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The development and use of simulation models to provide administratively oriented planning tools for campuses is discussed based on work previously done at the University of Washington on student/space/density relationships. These relationships are extended toward development of simulation models of relationships between student academic programs and resulting space needs. It is intended that the models be adaptable to computer programs capable of using projections of variables which affect staff and facilities requirements to produce estimates of those requirements at any future time. Existing data weaknesses, the application of the models to other colleges and universities, and the models' interrelated computer programs are discussed. (HW)

Remarks made to Association for Institutional Research, 1968 Annual Forum, San Francisco, California, May 8, 1968

SOME EXPERIENCES WITH COMPUTER APPLICATIONS TO CAMPUS PLANNING

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A major purpose of my remarks is to discuss some peripheral matters relating to the development and use of simulation models. Before an institution decides to invest much time or money in a simulation model or models, a great deal of thought should be given to a host of related matters, including: the need to integrate (or at least closely relate) the model to the total university record-keeping methods, academic and financial planning, systems and procedures, and other institutional research studies. Looking ahead, careful attention should be given not only to the entire system of definitions and classification of data within the institution, but also to what changes may be necessary in the future to properly relate the system of classification of data to systems on a statewide, regional, and national basis. For a simulation model to be most useful and effective, it should be thought of within the context of the entire university planning process and closely integrated into that process rather than being thought of as an isolated project.

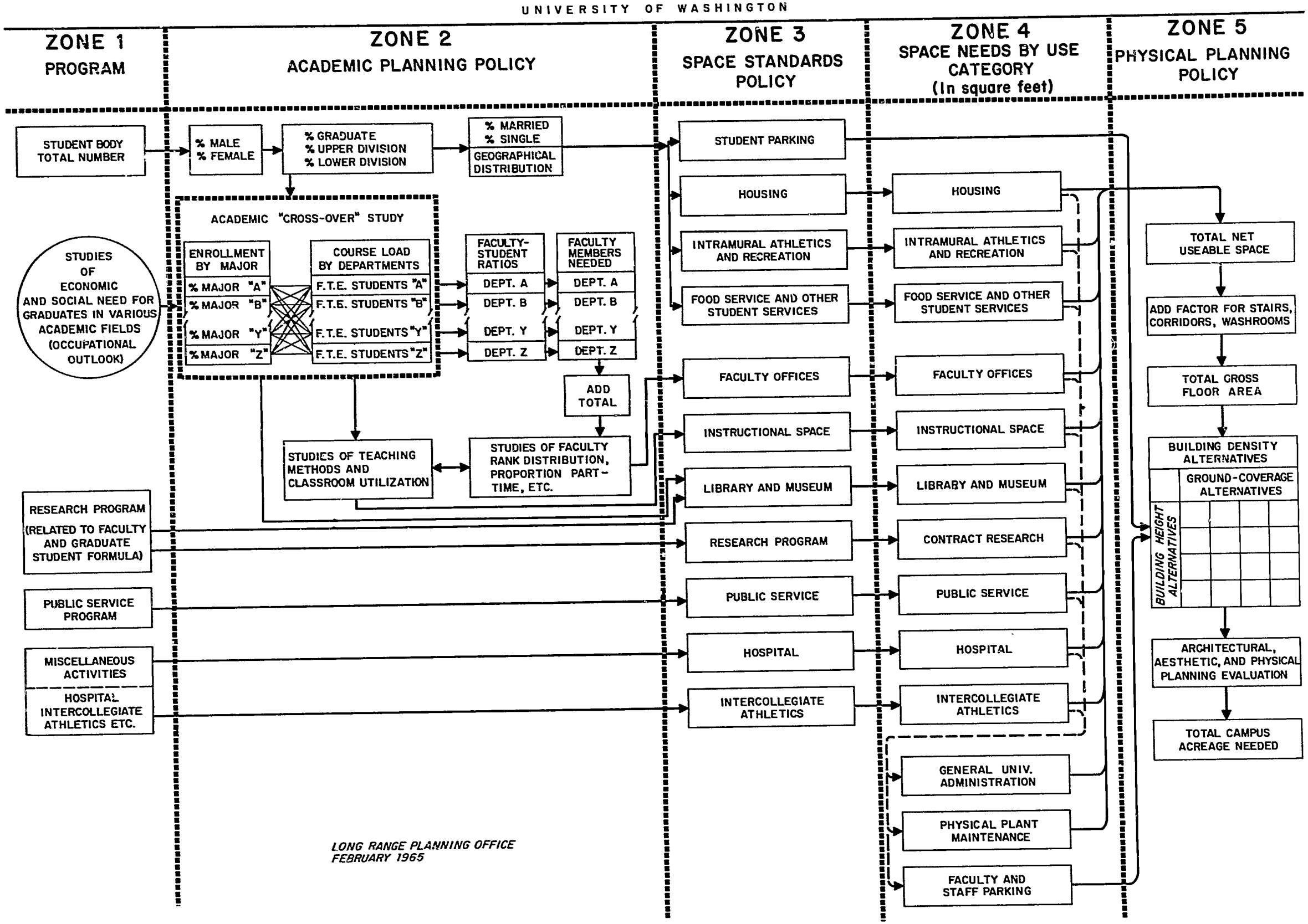
Student/Space/Density Relationships

The conceptual foundation for current work at the University of Washington leading toward the development of a planning simulation model was laid some five years ago with the preparation of a diagram of student/space/density relationships (see Figure 1). This diagram was partially prepared in order to illustrate the complexity of the answer to the simple question: "How many students do we have room for on campus?" The diagram illustrates that in

Figure 1

DIAGRAM OF STUDENT / SPACE / DENSITY RELATIONSHIPS

UNIVERSITY OF WASHINGTON



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order to answer the question of "How many students?" many kinds of prior questions must be answered, such as:

1. What is to be the student mix by level and discipline? (A graduate student in Chemistry may occupy ten or more times as much space as a freshman in English.)
2. What standards are to be used for rate of utilization of instructional space?
3. What standards are to be used for size of faculty offices, number of volumes per square foot of library space, percentage of student body to be provided seating space in library study areas, percentage of student body to be provided cafeteria seating, etc.
4. What proportion of the student body is to be housed in University-owned dormitories and thus what proportion of land area must be reserved for housing rather than academic uses?
5. What are the off-campus trends regarding housing and public transportation and their likely impact on parking demand and resulting amount of land area which must be reserved for parking?

In addition to helping to clarify thinking regarding some of these academic and physical planning relationships, the chart also proved to be helpful in setting the pattern, priorities, and relationships between other long-range planning studies undertaken by the Long-Range Planning Office.

Program Planning

Turning for a moment to a recent development in the fields of planning and budgeting, that of Planning-Programming-Budgeting Systems (PPBS), or

"Program Planning," some pertinent basic concepts are found. Program planning implies a careful definition of the various "programs" that an institution considers as its mission. There appears to be a tendency in educational institutions to consider the various administrative and budgetary units, such as the Physics Department or the English Department, as "programs." I feel that a better approach for planning purposes is to be primarily concerned with the classification of a student by his major and ultimately the degree that he receives, and secondarily with studies of course loads of instruction on a departmental level. In other words, the "output" within a PPBS approach, should be students receiving degrees, not credit hours of instruction by teaching department. The basic instructional program, therefore, should be defined by major and level of degree. Thus a Bachelor of Arts in English, a Master of Architecture, and a Doctor of Musical Arts are all academic programs. A Physics Department is not an "academic program" but is merely a convenient budgetary and administrative unit created to serve not only a significant portion of the teaching responsibilities for Physics majors but also to serve Chemistry majors, Engineering majors, and others.

Analytical Studies

With this basic framework in mind, a strong direction and orientation was indicated for two types of analytical studies undertaken at the University of Washington:

1. A preliminary "academic crossover" study was undertaken to relate students' majors to the resulting teaching load on academic departments, for it was realized that if it is necessary to administer and budget by departmental groupings, some means

would be necessary to translate academic degree programs into these departmental groupings. This was done by processing all student records for a given quarter through the computer and involved a very tedious programming effort. While we are not yet completely satisfied with the form of the output, we feel it was a worthwhile initial effort.

2. A series of "Occupational Outlook" studies were prepared for certain disciplines as one input factor into the determination of the future "student mix" of the University by teaching program. Other factors studied were patterns of student migration and curricular offerings at other colleges and universities in the Pacific Northwest region.

The Concept of a Simulation Model

With this amount of experience and thought about the diagram of student/space/density relationships, it was decided to proceed further toward the development of these ideas into a simulation model of relationships between student academic programs and resulting space needs by various categories of space. Development of such a model was seen as an important academic, physical, and financial planning tool.

The model was conceived as consisting of a series of programs to provide period-by-period estimates of future land, building, and staff requirements under various assumptions as to: character of student body, educational policies, level of research activity, level of service to the community, character of buildings, etc. It was intended that the computer program be capable of taking projections of variables which affect staff and facilities

requirements and produce estimates of requirements at any projected time in the future. This would then provide the opportunity to observe the effects of different projections of external variables and also provide an opportunity to manipulate those variables which can be controlled to see how requirements are altered. In other words, it should facilitate the answering of "What would happen if . . ." type questions.

Data Weaknesses

As the work on the project shifted from development of a conceptual scheme to study student/space/density relationships to the analysis of the form and characteristics of the necessary input data, it was found that definite weaknesses existed in the form and content of such data.

The data problem may be said to consist of three major parts: (1) lack of continuity in the form in which data is kept over a period of time or in the system of classification of data; (2) lack of compatibility in systems of classification and units of measurement of data between institutions and between various parts of the same institution; and (3) lack of availability of data. In some cases the data was not available at all or was available in an unusable form. In other cases it was available but was not on punch cards or computer tape and had to be converted to a form which could be easily and quickly stored in the computer. And finally, some of the data was on punch cards but recorded in a way that made it usable only for simple printings and listings. If such data is to be used for computing purposes, many complicated adjustments must be made to organize it for this use.

Experience with the above problems has led to the conclusion that universities should place greater emphasis on the maintenance of data in a

form which allows maximum flexibility for new applications, yet keeps a high degree of consistency and uniformity in systems of classification.

Work at the University of Washington has therefore, of necessity, shifted and expanded somewhat from the original concept of the student/space/density relationships model. A considerable amount of effort has been devoted to investigation of broader questions of the general university data problem, systems approaches, computer capabilities, implications for general university information dissemination, university administrative practices, and related matters.

Applications to Other Colleges and Universities

With the idea in mind that other colleges and universities were facing similar problems, and that any developmental work undertaken at this University might prove to be of widespread value, a proposal was prepared for financial support from the Esso Education Foundation. Basic criteria in the proposal included the following:

1. The need to develop methods and necessary computer programs which would be usable by other colleges and universities, an obviously more difficult task than constructing custom programs to serve only the University of Washington.
2. The need to create an approach sufficiently dynamic and flexible to meet the needs of a university that is changing its record-keeping techniques.
3. The need to create methods that will facilitate inter-institutional comparisons and the provision of data required or requested by outside agencies.

4. The desirability of creating methodologies and programs which will spare other schools and institutions the need to duplicate the extensive developmental work undertaken at the University of Washington, and which will make most efficient use of their scarce technical computer personnel.

The immediate reason for developing a management-planning model of this scope is its usefulness as a tool for college and university administrators. Planners and their staffs at universities and colleges should learn to communicate regularly with computers to obtain information and to test the probable consequences of alternative courses of action. Further, planners can spend very little time in technical preparation for such direct communication with the computer. Heretofore, only technical computer personnel, with their professional techniques and vast technical knowledge, had the necessary training for such direct communication. In order to bridge the gap, it is important that much of the routine work of the technical computer personnel be taken care of automatically within the computer.

Objectives of Project

As evolved, the current total design objectives of the project are to provide a user-centered and -oriented tool that is:

1. Applicable not only to schools that can afford a special data-processing staff for planning applications, but also to smaller and private colleges which at most can only afford computer time-sharing communication by a remote terminal.
2. Designed in a computer language (COBOL) that is not tied to any computer or manufacturer of computer machines. The language

instructions should be capable of running on nearly any "third generation" random-access processing medium- to large-scale computer.

3. Self-instructive, alterable, and maintainable by people who spend most of their time in efforts not connected with computers (except for initial setup which should be by professional programmers).

4. Easily applicable to the needs and problems of planning staffs and planning and research committee personnel.

5. Capable of providing a ready, coordinated data storehouse of past and present planning data and simulated or real projections for the future. Whether the user's information needs are general or very specific, he should be able to explore or construct the data in depth without being subjected to the arbitrary summarization of indexers or abstractors of data systems.

6. Capable of providing reports to management by remote terminal, high-speed printer output, or by graphic charts that can be custom tailored. The non-technically trained user of a remote terminal should be able to develop new programs and applications, easily creating, editing, correcting, updating, and storing programs from the remote terminal.

Thus, in summary, the objective is to provide a planning tool administratively and not technically oriented, a tool that is capable of coping with the changing data needs of a dynamic university or college.

International Business Machines and other computer manufacturers have or are working on a number of standardized programs to accomplish many of

the objectives that have been expressed. These may be called "General Information Systems" or "Management Information Systems." The distinction between these industry-produced programs and the work of this project is that the former are prepared for a specific type of machine and use a computer language understood only by that machine. The master program to be produced as a part of this project, on the other hand, is written in COBOL-65 computer language which is universally understood by all major computers, and is tailored to the information needs of higher education, of both large and small schools alike. The master program seeks to interpret in a uniform manner input from various schools--input data which may be organized in a wide variety of ways--without detailed, individual, technical reprogramming to reconcile differences in record-keeping.

Computer Program Relationships

The various interrelated computer programs are shown in Figure 2. A brief summary of their various functions is as follows:

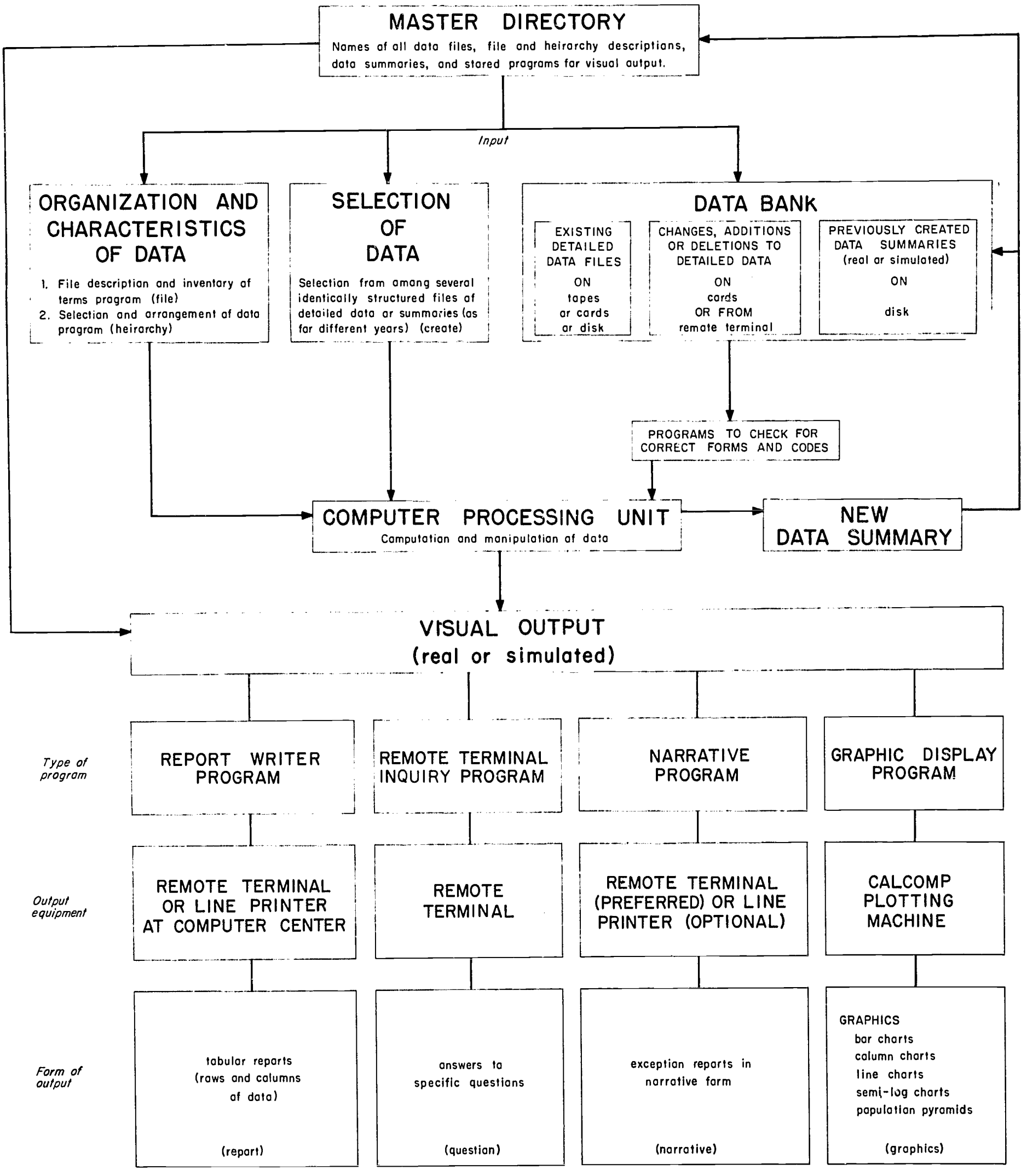
Computer File Creation--The basis for the planning and simulation process is the creation of a data bank of cross-classified and summarized information drawn from such source records as student master files, space inventory records, etc. This part of the project consists of two phases: (a) development of the classification scheme, and (b) "loading" the computer files with actual data.

Generation of Reports--Computer programs are being written to facilitate the creation of reports desired by the user. Since analyses of future requirements for planning purposes require extensive tabulation in varied format, a "report generator" (a higher level computer program) will permit rapid output

Figure 2

UNIVERSITY MANAGEMENT PLANNING MODEL
DIAGRAM OF COMPUTER PROGRAM RELATIONSHIPS

UNIVERSITY OF WASHINGTON



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of data in a form suitable for analysis without requiring the writing of a complicated computer program in each case. The user will merely specify the form most useful to him, and the "report generator" will supply the detailed computer program which will produce the report.

It will be possible to create new files of simulated data, based on the old files, holding some input factors constant, and varying others, as desired, in order to study the resulting changes elsewhere in the system. It is this aspect of the project, of course, which will be of most use to campus planning. It will make possible quick answers to those "What would happen if . . ." type questions referred to earlier.

Remote Terminal Inquiry--This portion of the project will design and test methods of retrieval of information from the data files in the computer through a remote terminal. A typical remote terminal is in the form of a teletypewriter of the sort found in many business offices. Its keyboard is much like that of a standard typewriter. A computer program is being written that will permit inquiries to be made of the computer data bank by typing on a remote keyboard. Requests would be stated in standard English words such as "How many freshman female out-of-state mathematics majors live in residence halls?" In a few seconds the computer would search the files, perform any necessary calculations, and send the answer back to the remote terminal where it would be typed on the teletype paper roll. While one may not be able to think of any worthwhile use of this specific information off-hand, it is an example of the type of complex inquiry which could be made of the data bank and which would receive almost an instantaneous reply. Remote terminals can be used not only to provide short answers to specific questions but also to print out complete reports.

There should be a great potential for remote computer terminals located in various administrative offices on a campus. An important secondary benefit of the development of a computer simulation model as a planning tool is the creation of an instantaneously accessible and up-to-date data bank. If such a data bank is accessible from a variety of locations, many of the problems of reconciling conflicting information would be eliminated. It would be good to know that all requests for information would be receiving the same answers.

Graphic Display--The last aspect of the current project involves experimentation with means of creating machine-produced graphic displays of various information from the data bank and from simulated patterns of growth. Programs are being developed which will use computer data and a CalComp plotter to produce line graphs, semi-log graphs, column charts, bar charts, and three-dimensional graphs, from simple commands.

Work thus far on this project strongly indicates that procedures such as these should be common practice on college campuses before many years pass.

REFERENCES

Bushnell, Don D., and Allen, Dwight W. (eds.) The Computer in American Education. Commissioned by the Association for Educational Data Systems. New York: John Wiley and Sons, Inc., 1967.

Caffrey, John, and Mosmann, Charles J. Computers on Campus. A Report to the President on Their Use and Management. Washington, D. C.: American Council on Education, 1967.

College Management Magazine. "Computers on Campus: the State of the Art Today," (March, 1967), pp. 60-68. Reprinted by permission in Data Processing for Education (June, 1967) pp. 1-6.

Dilley, Frank B. "Program Budgeting in the University Setting," Educational Record (Fall, 1966), pp. 474-489.

Duke University, Durham, North Carolina; Caudill Rowlett Scott, Architects Planners Engineers, Houston, Texas; and Hewes, Holz and Willard, Inc., Educational Data Processing Consultants, Winchester, Massachusetts. Computer Aided Campus Planning for Colleges and Universities. A research study sponsored by Educational Facilities Laboratories and Duke University. Interim report, August, 1967.

Harris, Britton. "How to Succeed with Computers Without Really Trying," Journal of the American Institute of Planners (January, 1967), pp. 11-17.

Henle, R. J., S.J., Coordinator. Systems for Measuring and Reporting the Resources and Activities of Colleges and Universities. National Science Foundation publication NSF 67-15, Washington, D. C., 1967.

Interuniversity Communications Council. "Information Systems in University Administration," EDUCOM Bulletin (January, 1968), pp. 1-6.

Knorr, Owen A. (ed.) Long-Range Planning in Higher Education. The papers and discussions of the Sixth Annual Institute on College Self Study for College and University Administrators held at the University of California at Berkeley, July 6-10, 1964. Sponsored by the Western Interstate Commission for Higher Education, Boulder, Colorado, and the Center for the Study of Higher Education, Berkeley, California. Boulder, Colorado: Western Interstate Commission for Higher Education, 1965.

Koenig, H. E., and others. A Systems Approach to Higher Education--A Comprehensive Report of Progress. Interim Report No. 3. East Lansing: Division of Engineering Research, Michigan State University, May, 1966.

Peat, Marwick, Mitchell and Company. "Computer-Assisted Planning for Colleges and Universities," World (A Peat, Marwick, Mitchell and Company publication) (Autumn, 1967), pp. 7-13. Reprinted (with editing) AEDS Monitor (Association for Educational Data Systems) March, 1968, pp. 5-8.

Robinson, Daniel D. "Management Information Needs in Higher Education." The Instructional Process and Institutional Research, Proceedings of the Seventh Annual Forum of the Association for Institutional Research. 1967.

Rourke, Francis E., and Brooks, Glenn E. The Managerial Revolution in Higher Education. Baltimore: The Johns Hopkins Press, 1966.

Rourke, Francis E., and Brooks, Glenn E. "The 'Managerial Revolution' in Higher Education," Administrative Science Quarterly, 9:2 (September, 1964) pp. 154-181.

Rourke, Francis E. "The Managerial Revolution in Higher Education." Academic Decision Making, Proceedings of New England Board of Higher Educational Workshop on Institutional Research. Durham: University of New Hampshire, June, 1965.

Smith, Jack W., and Dickson, William C. "An On-Line Nationwide Remote Inquiry System for the Dissemination of Educational Data," Journal of the Association for Educational Data Systems (September, 1967), pp. 5-14.