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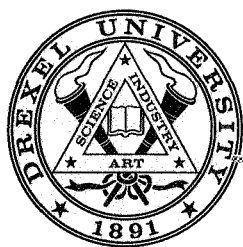
RESEARCH AND EDUCATION
IN MANAGEMENT OF LARGE-SCALE
TECHNICAL PROGRAMS

NASA Grant NGL 39-004-020

Third Semi-Annual Progress Report
June 30, 1970

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Third Semi-Annual Progress Report
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1.0 ABSTRACT

This report is a summary of the activities of the faculty and students working on the NASA Grant NGL 39-004-020 to Drexel University. It is the third of a series of semi-annual progress reports and represents the period of January 1, 1970 through June 30, 1970.

The Drexel organization concentrated its efforts on the following major areas:

1. Development and implementation of both traditional and action-oriented (participatory seminars) courses to meet the needs of this program as specified in the Educational Baseline. (See Second Semi-Annual Progress Report, December 31, 1969).
2. Application of both BUILD and MISPA as viable transfer mechanisms of technology and the management of technology relative to urban systems.
3. Development of a Working Paper on Action-Research to be utilized in the selection of an appropriate arena for the Drexel Team to carry out the research phase of this pilot program.
4. Preliminary investigation of the city of Trenton, New Jersey, and the county government of New Castle County, Delaware, as potential sites for action research.
5. Participation of the Drexel Team on the ad hoc transition team of the newly elected mayor of the city of Trenton, New Jersey, Mr. Arthur Holland.
6. Continued development of our interdisciplinary team by active member participation in workshops as both trainers and recipients of training. In addition, an intensive exposure to International Organizational Development was assured by the arranging of a European Seminar to be held in the fall of 1970.
7. Development of the Drexel Urban Simulation Gaming Laboratory for the development, and implementation of a variety of urban simulation games, or decision making exercises.
8. Feasibility study of the application of the NASA planning process to an urban action-research project.

2.0 PROGRESS REPORT

2.1 Education

2.1.1 Special Courses

Urban Simulation Gaming was developed and offered during the spring term. This course was open to graduate students and taught by Mr. J. Orlando, a member of the Drexel-NASA team. It included an introduction to the theory and practice of urban simulating gaming, the history of gaming, techniques of mathematical modeling and decision theory, experience with urban simulation games such as BLACKS and WHITES, GHETTO, BUILD, etc. Students developed five different games throughout the course, and participated in the development of a model for game design and its use as an educational device.

Pragmatics of Computers and Programming. This special course was an outgrowth of the NASA students' desire to equip themselves with a practical theory and application based knowledge of programming for future application in action-research. This course covered the fundamentals of computer hardware and software systems. Its objective was the development of a working knowledge of one computer language, FORTRAN IV, with programming experience on both time-sharing and real-time batch systems.

Seminar in Urban Sociology. With the approaching action-research phase of the program just a few weeks off, the NASA students arranged for an intensive seminar in the pragmatics of sociological systems in an urban environment. A. B. Shostak, Drexel consultant to the NASA team, is leading this ten-week course currently in progress during the summer session.

2.2 Development of Urban Simulation Gaming

2.2.1 BUILD

During the past six months, we have continued the development of BUILD, and also gained considerable experience in running it with various groups.

Development work included the addition of roles of News Media and Banker, and the deletion of the role of Agitator. In this way, we have verified the possibilities projected earlier for providing a flexible, computer-based decision model which can evolve through use. We also made progress in simplifying the numerical work required of role-players by providing worksheets.

2.2.1 BUILD (Continued)

Complete runs of the game were held in connection with courses (Urban Sociology, Urban Systems Design), and for other interested groups within Drexel (Community Relations Staff, Afro-American Society). Each of these resulted in a number of suggestions for improvements in BUILD, and added to our general understanding of urban simulation and urban education. A paper, describing our experience to date, was presented at the Conference on Computer Applications to Environmental Design in Lexington, Kentucky, April 20-22. The Abstract is included here.

Our work on BUILD has also produced two identifiable new activities: (1) The establishment of the Drexel Urban Simulation Gaming Laboratory described more fully below; (2) The generation of a proposal for interdisciplinary research on urban dynamics to NSF under the IRRPOS Program (Interdisciplinary Research Relevant to Problems of Our Society).

2.2.2 MISPA

Several rounds of this simplified linear simulation model of group decision-making were played both within Drexel and with viable governmental agencies at both the Federal and City levels. Although MISPA is designed to serve as a teaching and learning mechanism for multiple decision-making processes, the major thrust during this period was on the Risk factors associated with employees of governmental agencies and the effect of such factors on their efficiencies as allocators of resources in the decision-making processes. Department heads of the City of Philadelphia were participants in a workshop held at Drexel in April 1970. It is much too early to report on any significant findings since a larger sample size is needed to verify data. However, we are very encouraged by our findings and feel we have the capability to analyze group decision-making from a multi-dimensional array of both management science and behavioral science parameters at the same time. This diagnostic tool then serves to translate individual behavior patterns onto a measurable scale of performance. In the case mentioned above, group norms of willingness to take risks in decision making can be quantified and compared with the group's performance in terms of efficient utilization of budget or manpower.

2.2.2 MISPA (Continued)

A working paper of the results to date was completed and is being presented to The International Meeting of The Institute of Management Sciences in July 1970, by Doctor M. Silver of the Drexel NASA Team.

2.3 The Drexel Urban Simulation Gaming Laboratory

This facility was authorized in April, 1970, and will begin full operation in the Fall. Its purpose is to develop, acquire, and use a variety of urban simulation games, or decision-making exercises. Administratively, this unit will be a part of the Center for Urban Research and Environmental Studies (CURES), but its services will be available throughout Drexel, and also to outside groups as appropriate. In this way, the Laboratory will continue in a formalized way the work on urban game development and usage which has been carried on at Drexel under the NASA Grant, "Research and Education in Management of Large-Scale Technical Programs," since January 1969.

Simulation gaming is a relatively new learning technique which relies on the following elements:

- (1) Availability of factual knowledge and analytic techniques.
- (2) Experience with use of these.
- (3) Feedback evaluation of steps (1) and (2) and repetition of the process.

This approach has always been the basis of effective learning, but the advent of sophisticated audio-visual aids, computers and related technology in recent years has made it possible to implement the above educational philosophy in far more powerful ways than when instruction was confined exclusively to the lecture/reading mode of instruction. The Drexel Urban Simulation Gaming Laboratory will provide a vehicle for rapidly developing the use of these new technologies, and their introduction into the urban-oriented educational program at Drexel.

The Drexel Simulation Gaming Laboratory will develop, acquire, and use a variety of urban simulation exercises. Examples are:

BUILD (A computer-based community development game developed at Drexel)

CITY I (A computer-based metropolitan government game developed by Envirometrics, Inc., Washington, D.C.)

CITIES (A non-computer game published in Psychology Today magazine)

GHEPPO (A non-computer game written at Johns Hopkins)

2.4 Action Research Working Paper

The NASA-Drexel Program is about to enter a new phase with the beginning of the Action-Research. Several months of intensive study and review have gone into the evaluation and selection of a final locale. Basic to this final decision are the criteria as specified in the Working Paper on Action-Research for NASA-Drexel Grant.

2.4.1 Working Paper on Action-Research for NASA-Drexel Grant

The NASA-Drexel Ph.D. Grant is based upon a number of assumptions. First, NASA has developed valid management technology in the process of achieving its organizational objectives. Secondly, that NASA's Management Technology, though honed and refined in clearly defineable terms for outer space objectives, is applicable for the management of large-scale and socio-technical urban problems. Thirdly, that the NASA-Drexel research associates and investigators will attempt to test out the transfer of NASA's Management Technology to urban problems. Finally, such a transfer to any urban client system must, of necessity, involve an Action Research Methodology.

Doctor Paine, Chief Administrator of NASA, has described NASA as a "digital" social system where the objectives were clearly defineable and the major problems were scientific. But Doctor Paine also described urban systems as "Darwinian" or evolutionary where many human factors impacted and could not be as controlled as in a "digital" system. Therefore, the problem of achieving a resolution of critical urban problems is fraught with social and political uncertainty and demands a different management and research capability.

The NASA Research Associates have identified NASA's planning process, configuration management, information systems, and simulation as generically invaluable and applicable to some urban problems. Therefore, an urban social system should be found where these specific management technologies could be tested out for their transferability and resolution to critical urban problems. In order to insure the successful accomplishment of this transfer the client or urban environment in which the NASA Team would work must of necessity have problems which match the possibility of transferring these management technologies. Sanction must be obtained from the highest governing unit in order to have authority to work within a particular system on a particular urban problem.

2.4.1 Working Paper (Continued)

The key aspects of the model are the development of diagnostic skills, data gathering, feedback to the client group, data discussion and work by the client group, action planning, and action. Naturally this is a cyclical process involving the manager and those with whom he collaborates in studying the existing situation, state, or problem. But managers are not only interested in understanding what is but also in what should be the preferred state. The question then becomes how to reach that objective through what kind of alternative interventions or strategies.

Action Research should be considered the science of design where courses of design or action are aimed at changing existing situations into preferred ones. In the example of the NASA Research Associates, they will be dealing with live, critical problems in a complex urban setting, attempting to design actions or interventions to correct or change situations or people to a more preferred state of function in accord with the goals of the responsible authorities.

The Action Research Design and methodologies would serve as strategies for the Research Associates in Public Administration. The change problems in real urban situations to which they will address themselves will serve as the laboratory where they will learn and test out their expertise. The dissertations will be scholarly descriptions of their analysis, designs, interventions, and evaluations of their efforts to change an existing situation into a preferred one. There will be developed a methodological framework and a theoretical base in order to provide a systematic way to understand and keep track of the impacts of the significant variables.

However, action research is just not an attempt to enter a particular client system as an expert, apply a known body of knowledge or skill, and exit. It is rather the effort to assist those within a particular system to develop the skill and knowledge to manage their system or problems on their own with greater expertise. Being multi-disciplinary in their training, the NASA Research Associates will make every effort to assist those within the particular client system to be responsible for changing and managing their own system in a more professional manner.

2.4.1 Working Paper (Continued)

The Action Research methodology will proceed in the following manner:

1. Efforts will be made to gain initial entry to a particular urban system by June or September 1970. Sanction, and negotiation of terms of the relationships should be agreed upon before final entry.
2. Once initial entry is agreed upon, a period of 2 to 3 months should be utilized to study that particular client system in order to more fully understand how it functions and disfunctions. Furthermore, this initial explanation and orientation period should serve as a period of gaining wider acceptance and identification with that system. Finally, problem identification and definition would be accomplished in this exploration period.
3. Once problems are identified and agreement is negotiated with the client system, then each problem area will be studied as to strategies, designs or methods to effect change or influence to a preferred state. Alternative methods will be considered for each problem. Every effort will be made to consider the behavioral and organizational consequence of every intervention so as not to upset the homeostasis of that system.
4. Concurrent with the action research, evaluation of the particular projects will be made by the Associate Investigators, and the organizational preceptors. When appropriate, some of the preceptors may serve as adjunct professors. All of these will serve as process observers of the action research and provide consultative assistance.
5. Finally, upon successful accomplishment of the action research, a descriptive dissertation will be presented with hypothesis, action steps, and consequences or results, with generalizations drawn from the research. Successful action research should produce three basic outcomes: (1) the achievement of the planned change, (2) new knowledge, and (3) a manager of increasing professional competence.

2.4.1 Working Paper (Continued)

The problems to which the NASA Research Associates will address themselves must be doable within a time span of eighteen months, in order to terminate the action-research and accomplish the objectives of the Ph.D. degree. Finally, the client system in which the NASA Research Associates will function must provide a responsible official from within the system who will serve as a preceptor for the NASA Research Associates as they study and assist in resolution of particular problems.

This NASA-Drexel Action Research can be considered then as management problem-solving in complex urban social systems, where the action focuses not only on observing, but on the effective change, or transfer, of management technologies to the resolution of urban problems. Each Research Associate will call upon his increasing knowledge in technology, management science, behavioral science and public administration in the resolution of the particular problem, and he must also perform professionally as a change agent in order to achieve his Ph. D.

Because this action-research program calls for Ph.D. candidates able to function at increasingly higher levels of competence, the judgment concerning their ability to function effectively at a Ph.D. level began with the careful selection of maturer persons from middle-management positions. Their training will be to function as generalists rather than specialists in the field of public administration. This will be an on-going qualifying examination process rather than a single set of qualifying examinations given at a particular time. Because the NASA-Drexel Program spans the diverse disciplines of technology, management science and behavioral science, it will be the responsibility of the appropriate faculty member to develop the criteria and qualifying examination process for his field. This process would be the university's way of maintaining excellence among its candidates and the candidate's way of gaining a realistic appraisal of his ability to function effectively as a professional in his chosen field.

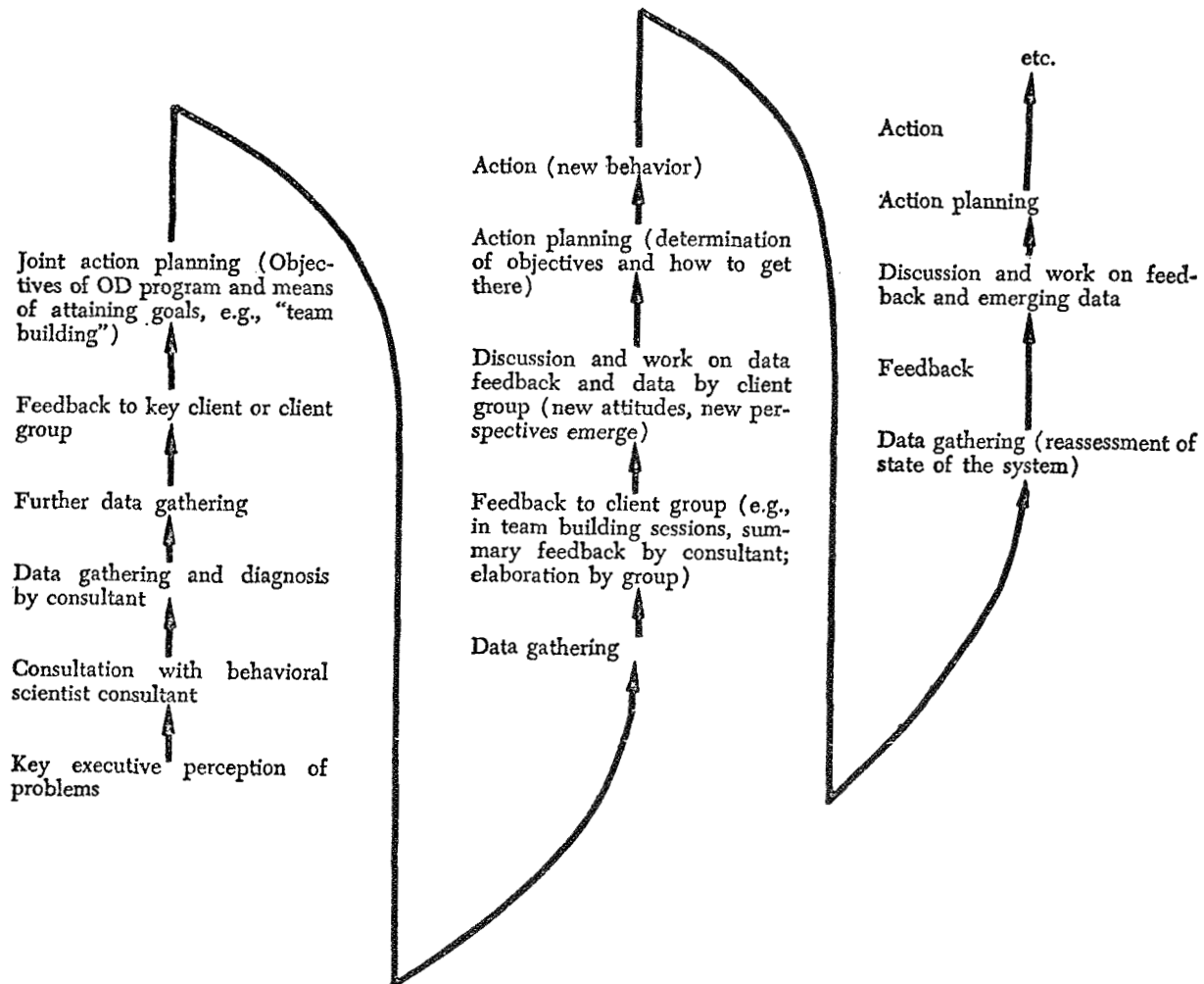
Action Research Definition and Theory

A major strategy and focus in urban government management will be to the action research model. Behavioral

2.4.1 Working Paper (Continued)

scientists involved in organizational development and change are convinced that this model is most valid for learning in such a rapidly changing society as we have created. This model has been described by William Fotte Whyte as "a continuous gathering and analysis of human relations research data and the feeding of the findings into the organization in such a manner as to change behavior." The following figure summarizes some of the essential phases of the action research model.

FIGURE 1. AN ACTION RESEARCH MODEL FOR ORGANIZATION DEVELOPMENT



1. Wendell French "Organization Development Objectives, Assumptions & Strategies" from California Management Review, Winter/1969/Vol. XII/No. 2.

2.5 Interdisciplinary Team Development

Several activities have contributed to the on-going development of an interdisciplinary team. Intensive weekly staff meetings are constantly devoted to both the planning phases of the program as well as dealing with the interpersonal relationships so necessary to a viable organization.

In keeping with our concern to develop a conscious plan of team collaboration alongside our task orientation, we have continued to participate in a series of specific studies, workshops, and seminars in team development. A major part of this work will come in the Fall when the NASA fellows, together with five other graduate students in the Management Development Laboratory, will attend a two-week workshop in Organization Development and International Consulting Skill Training under the auspices of Applied Social Psychology, Inc. The workshop, to be held in Mockelsnas, Sweden, will feature participants from all over Europe in both government and industry.

Prior to this event, the ten Drexel participants will have a one-week preparatory seminar at the prestigious Tavistock Institute in London, England, under the direction of its director of training, Mr. Gurth Higgin. The students have already participated in a seminar with Mrs. Hannah Ernst of the staff of Applied Social Psychology, who visited Drexel for two weeks this past May.

While Mr. Annett, Mr. Siegel, and Mr. Michael have worked on their skill development through participation in the leadership of workshops with such diverse groups as the Philadelphia Junior Chamber of Commerce, the Episcopal Diocese of Delaware, and several commercial firms, Mr. Orlando and Mr. Cadwell attended a two-week workshop in Organization Development at Boston University.

2.6 Government in Transition

2.6.1 Trenton - A Government in Transition

There was a run-off election in Trenton on June 19 for the office of mayor. Arthur Holland won and was to be installed into office on July 1. A contact, arranged by Doctor Stephen Sweeney, was made with Arthur Holland on June 22. He immediately invited the NASA team to assist him in making the transition.

Under the law concerning the governing of Trenton, all the department heads are subject to appointment by the mayor. The incoming Mayor Holland planned to replace all the existing department heads even though he did not have immediate replacements.

2.6.1 Trenton (Continued)

To facilitate the transition, Holland formed a committee on government transition which included local citizens and members of Rutgers faculty. The NASA Team members were assigned to various sub-committees which were to interview the outgoing department heads. The interviewing was designed to determine what decisions would have to be made in the first thirty days after July 1.

The NASA Team members' participation was welcomed by the local committee as providing both assistance and a more objective perspective. Following the interviews, a report was written by the team members. The reports were compiled into a comprehensive report with a careful listing of the most critical issues.

The outgoing department heads were most cooperative with the interviewers. The whole experience proved to be a very valuable educational experience for the team members as well as providing a real service to the incoming mayor.

2.7 NASA Planning Research

As has been previously reported, it is our conviction that one likely management procedure which may fruitfully be transferred from NASA to an urban context is the planning process which was developed and refined in 1969-70. We have conducted some interviews with Mr. Fleming of the Planning Office, and we are in the process now of designing a means of comparing the planning activity in NASA during that year with the activity which we should like to introduce into an urban project.

Our purpose is not to make an assessment of how well or how poorly the process has worked in NASA. Instead, we hope to conceptualize the process as a communication network using the ideas of Watzlawick, et. al. in The Pragmatics of Human Communication. A more complete development of our research activity awaits our actual introduction into an urban system.

2.8 Site for Action Research

New Castle County, Delaware

Working through the Greater Wilmington Development Corporation, several conferences were held with Mr. W. Conner, County Administrator and his executive assistant, Mr. Andrews.

Trenton, New Jersey

At the same time, the NASA-Drexel Team was exploring the compatibility of the City of Trenton via the newly elected

2.8 Site for Action Research (Continued)

mayor, Arthur Holland, and his transition team.

The purpose of these initial visitations was to gain a feel for the compatability of these systems to the team's needs and vise-versa as spelled out in "Criteria for Selection of Action Research" and the "Working Paper on Action Research." (See Appendix)

The accompanying comparison sheet is a summary of some of the key items which will be evaluated prior to a final decision during the month of August 1970.

2.8.1 A Comparison - Trenton and New Castle County

<u>Item</u>	<u>Trenton</u>	<u>New Castle</u>
1. Federal Agency Support State Agency Support	+ +	+
2. Present Commitments	Open	a. Written letter agreement in principle b. Need to negotiate letter of understanding
3. Achievable Project Goals	= ?	= ?
4. Department Head's approval in principle of proposed projects	+	?
5. Entry into system	Done	To be achieved
6. Partnership with local officials as a. Enablers b. Doers c. Experts	+	?
7. Existing relationships with related institutions	++	++
8. Openess to use of NASA Technology	+	?
9. Community participation in decision making	++	+

APPENDIX A

CRITERIA FOR SELECTION OF ACTION RESEARCH PROJECT FOR DREXEL-NASA TEAM

Action research is the vital link in the testing of the transferability of NASA's technology to solving urban problems. The selection of the appropriate location and the related project or projects is therefore crucial.

The basic criteria for the selection are as follows:

1. The invitation should be approved by the highest governing unit to which the project is related.
2. The inviting unit should have adequate resources (legitimate authority, financial resources or political influence) to carry out the project.
3. The inviting group should be able to provide or arrange for adequate financial resources to meet the local expenses involved in the action research.
4. The action research should focus upon the transfer of the planning configuration management process, information management and simulation.
5. There should be a reasonable chance of success in achieving the goals of the project.
6. The length of time for the action research should not exceed 15-18 months, depending on the starting date and should be completed by January, 1972, at the latest.
7. Preferably, the Research Associates should be able to function as a team of professionals in relation to the participants in a particular project.
8. Within the action research, the Research Associate shall be responsible for carrying out and reporting upon an identifiable aspect of that research. The resulting thesis based upon this research shall fulfill the academic requirements of Drexel University.
9. The project should have local participants with the competence and authority to see the project through to its completion.
10. The project should be of such scope as to involve the coordination of the efforts, resources, and approval of several governmental agencies and/or private agencies.

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11. The project should be relevant to a major social issue.
12. The appropriate governmental authorities should approve in principle the planning of the particular project.
13. The planning for the particular project should include representatives of the persons or group directly affected by the project.
14. The appropriate NASA authorities should be in agreement about the action research
15. The location of the action research should be within a reasonable commuting distance of an hour or less from Drexel.
16. The host agency or agencies should appoint a preceptor from within their organization to whom the NASA Research Associates can report, test out hypothesis, and receive feedback.

APPENDIX B

CLASSROOM USE OF BUILD A COMPUTER-BASED URBAN SIMULATION GAME

by

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ABSTRACT

BUILD is a role-playing computer game oriented toward community redevelopment in a city section of approximately 100,000 people. This paper describes the evolution and application of BUILD as an educational resource in courses on urban sociology, urban systems design, and others at Drexel during the Spring of 1970. Student participation in the computer-based game was seen as only one part of a three-part approach to urban education, the other two being the presentation of factual information, and the evaluation and challenge of this information in the light of the gaming experience.

BUILD was limited to twelve distinct roles, with the options available to each role limited to the major functions of the role. The game was not intended to be a replication of reality, but instead was to be realistic enough to represent to the participant during a few hours the major functional and psychological characteristics of his role. The simulation model was deliberately made highly sensitive to player decisions in order to rapidly and clearly illustrate the consequences of any action.

Our conclusion is that simulation gaming can be an extremely effective component of urban-oriented courses, and that it offers the promise of a substantial restructuring of the education experience along the interdisciplinary lines which are necessary for urban problem-solving. The value of the game does not reside in the program itself, but in the actual process of the game play through which one becomes more aware of his factual understanding and emotional awareness of the urban situation.

Manuscript prepared for the Conference, Computer Applications to Environmental Design, April 20-22, 1970, Lexington, Kentucky.

APPENDIX C

MISPA

ABSTRACT

The management of information is a vital function of problem-solving, both within the urban complex and the private domain of industry. To date, research on this process of decision-making has been directed mainly towards a somewhat "rational man" concept of optimization. Granted there are a host of simulation models, either in operation or under design, which attempt to explore problem-solving from a more humanistic viewpoint, but it is our experience to date that the very complexity of such games in addition to the impersonal atmosphere created by the omnipotent computer greatly hamper this approach towards both learning and teaching.

MISPA is a simplified linear simulation model for both group and individual decision-making which attempts to bring together within one system the behavioral and management science conflicts encountered in problem-solving. Teams of 1 to 6 members are formed as a Systems Department within a medium size city. Their role is to make decisions regarding the allocation of resources of money and manpower based on information supplied to them from other departments within the city, and as a result of previous and future data from the resources they allocate. The menu of projects include problem areas of pollution, housing, recreation, and efficiency of intra-governmental systems. The tasks may be varied as the nature of the groups playing the game dictates. An infinite number of moves can be played with any number of groups. Each move represents a period of six months' time within the life of the organization.

The objectives of the game are to (1) provide a vehicle for studying the behavior of individuals as they respond to group interactions and task oriented problems (2) provide comparative evaluation of management (decision making) found in federal governmental, city and industrial organizations (3) serve as an assessment of the transferability of the NASA management system to solution of urban problems (4) training and development of career governmental personnel.

Specific behavioral variables, such as risk taking, leadership determination, communication patterns, etc., are identified within each group prior to playing the game. Such variables are then correlated with respect to the group as a function of their financial performance, i.e., department savings. This allows for both an insight of why the group responded the way it did and the effect of its response on the tasks undertaken.

Initial runs of the game have focused on the risk-taking levels of individuals and groups. Several hypothesis have been formulated regarding

APPENDIX C

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(1) the risk taking in management decision of governmental (Public Officials) versus industrial managers, (2) risk taking as a function of the group versus the individual risk characteristics of each member.

Data collected from several rounds of play with public administrators from the city government of Philadelphia look most encouraging. The techniques of play have been ironed out and qualified students of behavioral science and management have been trained as leaders and observers. Our immediate plans call for continued play of the game with agencies such as the county government of New Castle, Delaware, NASA, City of Philadelphia and several large industrial corporation.