picture of the acceptability or desirability of sites for low income housing based on the simulated points of view of all the groups. In some cases, the outcome will be that there is an overall agreement on acceptable sites despite differing preferences on individual decision parameters. More typically, the technique will reveal basic disagreements on site acceptability as a result of differences of opinion on individual decision parameters. The technique can provide an analysis of the sensitivity of composite site acceptability to compromises on particular points.

**"Computer Simulation of a Regional Housing System"**

David W. Sears  
*Asst. Professor of Regional Planning*  
*University of Massachusetts*

Increased government intervention into the American housing market appears to be both necessary and likely. A major need of public policy makers is the ability to predict the consequences of alternative government actions intended to affect housing. Computer simulation is proposed as a useful technique. The New York State Regional Housing (NYSRH) model, which is a computer simulation of a regional housing system, is described. It is suggested that six modifications of the present version of the NYSRH model will improve its utility for public policy-makers.

**"A Demonstration of the Use of Computer-Aided, Land-Use Modeling  
 for Regional Service System Design"**

David Seader  
 Sigurd Grava  
*Division of Urban Planning*  
*Columbia University*

The Urban Systems Engineering Demonstration Program of the U.S. Dept. of Housing and Urban Development represents an attempt at a comprehensive approach to the design of service systems. This paper explores the systems techniques utilized in the planning segment of one of the first projects funded under this innovative program. The work concerned designing a water supply system for the year 2010 in the greater Cleveland region, and the planning portion projected the future demands for water. The demand pattern was generated using a computerized land use model, DYLAM II. The model's aspects are presented and explained,

Especially detailed is the extensive calibration exercise conducted to insure dependable results.

**“Computer Modeling of Small-Area Transportation Service”**

Robert E. Paaswell

*Assoc. Professor of Engineering & Applied Science*

Wilfred W. Recker

*Assoc. Professor of Engineering & Applied Science,  
State University of New York, Buffalo*

The Buffalo, N.Y. Model Cities Agency is currently sponsoring a demand-activated, free transportation service for the elderly of a specified area of the city. Data collected over the first five months of operation permits trips to be assessed by trip purpose, time of day, volume, and length in miles. Demand can be established as a function of time of day and probable origins and destinations. The service is funded by a fixed sum amount, so maximum efficiencies can be provided by high volumes, and optimum vehicle use. A method of studying demand and routing through linear programming techniques, utilizing computer facilities is developed. Based upon the transportation model, an example of use is provided.

Discussant: Charles Zucker  
*School of Architecture  
City College of the City University of New York*

Section C: PUBLIC SYSTEMS  
Chairman: Charles A. Kohlhaas  
*Parsons, Brinckerhoff, Quade, and Douglas*

**“An Algorithm for Obtaining Optimal Looped Pipe Distribution Networks”**

Charles A. Kohlhaas

David E. Mattern

*Water Resources Group*

*Parsons, Brinckerhoff, Quade, and Douglas*

The optimization of additions to a municipal water distribution system involves more than efficiency considerations. Such factors as public health and reliable service must also be considered. A review of the state-of-the-art in water distribution system optimization is made. A new algorithm is defined to enable a linear program to optimize a looped distribution system. Its basis is the specification of minimum sized pipes to meet emergency flow requirements and the specification of flow as the linear programming



decision variable. A discussion of the computer implementation of the algorithm includes decomposition of the distribution system, matrix generation, optimization using separable nonlinear programming, and report writing. The checking of the optimization with a water distribution simulation model is discussed and typical computer run times are given. Cost savings resulting from application of the model are also discussed.

**"Information Systems for Urban Fire Protection Planning: A Case Study**

John J. Gaudette, Jr.

Joseph J. Harrington, Ph.D.

*Harvard University*

The technical and economic feasibility of an information system for fire protection planning is demonstrated by developing such a system for Cambridge, Mass. Municipal, federal, and private data are merged permitting analysis of factors influencing alarm rates such as time, construction class, occupancy, and socio-economic and demographic forces. Some 29,000 alarm records for five years and 13,000 individual structural data form the primary data base. Data collection strategies, processing approaches, and verification procedures are discussed.

Results from preliminary analyses suggest the power of the information system. Statistical analyses are possible on both an individual structure or area bases. Computer mapping display programs detect patterns in contiguous areas. The direction of future work is discussed.

**"A Decision Tool for CBD Bus Operations"**

Gary Nelson

*Research Assistant*

Frank DiCesare

*Asst. Professor of Systems Engineering*

*Rensselaer Polytechnic Institute*

For the many cities too small for a rapid-transit system, a Shuttle Bus system could provide the answer to Central Business District (CBD) transportation inefficiency. This work is done to provide a more sound basis for implementing a shuttle bus system in a CBD. Bus systems are placed in proper perspective in the urban environment. A travel demand model is developed which is more sensitive to relative activity strengths than to travel time. This model is combined with a system operation model to provide outputs in both rider usage and system cost as a function of various routes, fare structure, and other operating policies. The model is applied to the Albany, N.Y. CBD and the results of various strategies are given.

**"Systems Analysis for Subway Environment"**

Tio C. Chen

*Chief Systems Engineer, Advanced Technology Division  
Parsons, Brinckerhoff, Quade, and Douglas*

This paper presents a tool to analyze the existing subway environmental problems and to predict some possible environmental problems in a proposed subway system. It thereby provides an efficient means to control the subway environment. This tool consists of dynamic systems analysis and the use of a five step scientific method.

This scientific method represents a comprehensive approach to the development of the aerodynamic and thermodynamic models, and the development of the integrated computer model.

The use of dynamic systems analysis provides the analyst with the best approach to a subway environmental design through a multidisciplinary team and the development of an optimal solution for the subway environment.

The body of information presented in this paper is directed to subway planners, engineers and analysts concerned with the environmental design, and control in the rapid-transit systems.

**"Computer Simulation of Traffic Volume-Speed Delay Model"**

Mo C. Li

*Assoc. Professor of Civil Engineering  
New York University*

John T. Collins

*Asst. Professor of Civil Engineering  
Manhattan College*

This paper develops a model on the basis of an academic approach for determining volume-speed-density and delay relationship of a roadway system. The model imposes a frictional impedance on the traffic by lane and processes dummy vehicles through the system. The speed is the average overall speed of the system. The delay incurred by the dummy vehicle is taken as that of the average vehicle. Turning delays at signalized and unsignalized intersections in the system are based upon average conditions.

Webster's experimental model is used to validate the simulation model developed in the study. Two problems are used to illustrate the capability and flexibility of the model. The first problem is to establish the interrelationship of travel time, delay, density, and volume for one-way and two-way operation. The second is the development of left-turn lane warrants for signalized intersections. Opposing flow rates and percentage of left turns are combined to yield a Turn-Impedance factor.

The model has a ratio of real time to computer time in the order of fifty to one. The language used is FORTRAN IV.

Discussant: Nancy Adler  
*Environmetrics*

Section D: ROUTING AND SCHEDULING  
Chairman: Lawrence D. Bodin  
*State University of New York, Stony Brook*

“Scheduling of Committees for the New York State Assembly”

Lawrence D. Bodin  
Allen J. Friedman  
*Urban and Policy Sciences*  
*State University of New York, Stony Brook*

In this paper two aspects of the problem of scheduling the legislative committees for the New York State Assembly are discussed. The first part describes how to find a schedule for the committees given the committee assignment of the legislators which minimizes the total number of meeting hours while avoiding conflicts. The second part describes how to perturb the given committee assignment of the legislators to reduce the number of hours necessary for all committees to meet. These procedures are illustrated in the last section of this paper for the New York State Assembly problem.

“Implementing Proportional Rotating Schedules”

Nelson B. Heller  
*Staff Member, Board of Police Commissioners*  
*St. Louis Metropolitan Police Department*

Proportional rotating schedules may be designed to distribute manpower by shift and day of the week in proportion to the demand for service. Police, fire, and ambulance services which operate around the clock, and other public services manned more than five shifts per week, may find these schedules useful. The design technique presented may be applied to schedules with any number of shifts per day, overlay shifts, and schedules in which some fraction of the men are permanently assigned to certain shifts. Methods for designing schedules for days off and vacations are also discussed. The design procedure is illustrated with two schedules developed for units at the St. Louis Metropolitan Police Department.

“Routing for Municipal Services”

David Marks  
*Asst. Professor of Civil Engineering*  
*Massachusetts Institute of Technology*

Jared L. Cohon  
Harley L. Moore  
*Graduate Students*  
*Massachusetts Institute of Technology*

Robert Stricker  
*Engineer*  
*Bell Telephone Laboratories*

Some municipal services such as refuse collection, street cleaning, and snow plowing are involved transportation systems requiring careful analysis to ensure proper routing and scheduling. Due to their nature as public rather than private sector problems, analysis methods for dealing with such problems must be tempered with the imposition of different, difficult to quantify, and often conflicting goals and constraints far beyond traditional cost minimizing or profit maximizing objectives. In this paper we outline some of the problems in analysis of municipal services, describe some techniques now being investigated, and present some work carried out in different programs in Cambridge, Mass.

“The State of the Art of Routing Algorithms  
for Demand-Actuated Systems”

Nigel Wilson  
*Asst. Professor of Civil Engineering*  
*Massachusetts Institute of Technology*

This paper reviews the state of algorithm development for a new type of urban mass transportation system which dynamically responds to the current demand for service in the area. In this type of system small buses provide door-to-door service using routes and schedules that are determined by a digital computer monitoring the state of the system and receiving new service requests. The routing decisions are made according to an algorithm used by the computer, and the performance of the algorithm greatly affects the utility of the system. Ideally, an optimal solution algorithm would be used, but the size and complexity of the problem makes this infeasible at the current time. Consequently, heuristics have been developed. These heuristics are described and some of the important simulation results

presented to demonstrate the feasibility of good computerized assignment decisions and to indicate favorable operating regimes for this type of service.

Discussants:

John L. Everett

*Arthur D. Little, Inc.*

Arnoldo Hax

*Graduate School of Business Administration*

*Harvard University*

Richard Larson

*Massachusetts Institute of Technology*