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ABSTRACT

The Academic Games program (which aims at developing and testing simulation games for the schools) of the Center for Social Organization of Schools has sponsored this report of the proceedings of the National Gaming Council's Eleventh Annual Symposium. Sessions of the symposium considered simulations and games in education, management, communication and planning, as well as general topics relating to the design, extension and evaluation of simulations and games. (RH)

Center for Social Organization of Schools

Report No. 143

November, 1972

PROCEEDINGS OF THE NATIONAL GAMING COUNCIL'S ELEVENTH ANNUAL SYMPOSIUM

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The Johns Hopkins University

Baltimore, Maryland

INTRODUCTORY STATEMENT

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through five programs to achieve its objectives. The Academic Games program has developed simulation games for use in the classroom. It is evaluating the effects of games on student learning and studying how games can improve interpersonal relations in the schools. The Social Accounts program is examining how a student's education affects his actual occupational attainment, and how education results in different vocational outcomes for blacks and whites. The Talents and Competencies program is studying the effects of educational experience on a wide range of human talents, competencies, and personal dispositions in order to formulate -- and research -- important educational goals other than traditional academic achievement. The School Organization program is currently concerned with authority-control structures, task structures, reward systems, and peer group processes in schools. The Careers and Curricula program bases its work upon a theory of career development. It has developed a self-administered vocational guidance device and a self-directed career program to promote vocational development for high school, college, and adult populations.

This report, sponsored by the Academic Games program, presents the proceedings of the eleventh annual symposium of the National Gaming Council. The symposium was held October 5 - 7, 1972, in Baltimore, Maryland.

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PREFACE

It is encouraging to note that after eleven years an informal organization like the National Gaming Council can still draw people from diverse fields around the world. Today there are few meetings one can attend and be confident of meeting and/or talking with a Junior High School teacher from Burlington, Vermont, a professor from Drew Medical School in Los Angeles, California or a member of the Operations Research Group for the Japan Defense Agency. The Council still retains its multi-disciplinary nature even though behavioral and social scientists are playing a more active role each year. More effort may be needed in the near future to maintain the Council's vigorous cross-disciplinary interaction.

To date, the National Gaming Council has been an informal organization of people interested in the development and use of simulations and games in many areas. This may change over the next few years because many people feel that for practical purposes the organization, should be formalized. In support of the development of the organization, stronger ties are being made with two widely read publications in the field, namely, Simulation/Gaming/News and Simulation & Games: An International Journal of Theory, Design and Research. If interest and active participation in the Council increases, perhaps a formal organization will be realized over the next few years. Many times I have been asked for the names of those individuals who are "in charge" of the National Gaming Council. The continuity and direction of the Council are handled by the Executive Committee that includes:

Martin W. Brossman	Cathy S. Greenblat	Elliot Z. Ratner
James S. Coleman	Peter W. House	Carl H. Rinne
Richard L. Crawford	Steven J. Kidder	Theodore Wang
Richard D. Duke	JoAnn Langston	
Allen G. Feldt	Philip D. Patterson	

If you are interested in contacting members of the Executive Committee, most of their addresses are included at the end of these Proceedings.

Interest in next year's symposium will undoubtedly be heightened by the simultaneous meeting of the International Simulation and Gaming Association (ISAGA) with the National Gaming Council. The meeting will take place during September, 1973. The ISAGA is the European counterpart of the National Gaming Council with the exception that ISAGA's members are more heavily involved in simulation than gaming. The secretaries for ISAGA are Dr. H. A. Becker, University of Utrecht, Department of Sociology, P. O. Box 13015, Utrecht, The Netherlands and Dr. R. D. Duke, School of Natural Resources, University of Michigan, 109 E. Madison, Ann Arbor, Michigan 48104, U.S.A. For further information about ISAGA, the reader is invited to contact either secretary. The meeting for 1973 will be held near Washington, D.C. For details, contact Dr. Edward Cushen, Division Director, Technical Analysis Division, National Bureau of Standards, Washington, D.C.

It should be emphasized that the planning and follow-through for the Eleventh Annual Symposium of the National Gaming Council was greatly facilitated by the helpful advice of Martin Brossman and the assistance of Alyce Nafziger.

Steven J. Kidder
Center for Social Organization of Schools
The Johns Hopkins University

THE MANAGEMENT GAME: AN EXPERIMENT IN REALITY

Myron Uretsky
New York University

The Management Game at New York University is a large, complex man-machine simulation that attempts to expose students in an MBA curriculum to a realistic and integrated experience. It is unique with regard to the extent to which it involves participants from the surrounding business community. These participants, such as bankers, are not simulated, but play their real roles within the gaming environment. By taking this approach, it has been possible to integrate numerous factors that might not otherwise be representable within the environment. Similarly, this approach has made it possible to transfer the Game fron one installation to another, even to as socially and economically diverse places as Eastern Europe, with relatively little effort. The point has now been reached where its transferability has been proven and a cross cultural research mechanism is being investigated.

Objectives

The Management Game was introduced to New York University six years ago. At that time it was recognized that there were a number of needs that ought to be satisifed within the school, but which had been as yet unfulfilled. These needs fall into two major classifications -- institutional requirements and educational requirements. From the point of view of the institution as a whole, the faculty found itself looking increasingly for a mechanism that would provide integration of the faculty and student experiences in various courses, a reduction in the perceived (and perhaps real) gap between the more or less theoretical approach taken in the University and the pragmatic environment of the real world, improved contacts with the surrounding business community for both the faculty and students, and a research base that would permit investigating complex business problems within a relatively controlled environment. At the same time, the faculty clearly recognizes that from a purely educational point of view it was necessary to fill in some existing gaps. For example, while there were numerous courses dealing with problem solving techniques, there was no meaningful mechanism for teaching students problem recognition and formulation. While students were taking courses on human behavior, there were few opportunities to place them within interpersonal conflict situations over an extended period of time, so that they could learn how to develop an effective managerial operating style. And finally, it was felt that, even after having taken an extensive number of courses dealing with business, the student's perceptions of how businesses really function still left something to be desired.

It was therefore felt desirable to try to find some way in which students could be given the experience of operating within a realistic business environment, subject to some educationally developed constraints. Some investigations were carried out regarding the possibility for developing internship programs with the surrounding businesses. These possibilities were rejected on the grounds that they did not provide adequately high level experience together with sufficient institutional control over the process. It was therefore decided that a simulated environment might be a satisfactory guide.

Overview of the NYU Management Game

The NYU Management Game is a complex simulation of business enterprises operating in a competitive industry. It is designed to provide students with a compressed and integrative, but realistic experience in the management and operation of a medium sized, publicly held corporation. In this one semester intensive course, the students are exposed to the problems, uncertainties, stress and opportunities that arise in managing a company for a simulated two year period. The simulation program duplicates not only the actual operating, marketing, and financial transactions encountered in competitive business operations, but also the internal problems of operating in a management group under conditions of limited time and resources, reward and penalties, and high stress.

Participants in the program are divided into nine groups, each with eight members. Each group represents the management of a corporation and has control over all operations of the company including production, marketing, and financial transactions. The members of each firm act as senior management, while the computer fulfills the role of middle management and all other employees. The computer carries out decisions, performs day to day operations, evaluates competitive interactions, and reports results. It almost always follow the directions handed down by the top executives.

In its current implementation, there are three separate industries. Each industry is completely independent of the others, but is similar to the U.S. (although economic patterns may vary from industry to indsutry). Individual companies compete only with the other two companies in their own industry. By defining each of the industries to be essentially a separate U.S., it is possible to simultaneously make U.S. laws applicable and to permit inter-industry contractual relationships that would otherwise constitute a breach of antitrust laws.

The firms produce and market products in a competitive industry made up of three companies. The simulation is loosely modeled after the detergent industry, however, for educational purposes many other factors have been included in the models, so that it cannot be truly said that this is an accurate representation of the U.S. detergent industry. In addition, companies conduct financial operations that are similar to those occurring in the business world. Each company has a research laboratory, a factory, warehouses, machinery, a unionized labor force, and salesmen. It may produce and market up to three different products at one time. The firms can use various types of testing to conduct market research on the products and activities of their competitors. Both applied and basic product research can be undertaken. Other basic marketing tools such as pricing policy, advertising, salesmen, retail allowances, and discounts can be used. In addition to marketing, the firm must handle raw materials purchasing and storage, production and maintenance scheduling, warehousing and distribution operations in four separate regions. In addition any labor relations and similar problems that effect normal operations of a business can also be represented within the simulation.

Various types of financial reports must be prepared, and business operations must be financed. Nearly all forms of financing are available, handled through negotiations with financial institutions such as banks, insurance companies, and underwriters. An automatic loan at exhorbetant interest rates is available whenever other forms of financing cannot be obtained. Finally, companies are required to have an independent audit, and management has to negotiate a new labor contract. As in the regular business world, the economy is sometimes effected by growth or recessions, inflation, deflation, social problems, environmental concerns, and many of the other outside factors that influence business.

As in the real business world, results depend upon the competence of the members of the indivudal firms and on the decisions of the other two competitors in the industry. The reaction of the market to any given product depends upon a multitude of variables including product quality, distribution methods, and price. Each firm may market up to three products at one time. Each product is assumed to be a detergent and has three major characteristics -- sudsing, washing power, and gentleness. The market is segmented, meaning that there may be a market for a low sudsing product, a high sudsing one, a gentle product, all at different prices and different combinations. Costs of production are dependent both on product attributes and the firm's manufacturing efficiency. Product development is directly dependent on the success of the firm's research activities. The outcome of the competition is, therefore, dependent on a variety of factors which are closely comparable to those found in the business world. The simulation realistically portrays the business environment and is of adequate duration so that the indivudal group performance can be reasonably measured by such indices as profit or market share.

The External Participants. There are a number of factors in the business community that have never been adequately duplicated in a computer simulation. In some cases, the failures have arisen because the current state of the art does not permit exact representation of the decision making processes. In other cases, the difficulties are simply the result of an inability to simulate the attitudes involved or the circumstances surrounding the decisions being made. In each of these cases, The Management Game does not try to simulate these functions. Instead, NYU has received substantial support from the surrounding business community, which permits a large number of prominent businessmen to bring their skills to the Game environment and play their real life roles within the Game. At the present time, the external participants are the Board of Directors, the Bankers, the Underwriter, the Insurance Company, the Legal Counsel and Judiciary, the Internal Revenue Service, the Federal Trade Commission, and related classes being held at NYU.

Each Game firm reports directly to a Board of Directors, consisting of six to eight outstanding members of the business community. The Directors are high level executives who are often found on the Boards of publicly held companies. In each case, the Directors bring to the Game a proven record of success and an experience bank that can be used by the student companies.

As with all of the other external participants, the Directors serve in a Game capacity without financial remuneration. Past Directors have explained their participation on the following bases: psychic satisfaction; a sense of duty to the educational processes; an ability to view potential employees over an extended period of time; a convenient means for keeping themselves up on recent academic advances and student attitudes; a laboratory for testing out ideas before trying to apply them in their real companies. As one might expect, the actual level of Director involvement has ranged over the entire spectrum from simple attendance at required meetings to such active participation as providing student firms with office space and facilities.

Short and long term financing arrangements are provided through the use of bankers and an insurance company. When student firms require short term financing, they negotiate directly with representatives that have been assigned by the largest banks in New York. Similarly they can apply for long term debt financing by negotiating directly with the treasurer of a major life insurance company, who acts as the trustee of the union pension fund. In each of these cases, the firms are evaluated by using the same criteria that are currently being applied to real world firms requiring loans. There is no obligation to make a loan to a firm if the conditions of the firm or the economy are unfavorable.

In a similar sense, equity funding can potentially be obtained by negotiating with the underwriter, one of the underwriting partners associated with a major New York Stock Exchange associated firm. As in the case of the banks and the insurance company, the underwriter sets his own criteria for presentations and for evaluating potential investments.

An agreement exists between the University and two U.S. government agencies -- The Internal Revenue Service and The Federal Trade Commission. The Internal Revenue Service provides tax advisory services and monitors the tax compliance of Management Game firms. In the latter case, all tax returns are revieed and several are selected for investigation based upon their contents. The Federal Trade Commission is responsible for monitoring consumer practices, such as pricing and advertising. They can, at their discretion, hold investigations and take punitive action against Game teams.

Because of the complex nature of The Management Game environment, all of the Game firms are provided with access to lawyers. As in the case of the Directors, the lawyers are leading members of the profession in New York. In the same sense a U.S. Federal Judge participates in the resolution of legal issues and hearings. He has become involved in a number of cases ranging from breach of contract suits to actual bankruptcies.

Several other courses being offered at the University are related to Game activities. An accounting class acts as auditors and performs the same services that would normally be obtained from a firm of independent certified public accountants. A labor relations class, takes on all of the rights and perogatives as any labor union. Thus, for example, they may negotiate new contracts or they may go on strike. And finally, an information systems class provides computer expertise that may be acquired by the Game firms. In each of these cases the classes use their involvement with the Game as a critical part of their own learning processes in other courses.

Flow of Activities. At the beginning of the simulation, each firm is provided with a 12 month operating history that presumably reflects the results of actions taken by the past management. The firms are cautioned to view this 12 month history skeptically, without drawing conclusions regarding the quality of these past actions. Indeed, they are informed that some decisions have been intentionally varied in an attempt to improve their ability to study and determine the interactions between variables.

As shown in Figure 1, the managers of Game firms are surrounded by an environment that involves extensive interaction with external participants. A given play of the Game begins when the players find themselves faced with the necessity to make a large number of decisions ranging over the full spectrum of business operations. These decisions are made by the players, with possible consultation with the external environment.

The decisions of an individual company are submitted together with those of other companies within the same industry. These three sets of decisions then interact to generate the results of a play of the Game. The results are processed into two primary groups: (1) a complete set of results that is returned to each team as a means for analyzing what has taken place and as a means of providing a basis for decisions in subsequent periods; and (2) an administrative summary for use in guiding the overall simulation.

There is no formal relationship between the Game Administrators and the "external" participants. Instead, a newspaper exists to serve a function similar to the business section of a typical U.S. newspaper. It is this newspaper that is provided to regulatory authorities, bankers, underwriters, and Boards of Directors. The newspaper plays an extremely important function within the total sphere of operations. It is used to present individual players with events that relate to the environment that the company is operating within. As an example of such utilization, the paper has been used to announce conditions within a labor union, or regulatory decisions that had declared various raw materials to be polutants. Its function is to provide economic forecasts, industry related rumors and information needed for providing players with an adequate basis for environmental planning.

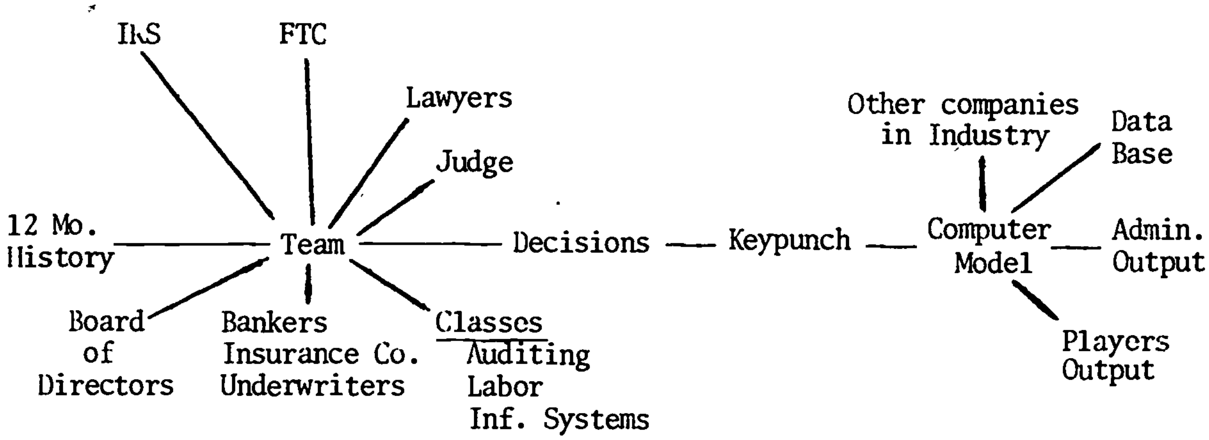

Figure 1. Flow of Activities in the Game

Relationship to the Real World. Participants in a simulated business program often experience difficulty in clarifying the relationship between the simulated environment and the real world. Broadly speaking, the simulated environment represents an attempt to duplicate real world experiences, and in most circumstances all participants are reasonably safe in extending their real world experience to the simulation. However, there are occassional deviations from reality in order to satisfy specified objectives of the simulalation.

One basic limitation of the simulation is the inability, thus far, to satisfactorily quantify certain subjective aspects of real world operations. For example, appropriate models to reflect the impact of differential advertising appeals for consumers, such as color of the product, packaging format, and advertising presentations, have not yet been formulated. Therefore, discretion on advertising within the simulation is limited to variations in spending implemented through unspecified types of advertising or through product price reductions.

While in some instances the complexity of the simulation is limited by the ability to quantify certain real world phenomena, in other cases the simulation has deliberately increased the complexity of actual operations. In practice, for example, the manufacturing operations of soap producers are quite simple, being confined principally to automated packing and filling. In order to introduce a reasonable element of complexity to the manufacturing side of the simulation the production models actually reflect more problems than tend to exist in the detergent industry. Similarly, the market models include seasonal variations in the demand that are much more pronounced than those in real markets -- again to provide an opportunity for the use of more sophisticated production control techniques.

There is a very fine line between the Game environment and the real world. The simulation tries to stay as close to that line as possible, but some weaving back and forth from side to side will occur in order to enhance the learning process. This means that participants in the simulation must be extremely cautious in using the real world as the sole reference point regarding the kinds of options that ought to be available or ought to be taken in a given situation. The Game is a course and there is a learning process involved. For example, certain situations are presented to simulation firms in order to see how firm members delegate authority within themselves, recognizing the fact that there are no other subordinates to whom work can be delegated. As an example of such a situation, consider the requirement that individual firms must keypunch their monthly decisions for processing. Clearly, in the real world, a clerical staff would exist and would be responsible for tasks such as this. Nevertheless, the participants in the Game are given this responsibility in order to teach them the need for establishing internal controls over the most minute details. Lack of control over even the most minute details can lead to disastrous consequences.

Transferability. As stated previously, the NYU Management Game has been successfully transfered to a number of institutions, both inside and outside of the United States. It is currently operating at the University of Iowa, Southern Methodist University, and Long Island University. In addition, the original Carnegie version has been transfered from Carnegie to a number of other installations. Transferability of the program within the U.S. environment is a relatively straightforward matter. It is programmed for an I.B.M. 360 computer using Fortran IV. A minimum of 128K of storage and one disc drive must be available. The documentation is still somewhat below par. As a practical matter transferability is quite smooth and it is best accomplished by having a technical specialist assist in fine tuning on the computer at individual locations.

Because the Management Game is so heavily dependent upon involvement with external participants it is most satisfactory to have someone with past Game experience meet with the faculty at the implementing institution. This meeting is generally intended to explain how to utilize and control the external environment. In addition, meetings can be held with business and alumni groups in order to assist the installations in obtaining their initial external participants.

An experiment has just been completed in which the Game was modified and transfered to a separate economic and social environment. Under sponsorship of The Ford Foundation, the Game was installed at Karl Marx University in Budapest Hungary. This installation did not represent a transfer of the NYU Management Game to KMU. For political and educational reasons, it was deemed preferable to develop a modified version of the Game that reflected Hungarian operating conditions. In this connection a group from the NYU faculty spent a summer in Hungary in order to learn more about Hungarian operating conditions. Similarly, several people from KMU came to the United States to assist in the modifications. A trial run of the Game, without external participants was held in Budapest in January, 1972. This trial run was advertised as an experiment. As such, external participants were omitted from formal inclusion within the environment in order to minimize the perceived risk to all involved. The test was satisfactory, additional modifications were made, and the expanded Game is now fully operational in Hungary -- with external participants.

There were a number of modifications made in connection with this implementation. Certainly all forms, materials and reports were translated into Hungarian. The Players' Manual was rewritten to reflect local business regulations and conditions. Parameters were modified so that the companies would behave in a manner that reflected local operating and economic conditions. By far, the largest effort was associated with a complete revision of the managerial and financial accounting systems to adjust for the differences between the two countries.

Although the above modifications were by no means trivial, they were facilitated by extensive use of the external participants -- Board of Inspectors (Board of Directors), the Hungarian National Bank, and the Hungarian taxing authorities. These external participants, simulating themselves, provided almost automatic adoption for large parts of the Game environment. (Note: There is a research study currently underway in both the United States and Hungary to determine the extent to which the external participants behave the same way in both their real world and Game environments).

Evaluation

The Game is evaluated on a continuing basis, although not always as formally as desired. There are a number of studies underway that should remedy this deficiency.

The success of the effort seems apparent, even on an informal basis. There is no longer any difficulty in obtaining the external participants. Where they were once obtainable only through favors, arm twisting, and so on, they are now referred by other current participants. Indeed, a point is nearing where there are some capacity problems with regard to the number of external participants that can be permitted to participate in any one semester.

Student reactions to the simulation are almost unanimously favorable. Their attitudes change over time. Approximately 90% of the students getting out of the Game feel that it was the most valuable educational experience.

And finally, two surveys have recently been undertaken with the Game. Last Spring a survey of student participants in the Game was undertaken to evaluate the Game and measure the students perceptions of business decision making. While the data is still being analyzed, preliminary results indicate that their attitude toward the Game is quite favorable. A similar survey was sent to the external participants during the past Summer, asking for an evaluation of the Game per se, plus reactions regarding the correlations between Game experiences and the external participants real world experiences. This study is attempting to determine the extent to which the Game environment can be used to make meaningful extrapolations regarding realistic decision making behavior. It is too soon to many meaningful observations regarding these results. Both of these studies are being replecated during the current academic year. In addition, the first study is being used with students who have not begun active participation in the Game so that a reference point can be obtained enabling us to observe differences in attitude over the course of the Game experience.

Summary

This paper has attempted to describe an on-going man-machine simulation that makes continual, effective use of practicing businessmen. This "Game" has permitted graduate business students to simultaneously gain an integrative experience and interact with the surrounding community -- all within a relatively controlled structure. And finally, the extensive use of the external participants facilitates transfer of this highly complex simulation both from institution to institution and from country to country.

FEDERA SIM: A PROTOTYPE WATER RESOURCES MANAGEMENT SIMULATION GAME

BY: Marshall H. Whithed, Behavioral Simulation Laboratory,
Political Science Dept., Temple University,
Philadelphia, Penna., U.S.A.

ABSTRACT: This paper describes a prototype computer-assisted multi-stage simulation-game focusing on the environmental and political problems of water resources management in a multi-state river basin in the United States political federal system.

Developed at the Behavioral Simulation and Gaming Laboratory in the Political Science Dept. at Temple University, the FEDERA SIM model, now existent in prototype form, consists of two sub-models--a political institutional sub-model and an urban land use development sub-model.

Among other issues, the simulation game, which has been developed with the assistance of the Center for the Study of Federalism at Temple University, emphasizes exploration of intergovernmental relationships in the context of the American federal system of government. This especially includes the role and utilization of Environmental Impact Statements, and the Office of Management and Budget Circular A-95 procedures.

The simulation-game has been played at Temple University, and a videotape of this session made.

It is planned to expand the development of this model further, to enable more extensive exploration of water resources management issues. Some funding has been received for this purpose, and development is anticipated over the course of the next several years.

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Increasingly mankind's attention is being directed to problems of environmental pollution around the globe. The just-completed Stockholm conference on the environment bears witness to part of this concern. And as this is being written in a city in the eastern part of the state of Pennsylvania, most of the rest of that state is in the process of digging out from some of the worst flooding in its history.

It seems that we presently have in hand much of the technology to at least make a good beginning on our pollution problems. But it also becomes increasingly clear that dealing with environmental problems will of necessity involve the resolution of many socio-political issues, and probably likely, the devising of new political-institutional machinery to do the job.

In the United States context, nowhere is this more clear than in dealing with major river basin systems, whether for purposes of flood (and water supply) control or pollution improvement, which cross state boundaries. Many water resources problems cross the boundaries of the individual states in the American federal system. These individual states each have individual rights and duties in the fields, as exemplified by the Massachusetts Hatch Act (or Wetlands protection law). And the American national government also has responsibilities in the field as well--as, for example, the responsibility of the U.S. Army Corps of Engineers for navigable rivers inland. Resolution of water resources managerial problems on large-scale river basins covering more than one state in the United States must take these political insitutional parameters into account.

In order to provide a mechanism to study some of these political institutional problems and some of the procedures presently in use for their resolution, such as the Environmental Impact Statement requirements and the coordination between governmental units effort represented by the Circular A-95 procedures of the national Office of Management and Budget; as well as an attempt to provide an instructional device to acquaint students and practitioners in the field with the context of the problem, a prototype simulation-game has been devised to look at the issues and provide a vehicle for future exploration of alternative institutional arrangements.

The setting of FEDERA SIM is in a large multi-state river basin running through three separate states in the United States. Major actors and situations are scattered throughout the three states. A new nuclear power plant is nearing completion in the most upstream state, and thus raises the two-headed dilemma of needed power supply versus nuclear and thermal pollution. Issues in the middle state include a proposal for diversion of some of the river waters to the water supply of a major city out of the river basin (thus posing problems of safety of water supply and also antagonism between basin population and out-of-basin major metropolitan area). The middle state also has a major developing city, posing the context of power needs for development versus increasing pollution from municipal sewers and private industrial development. The third and down-stream state has cities dependent upon the river for water supply, and therefore has strong interests in the quantity and quality of water available after the water-related activities of the two upstream states.

There are two distinct submodels, connected by feed-back loops. These two sub-models may be played simultaneously by different sets of players, or consecutively by the same set of players. The second possibility diminishes the number of simulation players and spatial facilities required; the first approach probably provides for richer interaction and a more realistic setting. Alternatively, it may at times be useful to force players from one sub-model to confront the effects of their decisions in the other sector. It depends, basically, upon the instructional objectives and the facilities available.

The first sub-model in FEDERA-SIM represents the development of a major new city in the middle state in the river basin. This urban development necessitates increased electrical energy generating demands, and hence a positive interest in seeing the nuclear power plant upstream (in the first state) go on-line as soon as governmental regulations can be met. As the simulation scenario develops through play, further development of the new city pends the availability of the increased power.

Conversely, the new city imposes environmental degradation upon the river below its location. The degradation derives from two sources: the municipal sewers and treatment plants, on the one hand, and major privately-owned industry on the other.

Among other issues, the "growth is good" syndrome is graphically raised for the simulation-game participants to deal with. Our field research in an actual river basin, upon which this simulation-game is modeled, indicates that a questioning of this traditional belief is in progress amongst our interviewees.1/

The urban development sub-model in FEDERA SIM is a

1/ The model is based in part upon actual field research in a major multi-state river basin in the eastern United States performed by the developer of the simulation-game. Participants in the exercise, to date, are not informed of referant world details, but rather, are presented with the problem in the context of an abstract description of the geography (i.e., State "X", State "Y", etc. rather than specific names and specification of states).

revision and special variant of the TeleCLUG urban land use model in use at the Behavioral Simulation and Gaming Laboratory at Temple University, Originally, this model has a computer time-share revision of the Community Land Use Game (CLUG) developed by Feldt and associates when at Cornell University. Besides the alterations made when the time-share computer assisted version was developed, subroutines to consider water pollution factors were imposed upon the variation developed especially for the FEDERA SIM model.2/

Because this, the computer-oriented part of the total FEDERA SIM model, is developed for computer time-share usage the logistical simulation-game environment is such that the total simulation-game may be utilized anywhere a phone line is available in the United States (and selected parts of Europe). All that is required is the phone availability and a computer terminal. The actual computer itself does not have to be anywhere near the user site.2/

The second sub-model in FEDERA SIM centers upon the politico-socio institutional and behavioral structures pertinent to resolution of water resources issue management in the United States context. Role-players represent such relevant entities in the American political system as the federal court structure, national governmental utility regulation commissions, Environmental Protection Agency (EPA), interstate regional planning commissions and regional within state planning agencies (modeled upon actual instrumentalities in the American governmental context), the governors of the involved states and their representatives, the mayors of involved cities and their representatives, various citizen and/or environmental concerned interest groups, and the mass media.

The socio-political institutional sub-model is developed in play with considerable emphasis upon the role and utilization of Environmental Impact Statements and Federal Government Office of Management and Budget A-95 procedures.

2/ The original CLUG model is described extensively in the literature elsewhere, and has given rise to a number of variations in both the United States and Great Britain as well as elsewhere. The TeleCLUG approach has been described elsewhere in papers by this writer.

2/ The Computer program is presently written in FORTRAN IV (extended) for the CDC 6400 time share (INTERCOM) computer at Temple University. It is extremely readily adaptible to Control Date Corp. (CDC) commercial time share (KRONOS) service available throughout the U.S.

It is the problem of actors in this sub-model to devise and explore means of originating and enforcing political-institutional procedures of a workable nature in a multi-state river basin context.

The reader must be cautioned that the development of FEDERA SIM to date is proto-typical, and that little documentation for either the computer or the role-playing actors portions of the project are currently available outside of the project development team. There is, however, a videotape which was made of a session of FEDERA SIM in play, and this videotape will most probably be available to interested parties for a small charge from the Office of Television Services of Temple University.

Projected future developments, based in part on a small grant received from the National Science Foundation (NSF) in the United States, include further revision and adaption of the FEDERA SIM model to study the political and social institutional problems generally, and also with respect to specific urban river basin systems. It is also planned to develop and refine the model documentation to make the project more readily usable by others for instructional purposes.

ERG - ENERGY RESOURCES GAME

SIMULATION GAMING OF REGIONAL ENERGY MANAGEMENT

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INTRODUCTION

There are many issues and problems associated with meeting our society's need for energy. The decisions confronting engineers, planners, and management in urban energy systems involve economic, social and technical aspects that are interrelated through an extremely complex set of relationships some of which defy explicit quantification.

ERG - the Energy Resources Game is being developed as a joint effort by three organizations: The Center for Urban Research in Environmental Studies at Drexel University, the Franklin Institute Research Center, and Decision Sciences Corporation. It focuses on the development of skills and experience in dealing with interdisciplinary problems requiring sound decisions in a social, political and economic as well as technological setting. It is a technically sophisticated computer based game which explores the following questions regarding regional energy supply and demand:

- Population and economic growth goals
- Acceptable levels of dependence on imported energy
- Acceptable levels of environmental impact
- Acceptable rates of return for energy industries
- Acceptable rates of risk for energy system disruption

BACKGROUND - ENERGY ISSUES

Historically, the United States has been doubling its demand for electricity every decade. With only 6 percent of the world's population, this country now consumes 35 percent of the world's energy. It has been estimated that by the end of the century the energy consumption per capita in the U. S. will increase by 60 percent. The possibility that our nation's apparently insatiable appetite for goods, services and "progress" will moderate significantly in the near future does not seem probable. Whether or not the use of energy should increase at the forecast rates with the concomitant need to commit our

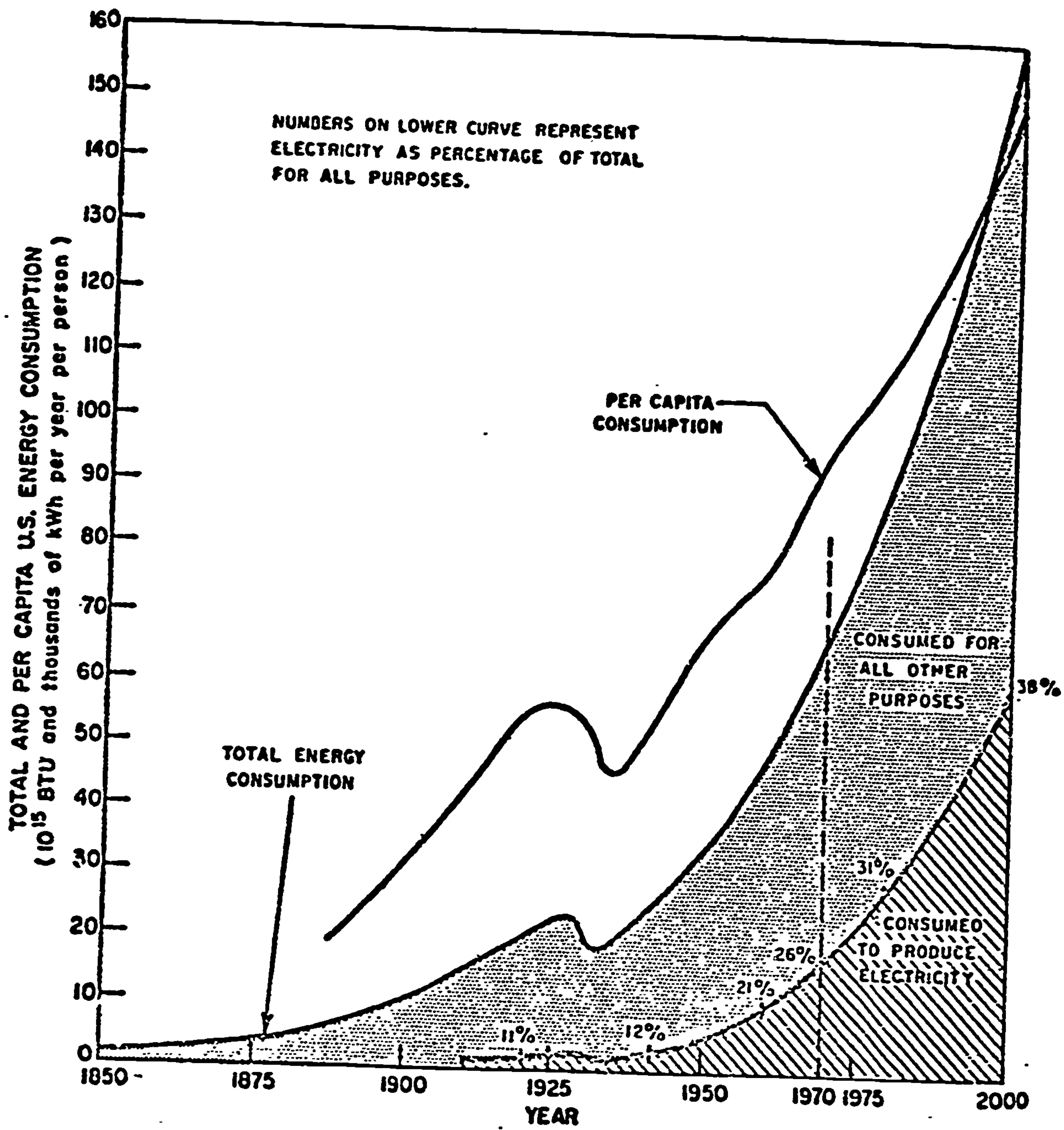

Figure 1. United States Energy Consumption

national resources in this way, is a philosophical and political question which society must consider. Regardless of the political decisions that may be made however, the time required to make them and to put them into effect are such that significant deviations from present trends in energy consumption are not likely to occur during the current decade.

The total consumption of energy in the U. S. in 1970 was about 65×10^{15} Btu. This is equivalent to the energy stored in nearly 2.5 billion tons of coal. By the year 2000, total energy consumption in the U. S. is expected to more than double, while the portion used for electricity is expected to increase from 25 percent (in 1970) to 38 percent of the total. Thus we see that, while electricity will play an increasing role in the total energy picture, even by the end of the century it will still account for substantially less than half of the total energy consumption.

The way in which our use of energy has increased during the last century, as well as projections to the year 2000, are illustrated in Figure 1. Also shown is the growth in the average consumption of energy per person. The total energy consumption in the U. S. in 1970 was 7 times greater than it was in 1900, and twice as great as its level in 1950 - only 20 years ago. Our use of electrical energy is increasing at such a rate that it is doubling about every ten years.

These facts are significant in two crucial respects:

- The rapidly increasing utilization (and depletion) of our natural fuel resources, and
- The environmental impacts that result from energy conversion and use.

ERG OBJECTIVES

Traditionally, educational efforts, especially in engineering have stressed only one of the many diverse segments of the overall energy systems environment at a time. For example, technical problems too often are considered in isolation from the other related problem areas, such as land use implications and environmental impact, if indeed the other areas are considered at all. The result has been to educate the student to only part of the overall problem and consequently to render him less effective in applying his technical skills in complex real world situations where all subsystems do in fact affect the ultimate outcome.

The primary educational objective in the development of ERGS (Energy Resources Gamed Simulation) is to correct these traditional deficiencies by exposing students and practicing professionals to a controlled situation in which they must consider all the aspects of energy related problems. In order to accommodate diverse audiences, several different versions of the same basic simulation game are being developed. This ability to develop several versions on the same basic design is a natural offshoot of the basic modularized developmental effort.

The simulated environment in which the broad-based energy-related decisions are made represents a serious attempt to develop the participants' awareness of the complexity of the issues involved, while removing the obvious limitations imposed on such learning processes in the real world situations. Simulated environments also remove some of the limitations of the case study approach, the only viable alternative for achieving such awareness and experience (without actually committing real world resources) that has been available in the past.

Within this broad context, the educational goals can be viewed in several different but related aspects, namely the acquisition of knowledge and experience with respect to:

- Energy-related technical facts and processes
- Development of energy strategies or policies in a long range planning context
- Effective crisis response
- Interdisciplinary considerations such as those involving economic and social interrelationships and processes.

The focus is on the development of skills and experience in dealing with interdisciplinary problems requiring sound decisions in a social, political and economic, as well as technological setting. As a result the decision making process emphasizes group processes and interactions and the effective utilization of diverse interdisciplinary resources. The types of decisions upon which attention is focused is policy oriented, for example, the development of long range energy strategies. However, the simulation-game also involves crisis situations and some short term problems which will generally require the participants to allocate their resources between immediate problem/crisis resolution and long range policy development. Either short or long range aspects may also be studied in isolation, but the real advantage of ERGS lies in its ability to combine both considerations in a realistic environment that requires utilization of an interdisciplinary approach in arriving at decisions acceptable in the broadest contexts.

ERG - DESIGN METHODOLOGY

There are several vital steps in game design. It is sometimes difficult to determine just where the outline of the game becomes actual development. The roles have to be defined and thoroughly documented. For example, for an energy simulation-game it is necessary to fully understand, and then be able to incorporate into the game, the electrical utilities interests, motivations and resources, as well as their attitudes towards the legislature, the regulatory bodies, and the consumers.

Unfortunately, in the case of game design, the disparity between the knowledge and experience that one needs to apparently do the job and what one must possess to actually do the job is not always obvious. It is not too hard to put one's perceptions of energy problems together in a package and call it a game. It is extremely difficult to take one's perception of energy problems, put them together in a package, and have a viable, educational tool capable of achieving pre-defined educational objectives.

In order to assure the accomplishment of this latter purpose, an approach is being used that centers around developing the simulation-game along the following ten-step guideline:

1. Definition of overall objectives
2. Determination of game scope
3. Identification of key roles
4. Determination of roles objectives
5. Determination of roles resources
6. Determination of the interaction sequence among roles
7. Determination of the decision rules and performance criteria, on the basis of which roles decide what actions to take

8. Identification of external constraints on actions of the roles

9. Formulation of scoring rules or win criteria based on the degree to which roles or teams of roles achieve their objectives with efficient utilization of resources

10. Determine form of presentation and manipulation, and formulate sequence of operations.

Each one of these steps provides a vehicle for the completion of certain aspects of the game design, and as such, provides a basis for the organization of ideas pertaining to that area for the research of necessary information, development of various hypotheses, and finally, the testing of those hypotheses, both independently and as an operating part of the game. It should be emphasized, in addition, that the development of any necessary mathematical models and the supporting computer programs is recognized to be a critical aspect of many of these design steps.

<u>Game Structure</u>

The following is a discussion of the design steps and how they pertain specifically to the construction of the energy resource game.

<u>Step 1</u>: In the broader sense, objectives are laid out as to whether the game is going to be primarily a game for teaching, or a game for research. Since these two are not necessarily mutually exclusive, ERGS is being designed, as an energy game system; in other words, it consists of various building blocks. Based upon the ordering of the blocks, the game could be effectively used as an educational tool in high schools, in undergraduate curriculum, or in professional education. The internal workings of these blocks are built around what the student should be able to do after playing the game. This is divided into two or more categories:

- Concepts to be understood (e.g. what is a regulatory agency), and

- Skills to be mastered (e.g. how do you satisfy pollution regulations and meet energy demands for region at the same time).

<u>Step 2</u>: One of the most important initial steps is setting the parameters of the game. This means determing the duration, geographical area and issues to be covered during the game play.

(1) Duration is really divided into two parts:

- Duration of the actual game
- Duration of the event to be modeled

For instance, ERGS covers energy planning in a geographical region for 20 years. This would be played in approximately eight hours of real time. The computer based "real world" through the utilization of time compression acts on the basis of the decisions made by the role players, considering all pertinent interactions, and then provides information feedback regarding the results of those decisions.

The models that are incorporated within the computerized "Real world" include mathematical models for:

- Population growth by geographic area
- Total energy demand growth
- Sector energy demands
- Primary energy supply
- Supply-demand interaction
- Environmental controls
- Environmental quality levels--at least for air and water quality
- Regional economic performance
- Social indicators
- Land use

(2) Geographical area is also an element that has to be divided into two parts:

- Actual geographical area being played. This can be a room; this could be several rooms; it could be a building, and
- Geographical area covered by the model. For purposes of ERGS, this could be a region corresponding to prevailing definitions for regions in the energy field, for instance, the game might be used to model regional planning in the northeast region which would

encompass Pennsylvania, New York and New Jersey. The issues to be used in the game could be real or contrived.

Since ERGS is actually a system rather than just a game, it will be adaptable to any particular region and, therefore, the issues which are currently prevailing in that region or have prevailed in that region can be utilized in the game. A play of the game will not only be an educational experience for the players, but it will enable them to grapple with the real problems, and the end result may be possible solutions to the real problems, therefore, bridging the gap between theory and the reality of practice.

ERGS then will be an intensive experience, occupying the greater portion of the day. It will be supported by the use of sophisticated mathematical models providing players with real time feedback on how other decisions affect economic growth and government interactions. The input and output requirements of the computer support system, however, will be of a direct conversational nature, not requiring computer expertise.

(3) Some of the issues which will be developed through the playing of the game are the following:

- What are the regional, economic and population growth goals?
- What level of air and water pollution is acceptable?
- What limitations are to be placed upon land use for energy systems?
- How much capital is to be devoted to energy systems?
- How much exposure to risk through use of new technology is acceptable?
- What degree of public participation in energy policy is desired?
- What delays on energy facility construction are imposed by regulatory authorities?
- What levels of financial return are desirable for energy and other industries?

° How can various groups influence the long-term social goals of the region?

Step 3: A decision that must be made concerns which forces in the situation are to be mechanized, and which ones are to be represented by human players. For example, nature is usually represented in the form of a chance device rather than by a player. There can be various levels of roles; for instance, a role can be played by an individual; a role can be played by a series of individuals who would make up a group; and a series of groups may make up another role which could be an organization making critical decisions. A total of seven roles have been defined:

° Utility - which will be made up of both gas utilities and electrical utilities

° Regulatory agencies - which will be made up of both state and federal agencies

° Judge - who will actually resolve conflicts between the other roles

° Industry - which will be made up of heavy, medium and light industries

° Public - whose concern will be both consumption of energy and the preservation of the environment

° Fuel suppliers - fuel suppliers will be made up of suppliers of oil, coal, gas, and nuclear energy

° Legislator - this role has the ability to pass legislation in response to public demand.

Step 4: A role can have one goal or many goals. Examples might include accumulation of power, the accumulation of wealth, or maintaining influence over other groups. In ERGS, the goals and objectives of the roles vary greatly.

° The role of utility is central in that its team members must balance the demands for increased energy with those for the preservation of the environment. At the same time, it must make a sufficient profit to obtain new capital. In case the utility management is unable to resolve an energy policy question, it is passed to the regulator.

- The regulator includes local, state and federal bodies responsible for regulating economic and technical progress of the energy utilities. These role players are constrained by the provisions of legislation typically found at the governmental levels. In case of an inability to resolve an energy issue at this level, it must be placed at the legislative role.

- It is possible for the legislator to pass new legislation in response to demands from the public or other roles.

- The judge role serves to interpret and resolve conflicts in the light of enacted legislation, but also considering economic and social equity which may include environmental impact. The judge role may overturn legislation.

- The fuel supplier comprises the suppliers of coal, oil, gas and uranium. The primary interaction is with the utility, but the fuel supplier must also meet the requirements of the regulator. He is constrained by the fact that he must meet the demand for his product and also make a profit at the same time.

- The industry roles serve to translate energy into finished products, and to provide the means by which economic growth is attained in response to desires of the public. Industry is constrained by the fact that it must provide products at an acceptable price.

- The public role comprises those who are primarily oriented towards receiving the fruits of economic growth, but who are also concerned with environmental impact and resource conservation. Their objectives can be achieved by influencing industry, the legislator, and the regulator.

Step 5: When the term resources is used to describe a role, monetary wealth often comes to mind. This, nowever, is not the only type of resource which is important in this game. Resources can cover a wide range including physical, social, political, economic and even informational resources.

For the purposes of those roles in ERGS that are political in nature, the resource can be the gaining of votes. The legislator will have to concern himself with not only passing laws which will satisfy the various energy issues at point, but also with getting re-elected. The industry will not only have to concern itself with producing products at a certain price, but also satisfying the public's need for environmental quality.

In essence, as in any real life system, resources are scarce commodities which must be utilized efficiently. So it is in the energy resources gamed simulation. Since much of the learning that takes place in these games is a direct result of the experience gained by participants in handling limited resources, this aspect of game design is an extremely important and likewise difficult one. The win criteria for each role must be determined based on its own particular value system, and also in terms of how its value system interacts with that of the other roles.

<u>Step 6</u>: In any game, it is important to have a sequence of events which provide a structure by which the activity of the game can take place. In ERGS, this sequence of events takes place in a proposed 2-hour round. The round simulates five years in the play of the game, and includes such things as:

° An election for public officials

° Regulatory hearings to determine energy policy

° Time for the various roles to plan and make decisions

° Time under which things like disasters and acts of God might occur

° Time in which roles can interact both formally and informally with each other.

Each one of these activities requires a minimum amount of time in order for it to successfully operate, and in the context of a round, there must be enough events to make the game interesting and fascinating.

<u>Step 7</u>: This section deals with two very important criteria in the game design, the first being the rules under which the game is to be played, and the second, the performance criteria which would determine exactly who performs well and under what conditions.

The rules, where possible, must be practical and embody real life limitations on the actions of roles, and also be worded in real life terms (e.g. if a utility contracts to buy fuel from a particular fuel supplier, that contract should be in writing, and it should embody all the terms that a real contract would embody).

One of the most important benefits of the game as an educational device is its ability to motivate the players to learn. The factor which is perhaps most responsible for motivation is winning. People play games to win. The winning isn't necessarily defined as being "the" winner. In the case of ERGS, each particular role has its own distinct and separate performance or "win" criteria. It may not be an accumulation of wealth for a role such as legislator. It may be getting elected. In order to motivate properly, the win criteria must be clearly defined and quantified so that each player will be able to determine where he is in terms of reaching his particular goal.

Step 8: Care must be taken that the actions available to roles, i.e. permitted by the rules, are realistic in terms of the alternative actions available to particular roles in a real life situation which the game represents. There is the additional problem of what action the players will consider legitimate. Consider a case like that of two teaching nuns at a workshop who are feuding bitterly because in a political simulation they were playing, one nun had confiscated the other's cache of taxes.

Step 9: ERGS deviates from most educational games in that the win criteria is really based on two levels. The first is the win criteria for a particular role as discussed earlier, and the second is the win criteria in terms of the total picture. Since ERGS is a game which deals with maximizing energy resources, the win criteria for all roles must be that goal. Conflicts arise in each role pursuing its individual win criteria, and a joint effort towards maximizing energy resources as a total picture. This, of course, is the most poignant educational experience of the game. A possible means of achieving this balance between role objectives and objectives for the group as a whole is the mechanism of altruistic scoring. Based on this mechanism, the score of any particular role may be based on how effective a complementary role is in achieving its objectives. In other words, the total success of the industry towards achieving its objectives and winning may be based on 50 percent of how well it works to achieve its objectives, and 50 percent as to how well the public is able to achieve theirs. Under these circumstances, a very strong bond is created between industry as a role, and the public as a role. Through a network of such relationships which, by the way, can and should be varied for particular plays of the game, goal relationships between various roles can be achieved.

Step 10: The formal presentation appears last on the list because we can only make this decision after running through the nine preceding steps. Even though it often means going back to step 1 and re-starting again, it is an important factor in game design that each element in the design of the game has a specific purpose towards the pursuance of the game's educational objective. No element should be in the game unless we know exactly what it does and what its effect is on the game's objectives. In this way, elements can be manipulated in order to alter the objective of the game to make it stronger or weaker, to make it more pertinent to one audience over another audience. Elements such as time, space, available facilities, computer access, and visual materials must be analyzed through experimentation. This is what the design process is really all about,--a highly refined scientific tool, the result of scientific experimentation.

VALIDATION

Validation of the ENERGY simulation-game consists of two major parts: technical validation and validation as an educational tool. Both of these lead to continuous improvement in the product through an iterative design approach. As experience is gained through use and through application to real data the model will be updated in order to assure its validity as a viable reflection of real world situations.

1. Technical Validation

The technical validation of the model consists in part of an inter-disciplinary review of the basic technical component models and of the inter-relationships between them. In addition, an integrated development/implementation plan, involving application and feedback from many groups, will be instituted.

Since the simulation model is being developed as primarily a training exercise, any attempt to use it as an impact or predictive tool must be tempered. However, to provide a greater range of confidence in such a simulation, a complete analysis and compilation of data over the past 10-15 years should be attempted to develop a means of testing this simulation "as best as possible."

The final proof-testing or debugging operation will be completed along with development of an integrated training program. In order to develop this to the fullest extent with maximum feedback, ERGS will be run and exercised with many diverse groups in order to provide feedback regarding the perceived strengths and weaknesses of the game in actual operation. By exploiting this experience, improvements that should be made in the design of both the game structure and the game operation will be identified. Successive trials with these improvements incorporated in them will guarantee a final product of maximum usefulness.

In addition, this process would facilitate the determination of which elements in the game design that would have to be altered to achieve a different objective. The result would not be one energy game, but a number of energy games, each one having a specific educational purpose for a specific educational audience. Once the basic design has been developed, it would be a relatively simple task to develop these modified versions.

2. <u>Validation of the Simulation-Game as an Educational Resource</u>

For a game to be a valid educational tool, it must be proven valid. It must be known exactly what it teaches and to whom, and the residual values of rapid "insight" acquisition. In addition, the game must possess functional validity. A frequent mistake made by designers of games is that in their endeavor to produce a game which is an accurate model of reality they try to model too much. The game, in effect, models so much of reality that it may not make the complex relationships any clearer and in fact may be just as confusing as reality itself, thereby losing its ability to be an effective educational device. On the other extreme, a model may be designed that is simple to understand, but just doesn't include enough of reality to be educationally useful. In order to create a model which is realistic yet simple enough to understand, the model will be tested against a base case. In this situation, the model would be designed around existing situations, and through the play of the game the results of the game play would be tested against the real life results of the base case. By this method, the model would be able to be refined so it would be complex enough to mirror reality, but simple enough to permit some understanding of the complex relationships.

With this idea of functional validity in mind, the more direct validation of the energy game as an educational tool will consist of two phases. The first phase will occur early in the project, as the game is being developed. It will consist of pilot studies, initially involving only each submodel and then involving groups of submodels and finally the complete game itself. These early pilot studies will be conducted primarily with student participants, although as the model becomes more fully developed, other groups will participate also.

The second phase in the educational validation occurs simultaneously with the technical development/implementation plan. It includes students as well as the other groups as participants in the game. Experiments are constructed whereby the effectiveness of the game as a learning mechanism will be evaluated. The experiments will consist of a pre-testing and a post-testing evaluation process with control groups.

Before the experimental participants play the game they will be given a pre-test. The actual test will evaluate five distinct areas:

- Knowledge of facts, especially technical facts related to energy sources, systems design, costs, locational considerations and environmental impacts
- Comprehension of social, political, economic and technical processes and interactions
- The ability (skills) to formulate effective strategies that might be used to resolve energy issues and problems
- The ability to react quickly and effectively in crisis situations, and
- Attitudes of participants with respect to, for example, perception of other "roles" in society and concern for environmental issues.

After playing the game, two post-tests, slightly different from the pre-test and from each other, will be given. The first post-test will be given shortly after the game and the second will be given after some time lapse. Both will assess, by means of slightly different tests, the participants' knowledge and skills with respect to facts, processes, strategies, and crisis situations as they relate to the subject matter of the game. By measuring a participant's knowledge before the game and by measuring the participant's knowledge of these particular learned aspects after the game, an assessment could be made as to just how effective the game is in teaching or satisfying the various objectives which had been set up for it, including the residual value of the type of rapid "insight" acquisition that is expected from the game. If indeed the game is weak in certain areas, then through the dynamic debugging process it can be strengthened appropriately. Thus, what is involved is an iterative design process through use, that is through game structure or design, and then game operation, with feedback from the operation providing input for restructuring and improving the game. The end result would be a simulation-game that refl cts real world situations and provides a viable educational tool.

THE USE OF SIMULATION IN THE STUDY OF INVOLVEMENT

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This paper is concerned with the usage of simulation games in the study of involvement. As the games were played, the authors felt the necessity to change the games, as well as their ideas concerning participation and involvement. In this paper we will discuss the experimental setting, its evolution, our analysis of both the theory and the method employed. Throughout the presentation, case material will be included to exemplify various issues.

The initial purpose of this research project was to study involvement through the use of simulation games. The game chosen for this purpose was "Generation Gap". We soon discovered, however, (through an analysis of video tapes of the procedings as well as the helpful comments of the student participants) that that game, in its original state, was not appropriate for our purposes. For example, while the subject assigned the role of son/daughter could quite easily "get into" his/her role, those subjects assigned to the role of father/mother demonstrated and voiced considerable difficulty in assuming such roles. It became apparent that one of the main problem areas was the difficulty of the student taking the role of a parent. That is, the student was faced with a paradox-type of situation in which he was torn between behaving as his parents did toward him, or behaving as a student "playing the role of a parent" using what he felt to be inappropriate responses. In other words, the student really did not know how to play the role of a parent and kept reverting back to his age-related position. A typical response of a "parent" to a "son/daughter" would be "I can't argue with you on that, I agree with you (son/daughter)". This happened with virtually every issue presented, from staying out late to the use of marijuana.

Due to such problems, then, the game was modified. Specifically, the simulation which finally evolved presented the students with a situation (such as pre-marital cohabitation) with which both participants could readily identify. Furthermore, the participants were provided with a minimum of defining characteristics or rules. Given this type of situation, the students were allowed to define their own parameters and discuss their own issues. For example, upon entering the laboratory, we would inform the students (a male and a female) that they were presently going together and that they were to discuss the possibility of sharing an apartment. We would then leave the room and let the couple take it from there.

Throughout this project we discovered that involvement tended to be maximized in those situations which were personally relevant and unstructured. Furthermore, it seemed as if the majority of subjects appreciated and enjoyed the experience of participating in an unstructured setting because it gave them the opportunity to discuss important and meaningful issues which they claimed is hard to do in the "real world". In this context it is interesting to conjecture that through the opportunity to discuss important issues, the simulation may have produced more "real" conversation than the real world does. It seems as if the ideal simulation for studying involvement would be one which allows individuals the freedom to create their own roles within a given situational context.

As mentioned earlier, the point of the research project was to use simulation games to study involvement, which we defined as a sense of oneness with the environment or aspects of the environment. It was anticipated that initially we would differentiate people according to their participation rates, and then through interviewing, attempt to determine the relation between involvement in a simulation and participation in it. It was hoped that the final product would be a way of using participation to measure involvement.

Soon after beginning the research program, it was clear that we had many high participators but, at least in our opinions, a great deal of variation regarding involvement. Perhaps because all the subjects were volunteers, they were all participators. As a result, we began to think in terms of different types of participators rather than about individuals differing according to their degree of participation.

After reviewing the data, there seems to have been six types of participators in the simulation. Type 1 is the person who could not become the assigned character; although the person interacted with others, he/she seemed unable to take on a new identity--the person would not "make believe." We suggest that this inability to play-act occurs because the person is already playing at being someone when he/she comes to the simulation, and that to play-someone, playing-someone else is too difficult a task. This is pure conjecture based on our observation of one person, but it makes sense; people who are not being themselves will find it difficult to accept a new identity. Remember also, we are discussing simulation, it is possible for people to change identities as they change environments. What we are suggesting is that people not being themselves will find it difficult to maintain the doubly false identity of someone-playing-someone, playing-someone else. Type 2 is the analytic player. This person is continually in and out of character. For instance, the analytic player may interrupt the game to question the adaquacy of the role-playing or to express his/her feelings of how unauthentic the situation is or to summarize what has happened or even simply to describe the group's behavior. The analytic player can not remain in the simulation. Type 3 is the role-player. This is the person who remains a cardboard figure. His/her playing has no depth; the character has not history. With role-players, a discussion sounds like an interrogation. For instance, there occurred the following piece of dialogue between two people discussing their marriage plans: Girl: "Would you object to being married in church?" Boy: "Yes..." Girl: "I'll have to think about that." The girl had no reaction to the boy's rather important revelation. She had a list of questions to ask, information to gather. She was interrogating a witness. Since she was not really, or perhaps it is more accurate to say "deeply involved" the girl had no reaction to the answers received. The information was simply filed away. Many of the subjects discussed potentially emotional issues such as unfaithfulness or "swinging" in very matter-of-fact ways. These interrogations had no context. The respondents did not try to imagine a longtime relationship extending into the future. If they had done so, answers to questions about a church-wedding or unfaithfulness would have elicited more personal and more character responses. As one subject said: "The hardest thing is to assume you know others," that is, to give history and a future to the simulation. Type 4 is the anticipator. This person stays in character and tries to create a history for the relationship. For instance, a girl supposedly about to marry would start talking about the fight she had with her future mother-in-law a year before, or would reminisce about a shared moment of happiness. But the anticipator is, in a way, too good. He/she spends much time planning the simulation. Anticipators are truly involved only when they are performing. When others are simulating, the anticipator withdraws and tries to anticipate future developments in the conversation. When others are talking, they probably will look away, perhaps take on an introspective, introverted look. Anticipators are good players but poor listeners. Type 5 are those who stay in character, try to create a history, are good listeners, but whose body does not express involvement. In our simulations of engaged couples, there was never any physical caressing. It was monumental if they uncrossed their legs. A caress seemed out of the question. Our simulations never produced physical expressions of involvement, except for people occasionally leaning towards each other. Type 6 would be the person who stays in character, tries to create a history, is a good listener, and expresses involvement physically. This would be the truly involved person.

We have presented the above typology as forming a Guttman-type scale, but of course this is only a tentative analysis.

One characteristic that was used by some subjects as a sign of involvement we have not used in our typology. When our subject was asked to judge the times when his partner seemed involved, he chose those moments when the partner looked spontaneous, i.e. when the partner did not seem to stop and think before reacting. When the partner was asked about this, he revealed that at those moments of supposed deep involvement, he was in fact imitating his father. Spontaneous-looking behavior can occur whenever there is a model to follow, be it the subject himself or someone else previously observed in a situation similar to the simulation. The partner was playing the game effectively without being deeply involved in it. The partner described himself as being "automatic" but not deeply involved.

On the other hand, there were moments when the partner reported feeling involved. There were moments when he "had to think," when he "had to make up everything." The partner felt involved when he had to exert effort.

We are not suggesting that signs of stopping and thinking are necessary to assume involvement. On the contrary, it is possible that involvement is highest when there is truly spontaneous behavior. What we are suggesting is that ease of behavior is not a valid indicator of involvement.

In the previous section of this paper, it was suggested that individuals probably will become more involved in less structured situations in which they have the opportunity to discuss personally meaningful subjects. Is it possible, therefore, to measure involvement by the openness of a person? No doubt there is a positive relation between openness and involvement. Yet in one session in which this matter was discussed after the simulation, there was not complete agreement about this matter. It was claimed that even though more openness occurred in the simulation, some subjects felt more involved when trying to be a nice date, i.e. trying to meet their date's expectations. Again, we are not denying that openness is an indicator of involvement. But we do want to suggest that its validity varies for human beings.

In his play, The Balcony, Genet has one character say to another: "You've never performed an act for its own sake, but always so that, when linked with other acts, it would make a bishop, a judge, a general...." With Genet, we suggest there are people who feel authentic when they are constructing a role or an image. They do not feel themselves when they are open, but when they are constructing. For the latter, openness indicates involvement, but not the height of involvement. Conversely, the "constructors" can feel fully involved without being open.

In The Balcony, the "madame" complained of the danger of regular contact between the ladies and their customers--"It would be a catastrophe if my clients and girls smiled at each other affectionately. It would be even a greater catastrophe than if it were a question of love." Genet is suggesting that the affectionate smile is more dangerous because it is more authentically the person; it would mean a throwing-off of social conventions. But for some people, whom we have labeled "constructors" the smile would not seem as authentic as falling in love. They would feel uncomfortable simply smiling; they would feel involved when they defined themselves as lovers.

We suggest, therefore, that openness and involvement are not related in any simple way. For "constructors" openness is unrelated to feeling involved.

Is it possible to obtain Type 6 participation in simulation games? Such participation sometimes occurs in the theatre. In theatrical plays, physical expressions of involvement are culturally allowed, i.e. they are legitimate on the stage. This suggests that the probability of Type 6 participation, i.e. of maximum involvement would occur if the simulations were performed as "plays" rather than "games" with all the paraphernalia appropriate for the legitimate theatre.

In conclusion, we feel the ideal simulation would be one which would combine the freedom of a role-less situation, that is presenting the subjects with a situation which allows them to establish and create their own roles with the legitimacy of being in a theatrical play. An approximation of this situation would be the current developments in the theatre of improvisation.

Psychodrama as a Real-izing Agent in Simulation Games

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In education, simulation games are used to amplify learning by engaging participants in game relations which analogically or metaphorically describe problems in the day to day world which require solutions or the answering of research questions. Although a variety of techniques are available for increasing the reliability of the correlation between the analog and "reality" (self-report, computer models, etc.) few tools or techniques are available for validating the phenomenological commitment in the game which will often determine the success of the game in helping reform attitudes, values and behaviors.

Psychodrama is a method of translating phenomenological experience into tangible behaviors. As an adjunct to simulation game construction and practise, Psychodrama and its offshoots, such as guided fantasy, can help in the process of real-izing (making real) simulation game praxis.

At the beginning of the 20th Century, Dr. J. L. Moreno envisioned a concept of social intervention, Sociometry, based on an analysis of social experience based on the "social atom" -- the individual in connection with his significant relations. In his search for tools to articulate and measure these relations, Moreno created Psychodrama. We are all aware of the pushes and tugs we experience as natural components of social interaction. We evidence or experience charisma, leadership, isolation and group cohesion and yet are often frustrated in our measurement of these phenomenological realities. Moreno called these lines of interactive attraction and repulsion "tele" (tell-ee). Sociometry is the measurement of these tele and Psychodrama is a method of visualizing (perhaps actual-izing is a better term) the configurations of tele <u>in situ</u> (in the situation).

This short paper is not adequate space to outline the details of the varieties of Psychodramatic technique. The classical format of Psychodrama is best described in <u>Who Shall Survive</u> (Moreno: 1952) and many supplementary articles (see bibliography). However, within the scope of this paper, necessary functions for increasing effectiveness in game simulation will be paired with useful psychodramatic techniques.

Increase Involvement

The issue of involvement in games is a crucial one to the impact of the game on the perceptual field and value systems of participants. In a previous paper at the 10th Annual Gaming Symposium the author raised the question of the relative realness of a game to its participants. At what subtle point does a game cease to be a game and its parameters begin to coincide with internal phenomenological parameters. In that paper a hierarchy of games was proposed based on degrees of what might be called <u>surrender</u> to the game. It was further stated that the greater the degree of surrender (whether temporary or permanent), the greater the impact of the perceptual field generated by the game parameters. This function is greatly enhanced by psychodramatic techniques used to warm up groups for Psychodrama sessions and techniques drawn from both classical and more updated hybrid mixtures with encounter techniques.

Guided Fantasy, a term coined by Shutz but actually created by Moreno, entails the suggestion to participants to concentrate in imagination on the physical, psychological and psychic details of an experience in order to re-order their internal priorities -- helping them to try on a new reality -- feel it, smell it, touch it, taste it in imagination. Education has only recently given the senses their rightful importance in the totality of the learning experience. An example:

Our goal is to help some middle class white school teachers to grasp the realities of the Chicano life experience in California. The design of the game is such that we create experiences which, in order to be dealt with successfully, require some perceptual tools not readily available to the dominant culture. Too often, games of this type have the effect of punishing participants by showing them the ineffectiveness and inadequacy of their own perceptual skills. If the goal of the game is to increase the respect felt by participants for other cultural sets, it is essential that they are helped to put on the eyes of the other culture in so thorough a manner that they can experience success rather than frustration as they move through the game. They must realize the validity of Chicano perceptual skills in not only coping with, but enjoying life. This real-ization of the Chicano world view might be developed through guided fantasy by having game participants close their eyes and imagine key peak experiences of a day in the life of a Mexican-American both inside and outside his home community, i.e., being confronted with and successfully handling being stereotyped with all of the attending emotions and physiological responses-anger, pride, humor, embarrassment -- joining a family -- the foods, the smells, the warmth, etc. Through the psychodramatic technique of doubling: That is, entering into the mind of the protagonist (i.e. The Chicano) the participant can literally practise looking through the eyes of the person whose role he is taking. The skill of doubling is trainable and a very powerful function of classical Psychodrama. Newly developed spontaneity exercises can be used in which the participant is encouraged to be aware of roles and to successfully enter new roles. In a sense, game participants can be trained to be "role fluid" rather than "role frozen".

Increased Trust

Essential ingredients in the success of educational games are trust in the programmer (the person teaching the game) and the creation of a trusting environment. Jourard indicates that a key to the achievement of trust is transparency. Perhaps the key component in the achievement of transparency is spontaneity. Psychodrama entails extensive spontaneity training in order to facilitate flexibility, sensitivity to others and role fluidity. "Soliloquy" (ala Hamlet) is an excellent technique in which the protagonist speaks spontaneously of what he is experiencing within. Doubling also provides a key to helping participants verbalize their inner experience.

Generating New Formats for Games

Whole new worlds can be created and destroyed in one Psychodrama through such methods as future projection, dream psychodrama, the magic shop, the wizard technique (developed at Synanon) and a host of other synthetic relationships which, through psychodramatic practise, can take on deep and involving proportions.

Develop In-depth Research Tools for Measuring Game Involvement

In analyzing the "power" of a game; that is, its actual educational impact on participants, the prime, and often unmeasurable variable has been the degree of involvement. The core of the problem has always been the translation of phenomenological realities into quantitative descriptors. Psychodrama is actually an extension of sociometric praxis as incorporated into Moreno's Sociatry. By illuminating the phenomenological reality of game participants, Psychodrama extends the area of usable raw data. Although self-reporting lacks the elegance and stability of some other forms of data, its reliability can be established and some significant inroads can be made into the problem of game validity. The full classical psychodrama format, doubling, role reversal, soliloquy and post-discussion are all useful in expanding data sources and can be useful in pointing out new, researchable areas of investigation.

The above techniques are centered around the principles of spontaneity-creativity developed by Dr. J. L. Moreno over a half-century ago. The integration of simulation gaming and Psychodrama theory and practise can lead to a mutual enrichment of both approaches and greatly enhance the educational efficacy of games.

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Soliloquy Technique: This is a 'monologue" of the protagonist "in situ". The (person) enacts a scene in which he is on his way home from work, for instance. In life itself, his thoughts would not be verbalized as he is alone, but he is thinking about himself. The psychodramatic (director) instructs him to use the soliloquy technique, to talk out loud as he walks, what he is thinking and feeling at this moment, here and now.

Double Technique: An auxiliary ego is placed side by side with the (protagonist), interacting with him "as himself", physically duplicating him in space and assisting him in the assessment of his problems.

Mirror Technique: An auxiliary ego proceeds to represent the (protagonist), assuming his identity, is addressed by the director by the (protagonist's) name, and reproducing the (protagonist's) behavior and interaction with others... The patient sees himself "as if in a mirror" how other people experience him.

Role Reversal Technique: In this technique the (protagonist), in an interpersonal situation, takes the role of the other person involved. Distortions of perception of "the other" in interaction may thus be brought to the surface, explored and corrected in action, in the fold of the group. Role reversal has been used effectively with infants and children as a technique of socialization and self-integration.

Future Projection Technique: In which the protagonist describes a setting in the future which he peoples with his imagination. The situation is then acted out.

Auxiliary World Technique: The entire world of the (protagonist) is restructured around him "in situ" by the aid of auxiliary egos.

Magic Shop Technique: The director sets up... a "Dream or Magic Shop". Either he himself, or a member of the group selected by him, takes the part of the shopkeeper. The shop is filled with imaginary items, values of a non-physical nature. These are not for sale, but they can be obtained in barter, in exchange for other values to be surrendered by the members of the group, either individually or as a group. One after another, the members of the group volunteer to come upon the stage, entering the shop in quest of an idea, a dream, a hope, an ambition. They are expected to come only if they feel a strong desire to obtain a value which they cherish highly or without their life seems worthless.

A SIMULATED CLASSROOM TO STUDY PRE-INSTRUCTIONAL DECISIONS

P. David Mitchell [1]

ABSTRACT

Excepting practice teaching, it is difficult to provide teacher trainess with the opportunity to translate their ideas into classroom practice. Popular teacher training simulations are only a small step in this direction. Often they confuse the role of teacher as classroom manager with that of instructor and initiator or they fail to provide flexible and realistic reactions to the trainee's decisions. This paper describes research to develop an instrument to guide the trainee in making the transition by providing opportunities to practice instructional decisions within the context of a responsive environment, viz. a computer-based simulated classroom.

A computer simulation of an instructional system (i.e. a set of learners) is described. The game-player, cast in the role of a teacher, takes pre-instructional decisions. The model calculates coefficients for each decision, updating major sub-models within the simulation (attention, motivation, instruction and activity states) for each learner in the simulated population with regard to several educational objectives. It prints results of educational assessments called for by the game-player.

The game-player is able to test the effects of alternative instructional strategies and supportive action on the simulated students. The player may resort to lengthy trial-and-error, retrieval of information from various resources, discussion or higher cognitive skills. The onus is placed on the player to find one or more winning strategies. This is in keeping with the model's assumption that the learner is an adaptive, self-organizing system which begins in a purposeful state and responds differentially to instructional communications and activities. Thus the game-player is forced to adopt a learner-centered approach both experientally and in any winning strategies.

The function of the simulation model, contrary to first appearances, is not to describe accurately how certain phenomena (such as classroom interactions) operate. Rather, the EDSIM game is an instrument which provides both a theoretical and an experiential framework for observation and analysis of pre-instructional behaviour on the part of the game-player. Thus the simulated classroom will serve as a focal point for both teacher training and research on teaching.

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PREPARATION FOR TEACHING

Recent educational technology research and practice has emphasized not only the institutionalized replacement of some instructional functions of the teacher by other means and modes of instruction but also the changing nature of the teacher's role toward that of manager of the educational process. Somewhat disquieting is the realization that little has changed in teacher-training practices to implement this. Thus the teacher is left too often to his own devices while pursuing the elusive state of omnicapability. How can we help the beginning teacher learn to design and manage the conditions of learning for his students ?

One of the many problems involved in teacher training is the great difficulty in providing a transition from relatively abstract teacher training courses to the complex richness of classroom practice. With the exception of practice teaching (which at its best proves to be a valuable, if not the most valuable, part of teacher training) few alternatives exist which can be relied upon to provide a relevant practicum situation. And, unfortunately, even the traditional approach of observation and practice often leaves much to be desired (Broadbent and Cruickshank, 1965). Popular teacher training simulations are only a small step forward. Often they confuse the role of teacher as classroom manager with that of instructor and initiator or they fail to provide flexible and realistic reactions to the trainee's decisions (Booth, 1972. Mitchell & Taschereau, 1972). Is it possible to develop an instrument to guide the trainee in making the transition from theory to practice by providing opportunities to practice instructional decisions within the context of a responsive environment, viz a computer-based simulated classroom?

The Sir George Williams educational simulation (EDSIM) project is intended to develop a computer-based educational game which will provide such opportunities (cf. Booth, 1972; Mitchell, 1972a; Mitchell & Taschereau, 1972). The game-player, cast in the role of teacher, will take pre-instructional decisions and a computer program, simulating up to thirty students, will provide plausible instructional outcomes for each. Thus a teacher trainee could test the effects of alternative instructional strategies and supportive action without confronting live students. And teacher trainers can study decisions involved in instructional planning.

Before describing this simulated classroom we must pause to consider a key issue which influences not only the project but also the conceptual model of the learner at the core of the simulation.

THE MANAGEMENT OF LEARNING

Teaching seems to be most popularly viewed as interventionist in nature; many recent developments in educational technology, for instance, have merely replaced some instructional functions of the teacher by other means and modes of instruction. Teachers and educational technologists tend to adopt the wisdom of the assembly line or of mass communications, seeing the student as essentially a reactive organism to be presented with information or to be guided toward a predetermined state.

The usual effect of instruction designed to transmit subject matter is that it neglects the teaching of thinking and learning strategies; it may simply select those who learn without being taught. What is worse, emphasis on technological efficiency in making the student choose to do what the instructional designer intended him to do can destroy efforts made to facilitate development of self-regulated learning strategies on the student's part. The increasing importance of éducation permanente (Conseil de l'Europe, 1968) suggests that such 'efficiency' is myopic. Lengrand has raised a critical issue, he asks:

> To what extent can education be defined as an intervention from outside, the transmission of know-how and technique? How far does education indicate a way of being in the world, a systematic directed effort by the individual to co-ordinate the facts of experience into a unified and harmonious personality? (Lengrand, 1970, p. 29).

The foregoing is not to deny the value of instructional design. On the contrary, too often the goals of instruction are not made explicit, and teachers are not precise or flexible in their use of instructional strategies to achieve these goals. Too often adequate resources for education are lacking. And, worst of all, too often instructional goals and strategies are not sensitive to the psychological nature and educational preferences of men --a design failure which seriously undermines the pre-conditions of learning (e.g. motivation, attention, study strategies) and self-management which control increments in capability. For the student's willingness and ability to engage in self-regulated educational activities is a sine qua non of education whereas the teacher's activities may be necessary but are never sufficient.

SELF-MANAGEMENT

Instructional planning and management, therefore, must be concerned with assessing the student's self-management capability, including his capacity both to select and engage successfully in educational activities and to generate or sustain motivation to do so. Developing self-awareness, strategies of investigation, communication and contemplation, and responsibility for his actions will all contribute to a student's self-management, or "ability to assess his own competencies, set his own... objectives and specify a contingency system whereby he might obtain these objectives" (Lovitt & Curtiss, 1969, p. 49). It is the responsibility of the teacher to free students from relying upon instruction, and to help them acquire essential techniques of self-management, either by direct instruction or by arranging conditions propitious to their discovery (Skinner, 1968). Indeed it is the basic assumption of institutionalized education that these skills, along with motivation, can be fostered and sustained directly through instructional design which induces the student to engage in them.

A design that would meet such student needs requires an educational ecology consisting of a contingency-oriented environment that includes people, film, texts, physical spaces, etc. (cf. Cohen et al., 1966) with emphasis placed simultaneously on both the development of learning resources and the facilitation of effective self-management strategies on the part of students (Mitchell, 1971). Thus instructional communications refers to something more comprehensive than transfer of information; it is at once instructive, motivating, and responsive to student-generated activities. And it is characterized by reciprocal communications and control between student and instructional system, making possible co-operative or co-intentional education.

THE PROBLEM

That there is much room for improvement in providing teacher trainees with a variety of instructional strategies and tactics before they enter the classroom is the key idea behind the EDSIM project. Related to it is the concern that the trainees themselves --like their future students-- should be helped to develop strategies of self-management which will stand them in good stead in an age of <u>éducation permanente</u>.

The problem is two-fold: How can the responsibility for learning be shifted from the teacher to the student so the latter can allocate his time or other resources to achieve his assigned or preferred educational objectives while the teacher functions as a guide and manager of learning resources for his students? How can students of education be prepared for this role?

A SIMULATED CLASSROOM

One promising approach to solving this dilemma involves operational gaming in which a human game player participates as a decision-taker within the structure of a system being simulated. The EDSIM Project will produce such an educational game in which the game player's decisions will simulate instructional communications within a simulated classroom.

Despite the plethora of descriptive and explanatory literature concerned with teaching and learning, slow progress has been made toward quantitative models of instruction. Yet such a model, no matter how crude, is required. Therefore we have formulated our first rud: :ntary conceptual model of the student as an adaptive, self-organizing system which responds differentially to educational communications designed to motivate, direct, or instruct him (cf. Mitchell, 1972b).

Needless to say, the complexity of the EDSIM Project demands that it be broken down into several steps which will eventually culminate in a flexible educational game in which the player will be able to specify the number of his simulated students and their initial characteristics (cf. Mitchell, 1972a).

THE EDSIM GAME

The EDSIM game includes a hypothetical class simulated by the computer and a human game-player cast in the role of teacher. In the interests of simplicity, the model is based on assumptions that do not resemble the class situation; for example, many variables, such as classroom behaviour, are omitted since the aim is to focus only on the pre-instructional decisions (i.e. lesson planning) of the teacher and their probable effects.

The game-player may specify what is to be taught in the forthcoming period; what size group he should teach; and how much time should be spent on recall, practice, evaluation, self-management --in other words, his precise teaching strategy. Figure 1 illustrates possible teacher activities.

Insert Figure 1

about here

The unit of play is a simulated fifty minute period; the game-player prepares his lesson plan knowing that each teaching act uses up a designated, arbitrarily assigned number of minutes. The sequence of activities intended to teach a single instructional objective is termed as instructional unit and a period may include several units. All pre-instructional decisions for a period are read into a computer that has been programmed to simulate the instruction process. They may be entered by teletypewriter or card reader.

THE CURRICULUM

A word about the curriculum is in order. The artificial curriculum is a set of mathemata (from Greek <u>mathēmata</u> -- things learned). Although at present each mathematom is independent of the others, later they will be organized into a hierarchical structure. The subject-free nature of this curriculum is intended to permit generalization by the game-player to any subject. We assume that

Choose number of Students (S) to teach in this instructional period

Request diagnosis of S: his pre-instructional state of attention, motivation, self-management capability

State instructional objective: i.e. the particular concept, skill or attitude the student should have at the end of the instructional unit.

State standard of mastery expected of S at end of instructional unit

Ask S if he accepts or understands objective

Ask S to state his preferred objective

Initiate substantive information: i.e. recall or review; introduce new material; integrate and generalize material

Arrange examples and illustrations (e.g. positive or negative, physical or symbolic, verbal and/or visual)

Give directions to S for reaching instructional objective

Initiate Student self-management: i.e. guide S to question or appraise or to initiate or sustain learning

Solicit response from S: for clarification, diagnosis, review or reinforcement

Respond to S: in order to clarify, confirm or correct

Figure 1. Illustration of Game Player's Range of Instructional Decisions

only one mathematom can be studied in a single instructional unit. Ideally this will be the one selected by the teacher but the simulated student may choose to work on a different mathematom or remain idle. The efficiency of instructional communications, and therefore learning, will be low for all but the topic presented by the game-player. Furthermore, we restrict ourselves to a learning model such that at the end of any unit the student has either learned the mathematom or he has not. If not, the probability that he will learn it in the next unit may be higher.

GAME PLAYING

Two administrative approaches exist for playing the game. If a time limit (e.g. a specified number of periods) terminates the game, the trainee's teaching effectiveness may be determined by what the class learned. Alternatively, the game could be played until a specified number of students reaches a predetermined critierion and teaching success is a function of the time required. Either way, the player can compete with his own past performance, with other students or with a required standard. Successful game-playing is discussed elsewhere (Mitchell, 1972a).

INSTRUCTIONAL COMMUNICATIONS MODELS

The computer programme simulating the classroom contains models that alter the capability state of each student with regard to each curriculum objective. Each instructional unit is processed independently for each student so the model calculates coefficients to up-date his motivation, instruction, attention, capability and

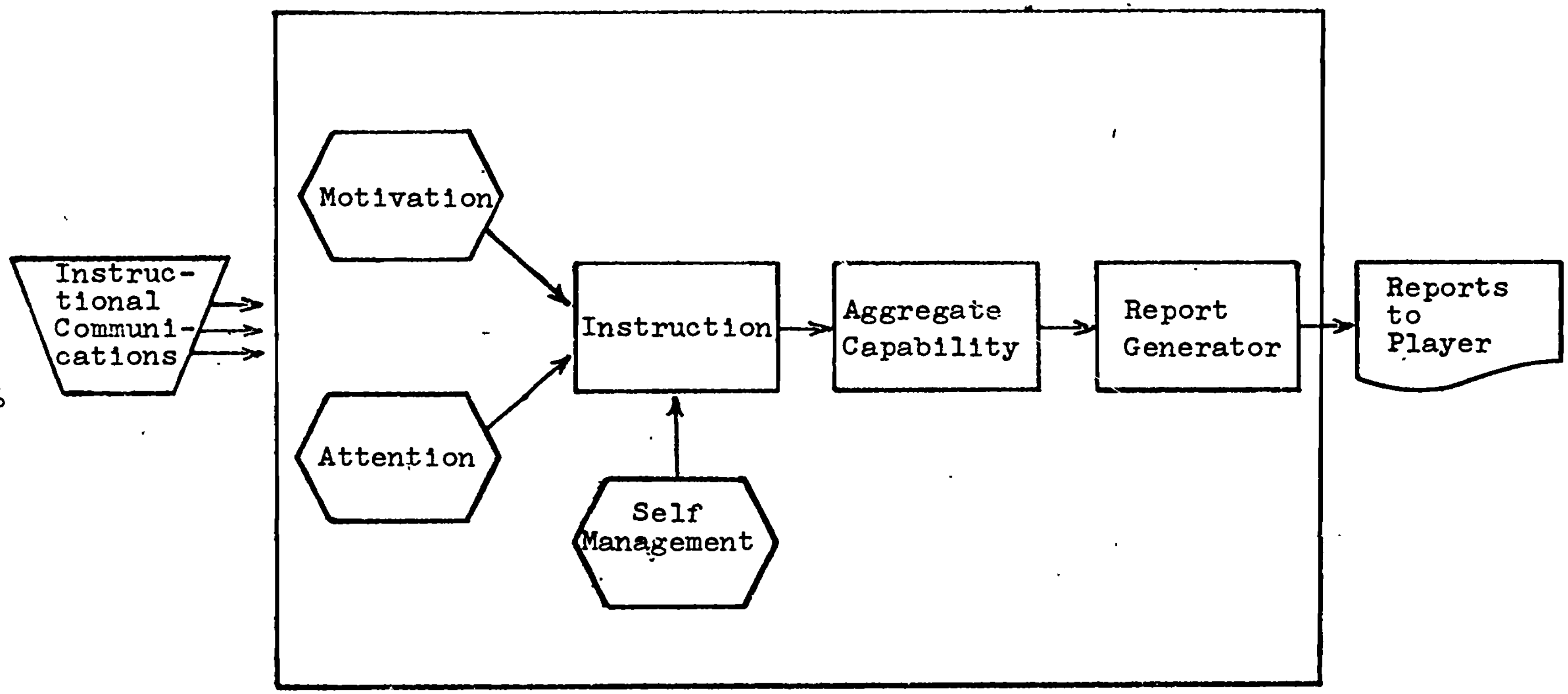

Figure 2. EDSIM Conceptual Model

activity states. The computer stores aggregate capability and prints results of instruction as directed at the end of the period (cf. Figure 2). For a discussion of these conceptual models and the student's purposeful state, cf. Mitchell (1972b).

Insert Figure 2

about here

THE FUNCTION OF THE SIMULATED CLASSROOM

Contrary to first appearances, the function of this simulated classroom is not to provide an accurate description of classroom interactions. Its major function is to serve both teacher training and research on teaching decisions by providing an instrument which includes both a theoretical and experiential framework for observation and analysis of pre-instructional behaviour. For example, studies are planned to compare the performances of trainees, experienced teachers and others as game-players. These should reveal strengths and weaknesses in the model as well as shedding insight into the teaching-learning process.

To the extent that the simulated classroom portrays realistically the ways in which people learn, the game-player may learn useful teaching strategies. In any event it will provide practice in relevant decision-taking before going into a real classroom with its confusing demands. Whether such vicarious experience of instructional design will alter the teacher trainee's behaviour in an ordinary classroom remains to be studied. Naturally this will be an important part of our research.

Yet another important function of the simulation lies in the fact that the onus is placed on the player to find one or more winning strategies. Thus the teacher-trainee is forced to adopt a learner-centred approach and, in addition, to experiment with precise instructional strategies for different learners.

The emphasis on self-instructional skills may seem belaboured. However it is justified not only by the importance of lifelong education and the need for students to develop cognitive and motivational self-management strategies but also by the embarrassing but well documented conclusion that "by about any academic standard that can be applied, students in teacher-training programs are among the least able on campus" (Koerner, 1963, p. 39). Hopefully, by learning and applying self-instruction and self-management procedures, the teacher trainee can overcome any deficit he may have; if his experience is fruitful he may be eager to help his students develop these skills. After all, Cohen (1966) has demonstrated that a history of constant educational failure can be reversed in a properly designed environment. His students (most of whom were dropouts; all were school failures) studied effectively, achieved remarkable rates of learning and demanded more study time, more resources. Hopefully participation in this simulation will be sufficient to help rectify the relatively modest educational shortcomings of teacher trainees.

The EDSIM project is based on the assumption that a student of education should learn a new instructional role. The simulation game is designed for him to practice this role both as a student and as a potential teacher. Is this preparation adequate, and sufficient? If not, what improvements or supplementary experiences would help?

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THE LANGUAGE OF GAMING

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Overview

Formal definitions of gaming exist in profusion. There is no attempt here toward the orderly review of these or to add yet another definition; rather, I offer the observation that all past attempts at definition have somehow failed to explain the great diversity of vehicles that parade under the gaming banner. These products, in terms of paraphenalia alone, range from simple physical objects (e.g., Et Alea, WFF'N-Proof) to very complicated computer dependent kits (Metro, Apex, City, Region). If paraphenalia gives no clue, then certainly subject matter is of little help. (Does any subject remain which has not been gamed?) Nor can we deduce much from gaming style or technique, since this varies from game to game or at least from author to author.

If gaming defies attempts at definition, perhaps it does yield to understanding from some given perspective. The three principal perspectives to date seem to be derived from education, mathematics (Von Neumann and Morgenstern) and predictive modeling through simulations in the gaming format. Each of these is too limiting in scope to ve very helpful: the education perspective and the predictive modeling context because they fail to explain the diversity of uses in other than educational contexts (research, public policy, information retrieval uses), the mathematic (theory of games) because it is too rigid and inflexible (few if any games, upon analysis, fit comfortably into a game theoretic structure). If, however, gaming is viewed as a communication form, we overcome these previous limitations and obtain a perspective from which the phenomenon of gaming can be more rigorously explained and pursued.

All forms of communication have specified conventions governing their use (grammars, manuals of style, etc.); as these become explicit for a given medium they permit its more effective use. Gamers now share a set of conventions (a gaming grammar) in an applied sense, but to date there has been no attempt to record or formalize them; the argument here is that conventions already in use or currently emerging can be codified and organized for the benefit of professional practice.

Games in the Communications Continuum

The various modes of communication currently in use rest along a continuum ranging from the primitive to the sophisticated; these are combined here into four major divisions: Primitive; advanced; integrated-simulated; and integrated-real. In a sense, the two extremes of the continuum can be viewed as being linked, in that two parties fully sharing a reality need no overt communication or suffice with primitive modes. (The stadium crowd watching a football game,

FIGURE 1
THE COMMUNICATIONS CONTINUUM*

Characteristics / (Examples of Each Communication Form)	PRIMITIVE		ADVANCED				INTEGRATED			
							SIMULATED		REAL	
	INFORMAL	FORMAL	SPOKEN	WRITTEN	EMOTIONAL	TECHNICAL	MULTI-MEDIA	HYBRID	EXPERIENCE	REALITY
	Grunts Hand-Signals	Semiphore Lights Flags	Conversation Lecture Seminar Radio	Telegraph Manuscript Books Text	Acting Art Role-Playing	Math-Notation Musical-Notation Schematics Diagrams	Film Television	Gaming/Simulation	Apprentice Job Training	(Any Shared Real Time Perception
SEQUENTIAL-GESTALT (Degree to which the form is constrained)	Most Constrained Because of Sequential Nature		Basic Character is Sequential but Various Devices Employed to Ease Constraint				Highest Gestalt Ability Short of Reality		Fully Gestalt Because Actual Reality	
SPECIFICITY-UNIVERSALITY (Degree of Flexibility of Use)	Employed for All Situations but Limited in Material Conveyed		Standard (universal) Modes Selectively Employed to Meet Specific Communication Need				Mode Specifically Tailored to Communication need		Specific (It is the Reality Encountered)	
SPONTANEITY OF USE (User Resistance, Skill Required, "Dryness" of Form)	Natural, Easy, Convenient		Special Skills Required. Sophistication Often Accompanied by Dryness, Artificiality of Use Inherent				Very Special Effort to Initiate; Then Spontaneous in Use		Natural "Life" Form, Skill Limits Involvement	
CHARACTER OF CONVENTIONS EMPLOYED (Formality, Complexity)	Relatively few, Simple, Informal		Formal and Informal, Simple and Complex, Highly Structured, Many				Many, Unique to Each Situation, Fairly Complex		Many Informal Complex	
CHARACTER OF CODING AND DECODING (Inherent)	None Required or Simple Effort		Essential; May be Elaborate and Highly Specialized				Elaborate Coding to Initiate Simple Effort by User		None Required	
CHARACTER OF THE MESSAGE THAT CAN BE CONVEYED (Complexity, Analogy, Qualitative or Quantative thought, Subtility, Permanance, Precision, Intangibles, Time Constrained, Systems Characteristics)	Only Rudimentary Message		Sophisticated Messages				Gestalt Substitute for Reality		Reality	

*This diagram is only meant to suggest major relationships among the various media to illustrate the character of gaming/simulation there is no suggestion of the comprehensive review of communication forms or their character.

From: "Gaming Simulation - A New Communication Form", by Richard D. Duke, presented at the Third International Conference on Gaming/Simulation, Birmingham, England, July 1972.

veteran foot soldiers engaged in a fire fight, two lovers in their time of ecstasy -- each situation relies on the fact of shared reality as the basis for communication.) When man does resort to any medium, it is to bridge the gap in the perception of reality between two or more parties. The greater the communications gap and the more involved the reality they wish to confront, the more elaborate and sophisticated their language becomes. Carrying this logic forward, a curious phenomenon is encountered. Attempts to convey elaborate systems emerge as a complex language form (gaming/simulation) approaching reality itself, and in so doing the process has gone full circle! The fourth category of communication forms (integrated-real) is included here to emphasize this transition. Because of this circular character of communication media, one is not better than the next. Rather, one may be more appropriate than another.

A quick review of the various communication forms is called for. Primitive forms have been divided into informal (grunts and hand signals) and formal (semiphore or light signals). In situations which are simple and transitory, the former will suffice; but as the communications need becomes more important, more involved, or more consistent these have been formalized. Both forms are characterized by spontaneity, limited message content, and immediacy to experience. They are generally used in face to face contact. For example, a cry of warning is almost universally understood by people of all cultures. Its function is to alert someone to a danger; it is effective only insofar as the warned person shares the message sender's perception of current reality, i.e. he is in the same place at the same time. Similarly, the standardized international traffic signals used to direct traffice are an example from the primitive-formal category.

Advanced forms of communication include spoken languages, written languages, emotional forms (art, acting, role playing) and technical forms (pictures, mathematic notation, musical notation, schematic diagrams, etc.), which are often used as supplements to other advanced forms. It is quite common, of course, to use these in some combination (for example, slides with a lecture), and such uses can be viewed as rudimentary forms of the integrated languages suggested by the final two categories. The first, integrated-simulated, is characterized by deliberate combinations of media (film and television) or by hybrids (gaming/simulation) which employ all prior forms in any combination which best enhances the transmission of some reality. The final category, integrated-real, does not attempt this in an artificial manner, but rather this level of communication inherently recognizes the circular nature of the communications process, and consequently extracts from reality itself. One illustration of this would be apprenticeship programs where the learner (party receiving the message) is placed in a situation of reality but buffered from the consequences of full participation. As he gains "experience" (better perception of reality) these buffers are systematically removed until he becomes fully part of reality.

Figure 1 identifies six major characteristics associated with the various language forms; and includes a brief interpretation of each of these characteristics relative to the four major types of media. The six characteristics include:

1. Sequential-Gestalt constraints - the inherent ability of the language form to convey gestalt or totality.

2. Specificity-universality constraints - the degree of flexibility inherent to the language form in adapting to new substantive material.

3. Spontaneity of use - the ease or relative freedom encountered by the user.

4. Character of conventions employed - the degree of consistency, the extent of complexity, the relative formality and their general vs. special use in a given communications attempt.

5. Coding-decoding - the extent to which the message must be artificially coded by the initiator and reconstructed by the receiver.

6. Character of the message that can be conveyed - the success with which a number of message characteristics can be conveyed, including but not limited to complexity, analogy, qualitative thought, quantitative thought, subtility, permanency (ability to reestablish), precision, intangibles, time constraints, and systems characteristics.

Communication needs (message transmission) can be analyzed by these characteristics, and a media or communication form is selected which yields the most efficient exchange. When no existing forms are successful, other forms (new or modified) are generated.

Gaming/simulation is the most intricate communication form available and as such its response to these six characteristics is unique.

Because gaming/simulation has emerged spontaneously to convey gestalt considerations, it is not surprising that it excells on this first characteristic. Primitive languages fail completely although advanced forms can be laboriously employed. The four "integrated" forms are most effective at conveying gestalt with the three artificial media (multi-media, gaming/simulation, and experience) often being more efficient than reality itself.

With regard to the second characteristic used in Figure 1 (specificity-universality) the integrated communication forms are the most specific (by reason of their highly particularized and complex construction to convey a single gestalt phenomenon). An example might help: Using a full primitive capability of grunts and hand signals, a traveler might get by temporarily in <u>any</u> culture. If he shifts to advanced languages he is limited to those particular cultures where he is learned (of course, he can participate more fully). If he now selects gaming/simulation, he will be restricted to communication with those who have a particular interest in the single gestalt represented by that gaming/simulation. (This is meant to imply that each gaming/simulation is best viewed as a separate and independent language, at least to the extent that we might view French, Japanese, and English as separate languages). It is important to examine this premise carefully, for if it is found acceptable, it then becomes possible to construct general principles to govern the construction of each new gaming/simulation).

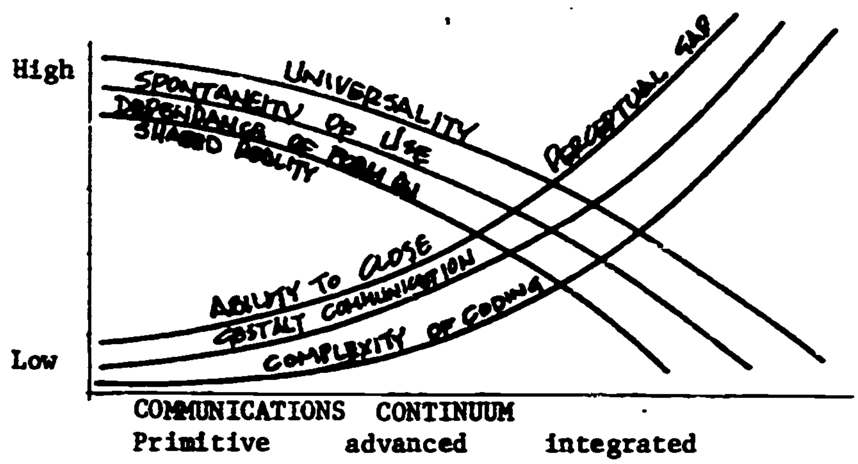
The third characteristic of "spontaneity" is intended to convey the relative ease of use of the various modes. Associated with this characteristic are the concepts of "dryness" (defined as the energy required to overcome the resistance to use of a given communication form) and expertise. The advanced forms are often viewed as "dry" and in their more sophisticated use they are almost universally "dry". This inverse relationship becomes a serious constraint when attempting to establish communication about serious and involved problems, and generally results in shared comprehension only among an elite group. Return to the continuum in Figure 1, there is an increasing requirement for special expertise as we move from the primitive through the advanced communications forms. This continues through the construction stages of the integrated forms, but is markedly reduced in their use. (Films often present intricate messages successfully to audiences who would not master the same material presented through the advanced languages.) Spontaneity is often constrained in the early stages of using a gaming/simulation since the players are literally learning a new and highly specialized language. After several rounds of play they will master the particulars and now communication advances to a level not previously possible (assuming, of course, that the primary rules of construction have been thoughtfully followed).

The fourth characteristic is "conventions employed". The importance of this is generally not understood by developers of gaming/simulation with the result frequently being an inferior product. To illustrate convention, consider several examples from the advanced form of communication: grammar for both spoken and written languages; consistency of mathematical notation (also musical notation); the rules governing the use of any given computer language; the symbols employed in flow-charting; etc. Contrast this with several gaming-simulations, all of which employ Lego blocks as a construction device, but, unfortunately, to convey different ideas in each case. Because each gaming/simulation is a separate language, the conventions are frequently invented for that particular instance; there are relatively few conventions universally employed by gaming/simulations except those previously adopted for the communication forms from which the gaming/simulation hybrid is constructed.

The fifth characteristic from Figure 1 is "coding", by which we mean the artificial and temporary translation of the message to some intermediate form from which it must be decoded before communication takes place. Perhaps the most clear example is semiphore transmission which requires coding from a given written language into separate and distinct symbolic representations (the flag positions) and subsequent decoding before the message would be understood by its intended receiver. Most media employ coding to some degree; when it is cleverly employed in gaming/simulation the technique becomes much more powerful. (For example, the use of the graphic display "SYMAP" to encode a large data set which can be visually decoded by the player at a more useful level of abstraction). The secret of success in "coding" messages for gaming/simulation is to employ codes which can be readily interpreted by the participants of that particular gaming/simulation.

The final row in Figure 1 is "message characteristics"; and is intended to suggest a large number of particular characteristics, several of which are illustrated (complexity, analogy, etc.). It is essential for the designer of a gaming/simulation to reflect on the character of the message(s) to be conveyed; this will suggest which communications forms are best combined into the hybrid. As a general observation, it seems that there is a direct correlation between the clarity with which the game/simulation designer specifies his communication problem (message, sender(s), receiver(s)) prior to construction, and the quality of the product. (One very good gaming/simulation had as its objective improved communication among a citizen group who were constructing a city ordinance to control aesthetics of builders. The game designer employed art (painting) as one of the component language forms).

Figure 2
Message Characteristics and the Communications Continuum



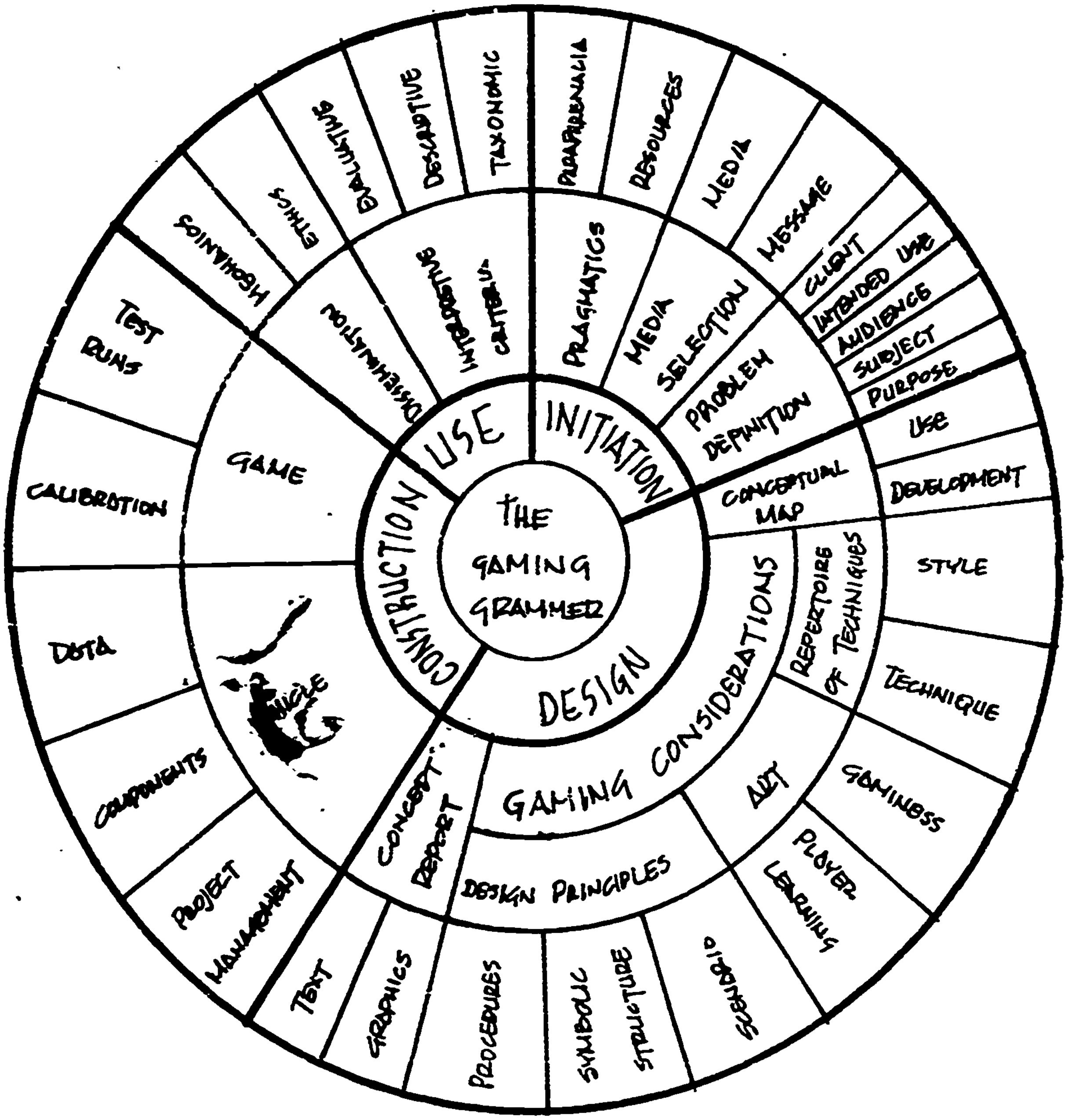
All along the continuum the purpose of communication remains the transmission of perceptions of reality. But as the scope and detail for the perception to be conveyed increases, becoming more comprehensive, total, or gestalt-like, a price is always paid in spontaneity of use (see Figure 2).

The Emerging Grammar of Gaming

If the perspective of games as a communication form is acceptable as a premise, it then becomes productive to begin to formalize the conventions currently in use and to suggest new areas where specification of convention might be productive. A format for this inquiry is suggested by Figure 3. (This is a very rudimentary statement, with less than 50 variables; a more complete version is under preparation that contains perhaps 500-1000 elements).

The game designer might well sort his efforts into four categories: Initiation, Design, Construction and Use.

FIGURE 3
The Gaming Grammar-Elements of Style



Initiation imples those questions that should be resolved prior to making the decision to use gaming;

Design relates to the deliberate procedure associated with problem analysis, synthesis with gaming considerations, and the careful reporting of the process;

Construction refers to the iterative process of creating the gaming vehicle, loading appropriate data, calibration, and testing of the product;

Use involves dissemination of the game and specification of those criteria which permit its proper interpretation by perspective users.

The time has arrived for those who share a professional interest in games to give serious consideration to the development of a set of conventions governing their development and use. This is necessary not only for improved communication among those with professional interests but also to assist the neophyte in game development and potential clients.

The "gaming grammar" or "elements of style" presented in rudimentary form here will be extended in subsequent papers.

THEORY - GAMES - REALITY

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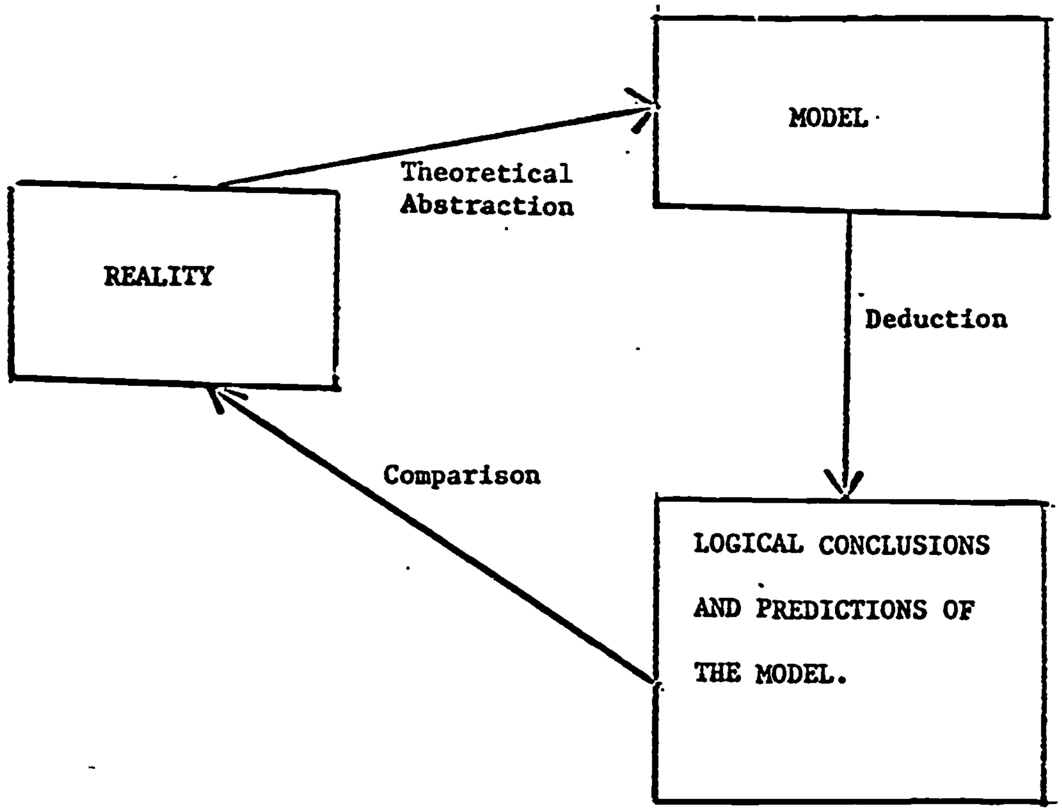
Throughout the past few years a discussion concerning application of simulation games to theory development took place. In particular, papers of James S. Coleman / 1968 / and Michael Inbar / 1970 / focused on this problem. Unfortunately, this discussion did not result in constructive propositions, and the question of how one applies simulation games to theory development remains open. Thus, the main purpose of this paper is to open the discussion once more, and introduce some propositions on this matter.

The process of theory development has been the topic of philosophy of science for hundreds of years. At the present, every scientist is aware of what the basic methodological framework is for constructing a given theory. Let me give a brief description of this framework.

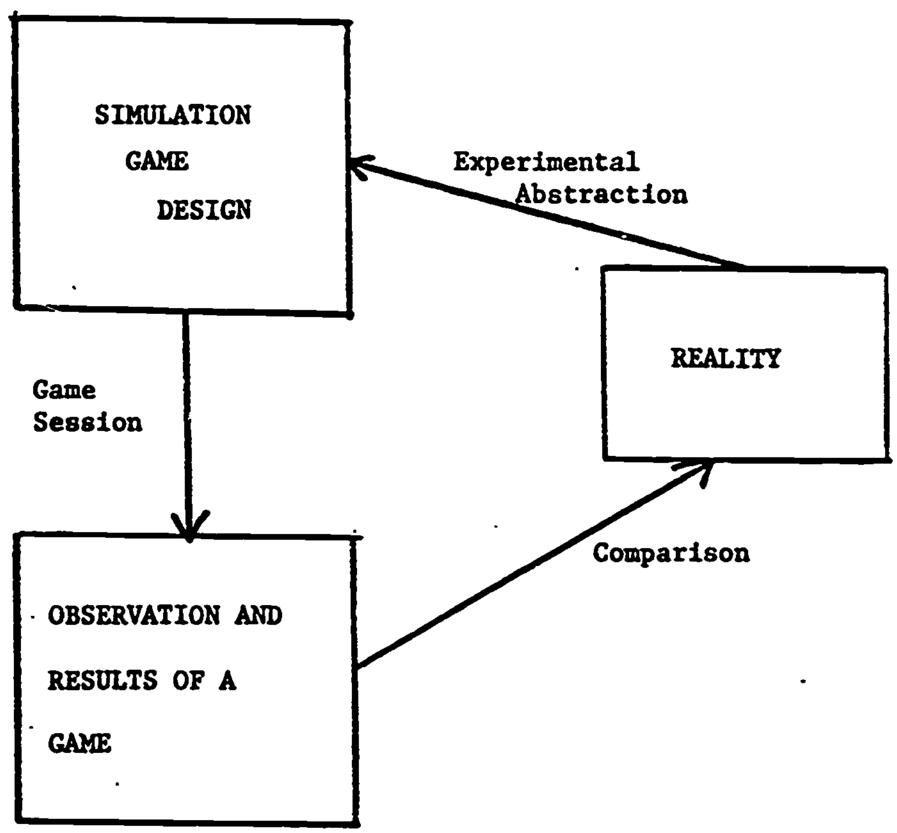


The process of theory development starts with theoretical abstraction. By abstracting from the real world, it is possible to achieve a level of simplicity at which human action may be analyzed. However in the process of abstraction, the analyst must be careful to preserve the essential features of the real world with which he is concerned. By means of theoretical abstraction one reduces the complexities of the real world to manageable proportions.

As a result we obtain a logical model, suited to explaining the phenomena observed. By logical arguement, that is deduction, one then arrives at logical or model conclusions. The next step is the comparison between conclusions of the model and the reality itself. This possibility of comparison stems from the basic requirement for scientific theory which states that the theory should include both abstract concepts and concrete implications, and that the two are logically connected.

The most frequent case in social sciences is that the theories which do exist are not comparable with reality because the theory is too abstract. On the other hand, throughout the development of science, other methodological devices have arisen to explain the real world's phenomena. One such device is simulation games and gaming. Gaming usually is understood as an exercise employing human beings acting as themselves or playing simulated roles in an environment which is either actual or simulated and which contains elements of potential conflict or cooperation among the real or simulated players. The players may be experimental subjects whose behavior is being studied or they may be participants in an exercise being run for teaching, training, or other purposes.

For the past few years an enormous number of simulation games has been developed. The design of a simulation game has been a subject of several publications, but an overall methodology of gaming hardly exists. Generally, one finds the following methodological framework for game design and comparison with reality.



In designing a simulation game, one applies the procedure of experimental abstraction which to a certain degree reduces the complexity of the real world. A social simulation game is a kind of abstraction which makes explicit certain social processes that are implicit in everyday behavior.

One of the first steps toward game design is to construct a set of rules according to which the course of the games is determined. The set of rules in one way or another incorporates the social environment. James Coleman (1968) suggested that there are two different ways of doing so. The first way is to represent social environment by the players themselves. Each player is a portion of the environment of each other player. The second way is to represent a portion of social environment by a fixed set of rules which occur more or less corresponding to reality. When the portion of social environment is represented by the players, then the response of the players occurs on the basis of their own goals and role constraints,and the game designer does not need to know in advance what those responses will be. On the other hand, if a portion of social environment is incorporated into the rules of the game, more empirical knowledge of social organizations or of individuals is required. In that case, the game designer has to know in advance the environmental responses which in turn are dependent upon the possible actions of the players.

At this point, I would like to emphasize one thing, that is that the notion of social theory with theoretical assumptions and abstract concepts does not enter at all in such experimental abstraction. What happens instead is that the design of the game is based upon; direct empirical abstraction from phenomena observed in real life and an application of rules which are assumed to be commonly present in the real world of institutions and individuals.

The next step in simulation gaming is sessions with subjects. During those sessions one observes the course of actions which take place. Given these observations from a game, a comparison between those particular results and reality then takes place.

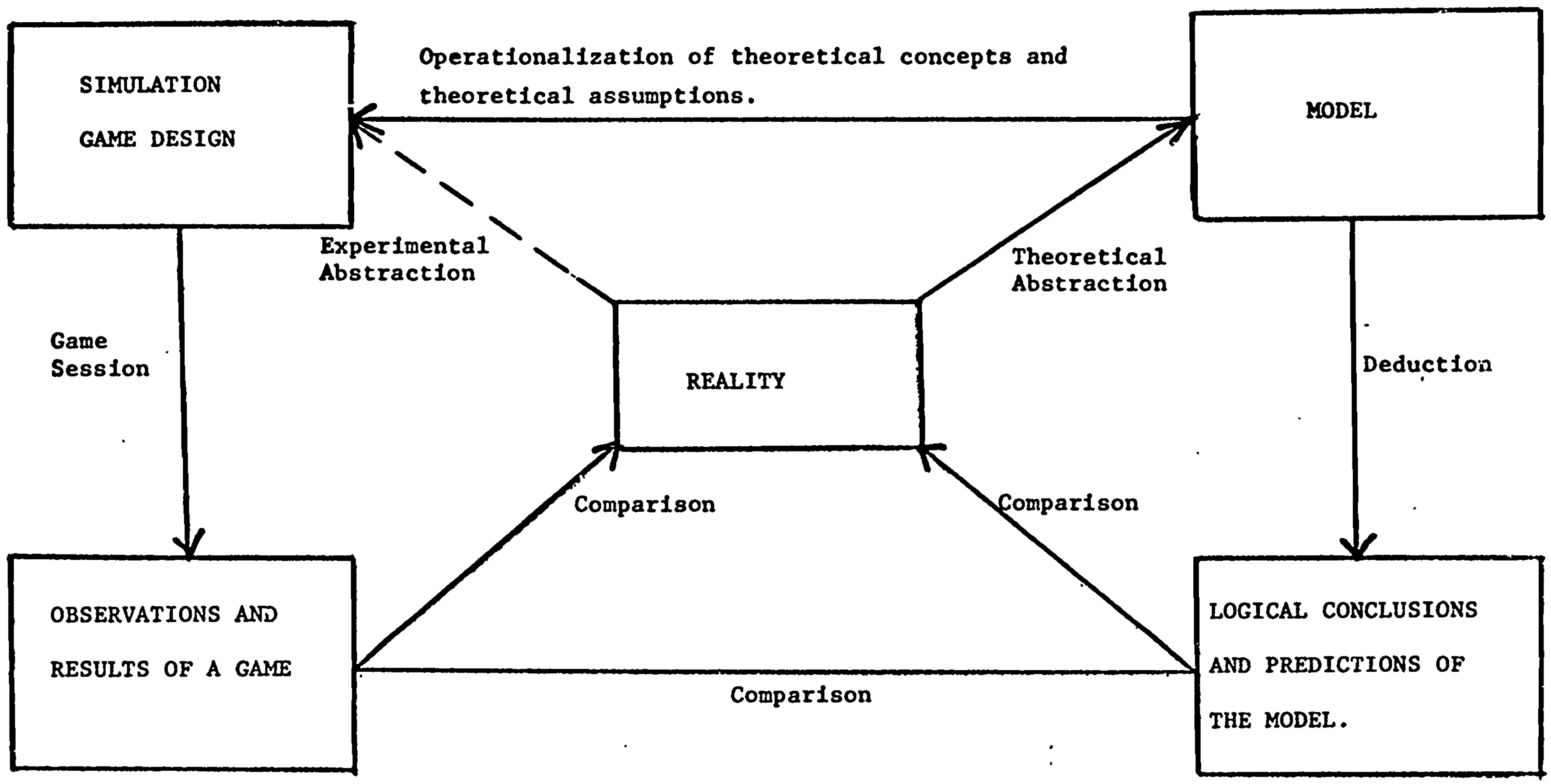
So far, in the methodological frameworks introduced, a direct linkage between theory construction and social simulation games does not exist. There is no basis for comparison between the logical derivations of the model, on one hand, and results and observations from the game, on the other hand. The simulation game design is apart from all the theoretical assumpeions and it is a result of abstracting some empirical phenomena and then analyzing it in an experimental setting.

The question arises, what are the possible ways to construct a relationship between a simulation game and a theory? What are the conditions which would lead to compatability between the model and the simulation game? In general, what kind of methodological framework is necessary to provide the possibility for using a simulation game as an aid in constructing social theory?

In this part of the paper I would like to present a proposition of such methodological framework. Hopefully, it will permit discussion of those problems.

The direction in which one would proceed is to combine in some way the two frameworks. The grounds for such combination is the fact that both procedures start from the same point, that is reality.

Thus, as the first step in introducing the new framework is to restate the diagram and relations among its elements.


SIMULATION
GAME DESIGN
Operationalization of theoretical concepts and
theoretical assumptions.
MODEL
Experimental
Abstraction
Theoretical
Abstraction
Game
Session
REALITY
Deduction
Comparison
Comparison
OBSERVATIONS AND
RESULTS OF A GAME
Comparison
LOGICAL CONCLUSIONS
AND PREDICTIONS OF
THE MODEL.

The proposed framework consists of five elements: reality, model, simulation game design, observations and results of the game, and finally the logical conclusions and predictions of the model. It can be easily seen that the elements themselves did not change, although the relations among the elements have changed.

Within the framework,we can distinguish the following relations:

1. The relation between reality and the model described by the process of theoretical abstraction, which has been already introduced.

2. The relation between the model and logical conclusions is described by the logical arguement, ie. deduction, which as well has been introduced.

3. The relation between the model and the simulation game design is described by the process of operationalization of theoretical concepts and assumptions. This particular relation is a new relation in our framework.

4. The relation between the simulation game design and reality is partially described by the process of experimental abstraction, and thus not quite compatible with the original relation between reality and simulation game design.

5. The relation between simulation game and observations and results of a game remains the same and is described by the play of the game, and actions which took place.

6. Finally, the relation between the reality, logical conclusions and observations and results from the game is a new relation generated by the previous ones and is described by the process of comparison among the three elements.

Let us now turn to a more detailed discussion of the proposed framework. The basic statement of the discussion is that, in order to use simulation games as an aid in constructing social theory, some requirements must be fulfilled. In other words, the simulation game design must be linked in some way or another with the theoretical model. Thus, as the first requirement, I would like to suggest the following methodological postulate:

1. Structural postulate.

As a result of theoretical abstraction one obtains a set of concepts and relations among them. Those highly abstract concepts, defined in theoretical language, very often do not have concrete implications. On the other hand, the basic requirement for a theory is for it to have concrete implications. If we consider the relation between the theoretical model and simulation game we arrive at two different levels of abstraction. Between the model and the simulation game, a change of language occurs. The abstract concepts in the theoretical model are translated into operational language, that is, action-related language. As a result, we obtain a set of rules which stem directly from our theoretical assumptions but are described in a concrete operational language. More generally, the elements of the game have to be well-defined and relations among them specified in operational language and derive from the theoretical model.

Let me give an example. The underlying model for the game "The Establishment" assumes that there is a conflict of interests between the interests of the individual and the same individual as an agent of a corporate body representing the interests of that corporate body. In addition, the interest structure for every individual in the formal model is represented by a set of numbers. At the level of the simulation game this particular assumption is operationalized into the following set of rules. The individuals are members of an Establishment which as its task has to fulfill the demands of the society. In the meantime the same members have their own individual interests not necessarily compatible with the action of the Establishment as a whole toward the society. Thus, given our theoretical assumption of the conflict of interests, the rules are set up as such that there is expected a competition both among the individuals' tasks and the Establishment's task.

2. Purposive Postulate.

When conceptualizing a theoretical model one has to define some mechanism which determines the basis for logical derivations. In a simulation game, one of the most important elements is a specification of the goals for the players. This specification of goals defines the purpose of actions which take place during the course of a game. Naturally, the specification of goals appears in operational language. In addition, the specification of goals should embody the theoretical assumptions included in the model. Let me give an example. The theoretical model proceeding the simulation game "The Establishment" includes the assumption that the individuals are rational. Rationality in turn implies that every individual will act to maximize his utility. This particular assumption is incorporated into the game. It is assumed that every individual will tend to fulfill his interests. His interests are now freely determined by him and if for example, the given individual discovers that the society's interests lie in a particular event, then the individual as a member of the Establishment, in order to gain as much satisfaction points as possible, will tend to follow the society's interest. The knowledge concerning the society interests is represented by partial information about those interests. Thus, it is expected that individuals who have that partial information will incorporate that into the determination of their own interests.

One way of linking together the theory construction and simulation game is to specify the following relationship. We start with the reality and through theoretical abstraction we achieve a level of simplicity at which we deal with abstract concepts and theoretical assumptions. From that point we proceed to another level - that is the level of operationalization. The given set of assumptions is translated into operational language and that is the basis for our simulation game. One always has to remember that there is a distinct difference between the level of theoretical abstraction and its exemplification in a simulation game. The theoretical abstraction with its abstract concepts provides the basis for deriving at operational terms and relations among them in a simulation game, but the abstract concepts do not enter the game itself.

3. Behavioral postulate

A simulation game design is not only a result of the linkage between the theoretical model and the game. One has to realize that another process takes place.

In a given simulation game with players, a portion of a social environment is represented by the players themselves. The players enter the game originally as members of reality. The behavior observed during the course of a game is a result of the players' action toward their own goals.

In this case, the uncertainty of predicting the behavior is very high, despite the fact that the goals are imposed by the set of rules of the game. Such factors as the motivation of the players, their intellectual capacity, degree of identification with the assigned role in the game, their personality, knowledge and understanding of the rules, etc. mirror in a microcosmic way the real world's complexities. Thus, the spontaneous aspect of a simulation game should not be neglected. Although we assume that the observed behavior should be generated by the first two postulates, if one faces some unexpected events during the play of the game, then this observation should imply some more thorough analysis.

Generally, the above discussion results in the following statement. The social simulation game, in order to be used as a tool for constructing social theory should follow the proposed postulates.

The structural and purposive postulates, if fulfilled, provide the linkage between a simulation game and the theoretical abstraction, the model. In other words, the concepts and relations among them which are embedded in the model have to be incorporated into the rules of the game. The incorporation occurs through operationalization of abstract concepts. Therefore, instead of a formal language, we use an operational one.

The resulting behavior process is in turn generated by structural and purposive postulates. The behavioral postulate, on the other hand, provides the basis for explicit exposition of the phenomenon embedded in reality.

The next problem which arises is the relationship between reality, observations and results of a game,and the logical conclusions and predictions of the model. One would like to see what are the benefits of such combined framework and at what kind of conclusions one might arrive.

Given that we have the observations and results from the game as well as the logical conclusions from the model, a process of comparison takes place. The comparison of the results is assumed to be between observations from the game, reality, and the logical conclusions. Let us list the following possibilities.

A. The first type of possible result of the comparison is the following. We observe that the results from the game are compatible with our logical conclusions, but at the same time they are not compatible with the observed phenomena in the reality. This type of situation indicates that our theoretical abstraction was wrong. In addition, it indicates that because our theoretical abstraction was wrong, the operationalization is invalid due to the improper conceptualization, despite the fact that operationalization itself might have been correct.

B. The second type of a result of the comparison is as follows. We observe that the logical conclusions of the model are compatible with reality and at the same time not compatible with the results from the game. Such a particular situation implies that the process of operationalization was done incorrectly and the theoretical assumptions did not enter the simulation game correctly.

C. The third type of results from the comparison are such that we observe that the results from the simulation game and aspects of the reality are compatible with each other but not compatible with our logical conclusions derived from the model. It might mean either of two things. The first possibility is that the theoretical abstraction was wrong and the operationalization was also wrong, resulting in counter-balancing errors. The second possibility is that we did not at all incorporate the theoretical assumptions into the simulation game and only followed the methodological framework presented at the beginning of this paper. That is, that the simulation game design stemmed directly from reality with no connections with the theoretical model.

Finally, I would like to elaborate further on the advantages of such methodological framework. Given that one attempts to use simulation games for constructing social theory, then he has to provide a direct linkage between the theoretical model and the simulation game. The theory development is not of course a one-step attempt. It might turn out, that the results of the comparison will indicate some false proceedings. That is, either a false conceptualization of the reality, or wrong operationalization of the theory, etc. But this, on the other hand, has some definite advantages. It means that, for example, we may manipulate the structure of the game by changing some rules and then once again repeat the comparison. If it turns out that the results of the game are compatible with the reality, then we may go back to the model and reconceptualize some aspects of it.

Another possibility is to change some theoretical assumptions of the model, followed by changes in the structure of the game and thus providing different results for comparison with reality.

In general, if we assume an on-going process of comparison, reconceptualization and operationalization then we might arrive at a stage of a fairly consistent theoretical model with concrete implications.

One additional comment. The proposed methodological framework implicitly assumes a definite sequence of proceedings. We start from reality and through theoretical abstraction we achieve the level of conceptualization. Then operationalization takes place and the design of a simulation game is both determined by such operationalization and experimental abstraction. Game sessions and deductions from the model are done independently. As a result, we obtain observations from the game, one one hand, and logical conclusions from the model, on the other. Then comparison takes place.

The assumption concerning such sequence of action does not necessarily have to be the case. One might,within this framework, arrive at a completely different sequence of action. For example, one might start from a simulation game design in operational terms and then proceed to the model and translate operational terms into theoretical language.

In general, the proposed framework provides several possibilities, the values of which depend upon the goals and invention of the social scientist involved.

EDUCATION AND URBAN PLANNING AS CONGRUENT EVENTS

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ABSTRACT

Out of my work as an urban planning consultant to the Board of Education in one of the smaller mid-Western cities grew a concern for the integration and coordination of urban planning and educational institutions in their areas of overlapping interest. Previous experience with urban simulation games seemed to indicate that these can provide an instrument not only for the integration and coordination of different public and private agencies, but also a vehicle for on-going education, and effective citizen participation in the complex urban planning process.

However, the question "why" urban simulation games can bring about all the above mentioned changes becomes crucial, if their implementation is to be considered seriously. Trying to answer the "validity question", at least partially, through linking the "autotelic folkmodel" theory of Omar Khayyam Moore and Alan Ross Anderson with urban simulation gaming is the main purpose of this paper.

Games have long been used as means by which people learn about and build a heuristic structure of the socialization process. In recognizing games as abstract models of man's relationship to their physical and social environment we are beginning to understand their conceptual depth and subtlety, and gain an indispensable historical perspective.

In all cultures we find games that fall into four categories: puzzles; games of chance, games of strategy, and aesthetic entities. Moore and Anderson use the term "folk model" to commonly refer to all four models. Existing folk models, however, do not adequately represent guides for action anymore. They were developed to match relatively static social conditions, which do not exist at present. Instead of a static social framework we now need a dynamic social framework to adequately reflect the problems in a changed and changing world.

Urban simulation games may represent such a new and dynamic model which can provide participants with a deep dynamic, conceptual grasp of fundamental matters or a concept of a civilization in acceleration. They also may be able to help overcome the institutional separation of educational and urban planning institutions, which is one cause of severe difficulties both agencies are facing today. The public school system, which in the past has failed to prepare people to recognize and deal with the problems we are facing now, can be seen as one possible agent to initiate urban simulation gaming as a process integrating on-going education, educational planning and urban planning.

Today functions of Education and Urban Planning are still separated by sharply delineated institutions, tasks, and roles. It is not an unusual practice for City Planning offices to produce "comprehensive masterplans" without involving the Board of Education and vice versa. Usually those involved have developed neither channels of communication nor an awareness of the close interrelatedness of the problems both agencies are dealing with. If there are any contacts at all they mostly are on an ad-hoc, informal, "personal effort" basis, at a technical level which clearly cannot lead to very significant results, as long as both struggle daily with a paramount in-house crisis. Since education today can be defined as an on-going process involving everybody between the ages of 3 and 75, and the entire city with all its human potentialities, institutional, commercial, industrial, and recreational uses must be defined as a resource, the institutional and functional separation of urban planning and education becomes obsolete, or worse, it becomes a barrier to urgently needed change.

To bring about this magnitude of change both agencies will soon search for an instrument which will allow them to coordinate and integrate their efforts to make the city a more viable place to live and to mobilize existing resources.

Our experience with gaming in the Urban Affairs Department of the Graduate School of Public and International Affairs[1] shows that urban simulation games or decision exercises with an automated feed-back mechanism can become such an instrument and provide: 1) a practical vehicle for the participation of citizens in the urban planning and decision-making process; 2) an instrument for more precise predictions of user-needs for the urban planning agencies; 3) an on-going learning and communication process, which will greatly increase an understanding of the fundamental needs of citizens, private and public agencies in the city, and 4) a new dynamic "folk model" which more adequately represents the growing complexity of our social and economic structure than traditional folk models which are still used.

The first three arguments for the use of urban simulation gaming have been made before.[2] However, I have not found any attempt to link urban simulation gaming with a theory about existing games, for example, puzzles, games of chance, games of strategy, and aesthetic entities, i.e. plays. The essence of this paper will be to prove, that in establishing this link we can learn a great deal about the theoretical depth, the practical application and the importance of the development of these urban games. Though the theoretical analysis of this link can be applied to other simulation games, the practical conclusions seem to "fit" the urban simulation game best, particularly when it is seen as a vehicle for gaining effective participation, which means on-going education, and developing and pretesting urban planning alternatives.

I am using the term "folk model" here according to Omar Khayyam Moore and Alan Ross Anderson, who were the first to relate the structure of games or folk models systematically to a theory about the human socialization process.[3] Their work, which builds on the ideas of George Herbert Mead[4] and Georg Simmel[5] seems to me crucial for a full understanding of the depth and importance of gaming as a device to learn about and pretest complex social systems without risking the welfare or survival of the participants themselves.

In every culture we can find four game categories: puzzles, games of chance, games of strategy, and aesthetic entities. Moore and Anderson suggest that puzzles stand in an abstract way for man's relationship to nature - insofar as nature is not random; games of chance can be seen as abstract models of man and the random or chancy elements in experience; games of strategy represent man and his interactional relations with others like himself; and aesthetic entities give people the opportunity to make normative judgements about and evaluations of their experience. To have a convenient name covering all four categories and indicate their development early in human history, Moore and Anderson called these "folk models." "It should be pointed out that until mathematicians had made formal analyses of the structure of some of these folk models, their depth and subtlety were not appreciated fully..."[6] Only since the work of von Neumann (1928) a mathematically rigorous distinction between games of chance and games of strategy has been possible.[7]

In spite of their mathematical complexity these models can be learned by almost everybody. People do not have to understand the mathematical treatment of probability to play games of chance. However, in playing these, they are gaining an understanding of the basic concept of probability. Looking at urban simulation games (our "new folk model") the same applies: e.g., participants do not have to be taught econometrics to understand the effects of alternative budgetary decisions on the urban system.

A variety of insights can be gained from the way in which early folk models were implemented:

1. most important is that they are "learned" and not "taught". Only the rules of the game have to be explained. Thereafter players are left largely on their own;
2. the real risk of winning or losing is kept at a minimum;
3. emotional expressions are allowed but extremes excluded;
4. the models themselves are fascinating enough that people do not have to be encouraged to play them - on the contrary they sometimes have to be prohibited from playing them too often.[8]

These points can be related to urban games: Urban simulation games, in fact, are primarily "learning" devices. There is no way in which the "dynamics" of the urban system can be "taught" conventionally. The interaction of persons with vastly different life styles and motivations, and the interrelatedness of different social and economic forces, is impossible to transmit theoretically. It has to be "experienced" or learned through "proxi" experience, i.e. simulation games.

The set-up of the urban simulation games usually protects the participant against serious consequences as a result of his actions. Except for the psychological damage to someone who loses, the welfare or survival of the participant is not at stake. However, to allow maximum freedom for each individual some control will have to be exercised to prevent extreme conflict situations. Outside a university setting, where the teacher will take the role, it may be necessary to employ some specially trained person with experience in human interaction, the dynamics of small group behaviour, and conflict management. This person should not take part in the game; he must be able to set the mood free for discussion, and prevent a situation in which people could seriously hurt each other. This however, should not be a very difficult problem, in a time where the expression of extreme emotions is quite against the social norm.

Though it will certainly be difficult to keep psychological and social risks out of the exercise, they can be minimized: e.g., a significant number of stress creating factors can be eliminated, when there are no rewards and punishments involved. The knowledge that no serious consequences are to be expected from the outcome obviously does not prevent the "player" from taking the game seriously, as long as it lasts. This applies to a game of chess as much as to an urban simulation game. Taking this one step further, it can be maintained that it is usually "no fun" to play a game with someone who does not take it "seriously". This sounds like a contradiction in itself, but if it were not the case, the notion of using gaming to pretest various options would have to be dismissed. Gaming as a pretesting device requires both "seriousness" and "maximum freedom and creativity", which renders the usual work-play distinction obsolete.

If our early folk models are fascinating enough that people have to be prevented from playing them, why do we need "new folk models"? As long as people lived in a static social environment, the existing folk models matched their world, i.e., in games of chess the rules and boundaries remain constant, in a jigsaw puzzle the picture to be completed is not subject to change, nor are the actors allowed to change their lines in a play. All folk models in this respect adhere to the Newtonian concepts of space and time "...both suppose a frame of reference which is invariant with respect to all that goes on within it."[8]

These conditions, however, have radically changed, since most industrial societies have undergone a massive acceleration in their technological development since the 1940's. Instead of a static framework we now need a dynamic framework, in order to be able to cope with our problems in a changed and changing world.

With some modification O.K. Moore's "Principles for the Design of Clarifying Environments"[10] can be used to see whether simulations in general and urban simulation games in particular can be classified as "dynamic models for a learning society which seem to require the imaginative use of a much more subtle technology."[11] The first three principles are derived directly from the analysis of existing folk models, the fourth is directed toward a learning situation undergoing rapid change.

1. the attractiveness of our new models will depend to a great extent on how many different "perspectives" the participant is allowed to take. In linking existing folk models to the structure of the human personality Moore and Anderson discovered that each of the four kinds of folk models corresponds to a characteristic attitude or perspective that a person might take towards his world:

a. puzzles emphasize a sense of agency or an active attitude toward the environment, which is called the "agent perspective";

b. games of chance emphasize a sense of patienthood or a passive attitude, called the "patient perspective";

c. games of strategy presuppose an agent-patient perspective, or "reciprocal perspective", which stresses interactive behavior;

d. aesthetic entities emphasize assessing, evaluating, and judging, or a normative role, which is called the "referee perspective."[12]

Relating these findings to the learning process it becomes apparent that different learning environments or games can be constructed which permit and facilitate the taking of one or several perspectives. Moore and Anderson found that those environments which allow several perspectives to be taken are more conducive to learning.[13] When the criteria for the design of clarifying environments are applied to urban simulation games, they should be ranked fairly high on a scale of learning conduciveness. There are few constraints to taking any particular perspective at any given time. Participants may be active, passive, inter-active, judging, or speaking, listening, arguing, mediating, etc., as they choose. As long as the gaming-unit is small enough, there is no danger a person will be confined to one basic perspective, e.g. the passive perspective of listening, for too long.

2. similar to existing folk models the attractiveness of our new folk model depends on the amount of freedom the simulation allows, to define the environmental boundaries, and to explore different alternatives, independent from authority (or people who "know") and safe from serious consequences; (Moore and Anderson would call this the "autotelic principle").

3. the success of a new folk model depends also on how "productive" the participant can be; e.g. it surely is more fascinating to see the impact of one's own and other decisions on the urban system as a whole, within hours (which can be done in the "GSPIA" game) than to compute the various outcomes "by hand" (which can only be done in the more simple games). The use of the computer, a precise data base, a highly responsive retrieval system, and sophisticated econometric models therefore seems to be essential if the urban simulation game as a new and dynamic folk model is to become as popular as our early folk models; and as adequate in representing a civilization in acceleration as early folk models represented static social conditions.

4. in view of a world that changes rapidly, anyone who either stops learning, or is somehow prevented from changing his knowledge and skills will soon become obsolete. An environment conducive to learning should therefore be both responsive to the learner's or participant's activities and helpful in letting him take a reflexive view of himself as a learner.

In an urban simulation game it is possible to comebine both requirements: participants should be allowed to explore freely, and be informed quickly about the consequences of various actions; and the urban simulation game can be constructed to be self-pacing because the individual largely determines the rate at which events are happening; it permits full use of the participants' capacity for discovering relationships of various kinds, and to link discoveries about the physical, cultural, or socio-economic aspects of the world around him.

The participant can also see himself as a social object; the reactions of others to his opinions, proposals or actions, reflect his capacity to make himself understood or convince others about his ideas. In addition, video-tapes have been used successfully as a "reflexive device."

> "The reflexiveness which is characteristic of maturity is sometimes so late in coming that we are unable to make major alterations in ourselves...It is a normal thing for human beings to make up hypotheses about themselves, and it is important that these hypotheses do not harden into dogma on the basis of grossly inadequate information."[14]

One device which was proved to be most successful in regard to the reflexive condition, is a questionnaire evaluation which gives each person a fairly exact account of his abilities as seen by others.[15]

I hope that this very brief summary linking urban simulating gaming to some general theories about earlier games can provide a few new practical deductions for the implementation of urban simulation games. However, the main purpose of this paper is to show urban planners and professional educators that there is more depth and seriousness in gaming than usually understood. It seems quite clear that present urban problems cannot be solved with more technology alone. More people will have to be educated to understand the mechanisms of the urban system and technological application. However, educators already challenge the belief that people are increasingly well-educated. On the contrary, Michael Marien says: as our society becomes more complicated and changes occur faster, people are in effect becoming more ignorant in terms of what they need to know. The greatest need, according to his report, is among the post-school population.

"The necessary adaptation of our ignorant society involves improvement in the quality and distribution of our knowlege, as well as the capacity of our population to utilize large quantities of conflicting and changing information in our roles as workers, citizens, parents, and individuals. We cannot attain a desirable society with incompetent manual and mental workers, ill-informed citizens, primitive parents and their turned-off children, and future-shocked individuals. More learning and different learning will be necessary not only for the young, but especially for ...post-school populations that will continue to have a major influence in shaping our future during the turbulent decades ahead."[16]

The general tendency is presently to isolate formal education from other aspects of society, which will lead, in the end, to a situation where people, whether young or old, finally no longer understand their relationship to society.

The public school system which in the past has failed to prepare people to recognize and deal with the problems they are facing today, now has a unique chance of initiating a new philosophy. In combining its efforts with those of other urban planning institutions to a more powerful thrust against ignorance, alienation, frustration, and-involvement, it can sponsor a more adequate decision-making process through urban simulation games in which education and the complex urban planning process become congruent events.

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[11]*Ibid.*, p. 584.

[12]*Ibid.*, p. 577.

[13]*Ibid.*, p. 578.

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[16]Michael Marien, "Higher Learning in the Ignorant Society", *The Futurist*, Vol. VI, No. 2, April 1972, p. 51.

POWER IN A SIMULATED COMMUNITY

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Although the nature of power in local communities has been a concern of American social scientists for half a century, agreement on the nature of local power structures seems as far away as ever. Despite recent attempts to break the stalemate,[1] elitists and pluralists still face one other, each armed with an arsenal of presuppositions, research techniques, and conclusions which contradict those of the opposition. Briefly, the elitist presumes somebody runs a community, uses a positional or reputational research technique to find these people, and discovers that a single, self-conscious, impermeable elite based on wealth is the decision-making group.[2] The pluralist does not presume that someone necessarily runs the community, uses a decision-making technique to find out if anybody does, and finds that a number of responsible, overlapping, relatively permeable groups which include a substantial number of political leaders constitute the local policy-making bodies.

Studies of local power structure are expensive and time-consuming propositions. In view of the cost of these research projects when real communities are studied, it would seem useful to seek a less expensive way of testing hypotheses about community power. Simulation may offer a possibility for doing so It is compatible with most of the major techniques used in community power studies and allows for a measure of control and replicability which the real world does not. These features may make it possible to break or weaken the elitist-pluralist stalemate through use of simulation in research.

In the spring of 1972, the Political Science Department of Trenton State College offered an introductory urban studies course using the CITY I computer-based urban simulation developed by Envirometrics, Inc. Along with the normal activities in the course, some explorations of power in the simulated community were attempted. These were very tentative in nature but they do indicate at an elementary level some ways in which community power can be studied using simulated rather than real communities.

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[1]See, for example, Robert Agger, Daniel Goldrich and Bert Swanson, The Rulers and the Ruled (New York: John Wiley and Sons, 1964).

[2]Peter Bachrach and Morton Baratz, "Two Faces of Power," American Political Science Review, 56 (December, 1962), 947-952; Edward Keynes "Elities and Community Power," and David Ricci, "Methodological Disputes in the Study of Power," Political Power, Community and Democracy, ed. Edward Keynes and David Ricci (Chicago: Rand McNally, 1970), pp. 27-61, 155-178.

[3]Ibid.

The roles in the CITY I consist of nine economic teams (A through I) and eight governmental roles: MAYOR, Central City Councilman (CITYCOUN), Suburban Councilman (SUBCOUN), Finance Director (FINANCE), Planning and Zoning Director (PLANNING), Highway Commissioner (HIGHWAYS), Public Works and Safety Director (PUBWORKS) and School Superintendent (SCHOOLS). Each round of the game represents one year of real time and at the end of each round decisions on various matters within the usual purview of the roles are reached by the players. The goals for each role are unspecified, but most economic players seek to make money rather than be philanthropists and the government usually seeks to manage growth in some way. In the eight rounds played in spring, 1972, the CITY grew from a population of 366,300 in Round 1 to 497,200 by Round 8. The net worth of the nine economic teams increased from $8,765,654 to $10,943,870 in the same time period. Thus growth did take place and most of the economic teams did make money.

The bases of power in a simulated community should be roughly the same as those in a real one. These include political resources (money, jobs, votes, popularity, friendships, reputation, status, knowledge, media of communication, etc.), political skills and political incentives.[4] Such things are probably more readily measurable in a simulated community than in a real one, but some of them are not easily measured anywhere. Because of space limitations, two

TABLE I
Net Worth of Teams by Round (in 1,000's)

	TEAM								
Round	A	B	C	D	E	F	G	H	I
1	869	1,084	1,005	944	987	954	946	1,045	933
8	1,179	1,417	1,146	871	1,387	539	1,547	1,534	1,323
Mean	1,035	1,250	1,164	898	1,171	800	1,197	1,276	1,112
Net Gain	310 (36%)	333 (31%)	141 (14%)	-73 (-8%)	400 (40%)	-415 (-44%)	601 (63%)	489 (47%)	390 (42%)

[4]See Robert A. Dahl, Democracy in the United States (2nd ed.; Chicago: Rand McNally, 1972), pp. 31-33.

of the more easily measured will be examined here as possible determinants of power relationships in CITY; these are money and votes. The net worth of the economic teams will be used as a measurement of the former. This is not a perfect measurement because it does not take into account cash on hand (lack of which sometimes causes serious problems for teams) and the ratio of industrial-commercial to residential holdings. Both of these factors, plus others, may be as important at times as net worth. These data are furnished by the computer programs for the game.

TABLE II
Voting Power of Teams by Round
(By Average Turnout in 10's)

	TEAM								
Round	A	B	C	D	E	F	G	H	I
1	644	1,345	1,059	198	681	465	242	916	928
8	868	1,608	1,456	438	1,348	420	396	1,126	1,108
Mean	794	1,418	1,293	319	898	458	293	1,047	998
Net Gain	244 38%	262 20%	396 37%	241 122%	667 98%	-45 -10%	154 54%	210 23%	181 20%

Interpreting these measures of power bases is somewhat difficult. Economically, which team has more power potential, the richest as of Round 1 (Team B)? The richest as of Round 8 (Team G)? The team with the highest absolute growth over the time period (Team G)? The team with the highest growth rate (Team G)? All of these indicators tap dimensions of wealth which may be suggestive of power potential. For the sake of simplicity, however, this paper will use mean net worth of the teams over the eight-round period as the measurement of economic power potential. Similarly, a mean of voter turnout over the period will be used as the measurement of voting power potential. A comparison of the rank orders of teams in terms of economic and voting power potential leads to the conclusion that teams H and B should be the most powerful teams, since they rank high on both measures. Teams E and C also rank fairly high on both measures, and teams G and I rank high on one measure but not on the other. These conclusions are at variance with the perceptions of the game participants, however. At the conclusion of the course, each student was asked to rank each role (economic teams and government roles) in terms of the influence each exerted over the course of events in the game. Using their rankings within the economic sector only and counting only their top three selections, one can obtain a rough picture of participant perceptions of economic power. Table III gives the results. The fairly high ranking of H, B and C are expected, but the reputation of G and A require some exploration.

TABLE III
Economic and Voting Potential of Teams
Compared with Participant Perceptions of Team Power

	Economic	Voting	Participant Ratings
High	H	B	G
	B	C	H
	G	H	B
	E	I	A - tie
	C	E	C - tie
	I	A	E
	A	F	F
	D	D	I
Low	F	G	D

The high ranking of G seems to be based on two factors. One of these is economic. Team G, as was pointed out earlier, had the highest absolute growth in net worth and fastest growth rate, and was the richest team at the end of the game. These facts no doubt influence their ranking. The other factor has to do with the relationship of the economic teams with the government; this fact is also related to A's ranking. Using the students' ranking of all roles, and again counting only the top three choices, one can obtain an approximation of participant perceptions of overall power relationships. This procedure yields a ranking in which six of the top ten roles are governmental roles: MAYOR, PLANNING, G, FINANCE, PUBWORKS, SCHOOLS, CITYCOUN, H, A-C (tie). It is not coincidental, one would assume, that one member of team G served as CITYCOUN throughout the entire game and another as PLANNING for all but the first two rounds. The ranking of A was undoubtedly influenced by the fact that one of its members was MAYOR for all but the first two rounds. One member of H held the office of PUBWORKS from Round 3 on, and team C held a variety of offices: MAYOR and PLANNING in Rounds 1 and 2, SUBCOUN in Rounds 7-8 (team also fielded unsucessful candidates for office on several other occasions). Thus it seems that the relationship of governmental position to economic status is a key to understanding the power perceptions of the participants.

An analysis of the individuals seen as most influential in the game confirms the impression that economic teams are seen as influential in large part because of their occupying key governmental positions. Students were asked to indicate the five most influential participants. A tally of these rankings produced the following results:[5] ANDERSON (three-term MAYOR); BENJAMIN (one-term FINANCE);

[5]Names are fictitious and are coded by team; i.e., all team A people have names starting with that letter; and so on.

DONOVAN (four-term SCHOOLS); GREEN (four-term CITYCOUN); CLARK (one-term MAYOR); CHILDS (one-term SUBCOUN); HEARN (three-term PUB-WORKS): FLANIGAN (no public office); ISAACS (three-term HIGHWAYS); IORIO (three-term FINANCE); EAGEN (no public office); IVERS (one-term PUBWORKS); BARNES (two-term SUBCOUN). No other player received any choices. Thus of the fourteen players who received any choices as the most influential, only two had held no public position during the course of the game, and both of these had run for city council on one occasion. Looking at it another way, only three players who held public office at one time received no choices as being among the most influential participants.

The participants in the game clearly were of the opinion that government officials were among the top leaders in CITY. In their view the Mayor and Planning-Zoning Director were the most powerful leaders. Only those economic teams which also played political roles were seen as among the key leaders in the community. This perception is consistant with the pluralist position. However, other pluralist conclusions are more difficult to test. The proposition of multiple, overlapping, competing elites, for example. This proposition can be tested by the decision-making technique, or by questionnaire items designed to elicit information about it. The decision-making technique turned out to be unfeasible because no clear, discrete, important decisions took place. Decision-making was incremental and not well publicized. No questionnaire items on the existence of multiple elites were included because the original intent had been to use the decision-making technique. Therefore an assessment of this proposition must be postponed. Likewise, the notion of permeability of elites must await detailed discussion. At this time the only evidence which can be brought to bear is this: Exactly half of the individual influentials were not from teams which were consistent members of the dominant political coalition in the game (ABDGH). Thus the elite seems to have been at least somewhat porous.

In sum, the participants' perceptions support some aspects of the pluralist view and neither confirm nor contradict others. It would seem quite possible to test these other matters in a simulated community, however. These initial explorations were undertaken as somewhat of an afterthought to a course which was being offered. Better pre-planning and more comprehensive research techniques should make possible the testing of a variety of hypotheses about community power structures.

NEW INSTRUCTIONAL PLANNING SYSTEMS IN BRITAIN: NOTES ON THE DEVELOPMENT OF URBAN GAMING-SIMULATION PROCEDURES

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The function of these notes is to highlight one or two of the more interesting yet less publicised simulation* developments underway in Britain as a preface to a basic bibliography on this topic. In short it is a personal overview of promising aspects of simulation work in progress.

'INVISIBLE COLLEGE' MODELS

If the writer concentrates on the less well documented or publicised environmental simulation work, then de Sola Price's term 'invisible college' seems an appropriate heading under which to review such activities (see Michael 1968 p.4). This label is used as a way of referring to the intermittent activities of informal small groups whose members consciously or unconsciously hone the cutting edge of new knowledge. Such 'colleges' have played a very important part in the world-wide development of instructional simulation but their mode of operation has militated against the receipt of proper and wider acclaim.

Several forms or types of environmental 'invisibile college' appear to be in existence in the United Kingdom and a selection of these simulation groupings will now be reviewed in turn:

(a) The School System

Environmental simulationists owe much to schools and colleges. Not only have they been quick off the mark in recognising the existence of the technique but they have been in the forefront of much of the innovative and experimental work in progress in Britain. The 'project' tradition has allowed games and simulations to be integrated unself-consciously into the classroom. In this context a low cost-high involvement format has been evolved which puts to shame many of the more commercial or promotional models intended for similar settings yet at a much higher cost in terms of both finance and resources. The invigorating wind of change springing from such endeavours has been felt outside the school and college system and has helped to improve relationships with other educational sectors as well as with the world at large (see for example the extensive work documented by Tansey and Unwin (1969), Taylor and Walford (1972)).

*As space is limited the writer stands by his earlier definitions set down at some length in 'Instructional Planning Systems' (Taylor 1971)

(b) Extramural Grass Roots Involvement

As a direct consequence of the school initiatives, a variety of charitable organizations, pressure groups and community action volunteers have employed the technique in a variety of settings. Liverpool's Educational Priority Area Project produced a game called 'Streets Ahead' to help children face and understand city life. Community Service Volunteers include 'Spring Green Motorway' - a simulation exercise on the advantages and disadvantages of building a motorway - and 'Mental Health' - a simulation involving the introduction of a hostel for mentally subnormal young people into a community - all as part of their 'sack' of teaching materials. 'Oxfam' have two simulations designed to teach young people about developing countries and 'Shelter' has a Tenement Simulation dealing with problems of families living in a multi-occupied house. In themselves, all such efforts appear very modest. Certainly they look very home spun in relation, for example, to the burgeoning products of American Evangelist groups. However, the real point of their significance in this context is their diverse range and comprehensive coverage. As a total effort it is impressive for the writer because of its uninhibited and yet unpretentious use of resources.

(c) Closing the Gap between Teacher and Student in Higher Education

The structure of higher education in Britain, particularly the fragmentation of scarce environmental planning resources has done much to hinder the build-up of strong centres of excellence in terms of teaching, practice and research. As a consequence, smaller institutional units are common and very informal learning relationships tend to predominate. It seems that experiential approaches to many aspects of environmental studies have, in part, benefited from direct contact with 'coffee break' research which often remains unsanctified by large foundation grants and sundry seals of approval. In an era where one man, one dog and a piece of string have been the rule rather than the exception in British planning circles all available hands have been frequently called to man the pumps regardless of status or departmental affiliation. What is being discussed here is a cottage industry approach to fashioning new tools for learning. Excitement and ingenuity have become the order of the day and writing about such initiatives is very much second best to actual involvement (see Bracken 1970 and 1972, Dimitriou 1971 and 1972, Green 1971 and Mackie 1971).

Such projects have an immediacy which defies simple description. Links to higher levels of complexity and other technologies are optional, for example, video tape, film, slides, graphic displays and three-dimensional models can be used if required but the predominant impression is very much of a low-cost and high involvement approach to simulation. Above all at an operational level such games do much to minimize the familiar accounting, administration and book-keeping problems which have bedevilled so many simulation procedures.

(d) Problem Perception, Identification and Mapping

Gaming-simulation as a process for thinking through urban problems still awaits serious development but there are signs that efforts to place the remote or passive subject into more actively involved learning situations is having some impact in a variety of spheres. For example, the work of Wilson (1962), Hoinville (1968, 1971) and Hambleton and Walker (1970) in examining community attitudes and public perception of planning problems has broken new ground in employing simulations as a piece of social technology. A popular by-product of these efforts has been the use of 'priority evaluators' as aids to public participation and as an alternative to the overworked questionnaire. At the research frontier, Manchester University Institute of Science and Technology has been noticeably ambitious in defining experimental approaches to socio-technical problems. In particular Forque (1969), Platt (1969) and Roy (1971) have each in turn examined the position of the public services in the future. Feo (1971) has considered the practical use of simulation as a tool for community action groups. Finally, Warshaw, Levy and Talbot (1971) have evolved and set up an informal testing network for a set of linked games and simulations which permit groups to identify planning problems and possible design solutions. Space does not permit more than a passing reference to the tip of the iceberg, already presented above, but the speculations of writers such as Armstrong and Hobson plus Goodey (1970), all at the University of Birmingham, leads one to be exceptionally hopeful about the potential of simulation when related to what has been termed the art of contextual mapping and long range forecasting.

EXPECTATIONS AND OPPORTUNITIES

If it is considered that certain British gaming-simulation approaches to environmental planning problems have any value or potential then it is possible to speculate about several avenues of development which seem particularly promising in their own localised context. Some of these opportunities are itemized briefly below:

(i) Wider and more varied employment of what is already on the shelf seems likely to be particularly rewarding - the only barrier to progress here seems to be the availability of better directories, operational manuals and introductory learning systems.

(ii) In crossing the credibility threshold and leaving behind a preponderance of half-hearted commitment, the role of radio, television and film seems likely to be of increasing importance. The use of such media in monitoring and analysis is already acknowledged but its value as a primer for '<u>simulating the simulation</u>' is barely explored beyond the superficial Madison Avenue image building.

(iii) From the above, it follows that an improved orientation toward the consumer ought to be developed. However, many still view games and simulations primarily as psychologically satisfying intellectual devices for a select group of academics rather than as instructional tools for an army of players. This self indulgence has to give way if a better match and balance is to be struck between designers' ambitions, the available technology, as well as consumer needs and resources.

(iv) The need for better packaging and distribution outlets seems clear and a move away from the cottage industry production line must be more realistically explored. It may well be that one of the better multi-media packages may still turn out to be a book - but in a format very much in tune with simulation's needs. Commercial exploitation of the technique in Britain is almost non-existent. This point has to be recognised if entrepreneurial initiatives are to be shaped by more than basic market forces. Whatever transpires it is possible to take comfort in the fact that even pale simulations of reality might provide a degree of instructional stimulus in much the same way as a pot egg sets the wayward hen laying!

(v) Finally it is possible to take comfort in such small beginnings if one subscribes to the view that there may be something to be gained from the logical motor progression of crawl- walk and run! Here the concern is not with the need to reinvent the wheel but for more practitioners to be better aware of existing models and experience. Certainly with respect to coming to terms with administrative and accounting problems attached to many simulations the hard won experience of military and business exponents of the technique seems to be very largely ignored.

If these opportunities to improve the performance of instructional planning systems are accepted, it is possible to see games and simulation as very much more powerful tools in the future. Clearly their use in urban studies could be very much extended in identifying how people perceive problems, generate different courses of action and evaluate chain reactions.

CONCLUDING REMARKS

In summary it is possible to be excited by a small number of new 'home spun' simulation approaches to urban problems which are crystallizing very slowly in Britain. But by any standards it must be acknowledged straightaway that this work is obviously embryonic and far from complete. There is a modest degree of enthusiasm and vigour associated with developments in hand but few signs of widespread support or a discriminating and rapidly growing clientele of users. In short, the absence of systematized and rationalized communication and co-operation networks largely defines the current state of the art. On the one hand, a high degree of 'isolationism' has left the individual free to quietly plough his own distinctive furrow whilst on the other hand it has thwarted efforts to foster, disseminate and up-grade the expertise at the fingertips of those at 'the frontier'.

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"U-DIG" GAME, A TOOL FOR URBAN INNOVATION

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This is a study of a study of a process. The environment of the design decision-making process exerts a very strong influence on the form of the city. The more we as designers or we as city dwellers understand this process the better are the possibilities of improving the quality of our urban living. The various "actors" in the process of the development of the environment have been isolated from each other for many reasons such as specialization, the academic division of disciplines, and the complexity involved. The contractor is concerned about completing the building with a good profit margin, the architect is concerned about the building's publishability, the banker is concerned about the building's loan, the building commissioner is concerned about compliance to a set of legal regulations and so on, until finally we reach the occupant who is concerned about adapting the building to his specific needs. This process has slowly evolved into its present form. The slow development and partitioning of the activities of design decision making have resisted and discouraged serious study.

One relatively recent method to study a complex process is through operational gaming. When answers can't be given because the variables are too numerous and inter-dependent, the process may yield understanding through simulation or gaming.

U-DIG Game is a study of the process of the development of city form. It is frankly only an entry and not an exhaustive study. The entry is the attempt to simulate and simplify the financial environment so that it can be a comprehensible component in the game. With this complex but relatively well-definable component designed, the other components can be studied for inclusion in the game. The development of the brute force of the computer has made this type of study more possible.

If such a study can lead to the elimination or lowering of barriers, so that the architect understands the influence of the financial structure on the physical structure, so that the banker understands the relationship of his financial decisions to the quality of living in his community, so that the building speculator sees the long lasting effect of short term decisions and the law-maker understands his role in the inhibiting portions of the building code and the zoning laws - then their attention might turn to innovative ways to attain a higher quality of living for all. I proceed from a naive belief that all the "actors" in the environmental design process would genuinely wish to work to improve the quality of life if they were able to break out of their narrow interest constraining cells by understanding their vital roles in attaining a better life.

The objectives of U-DIG are:

a) Pedagogical - for teaching university students and others about real estate investment and the building process.
b) Research - to investigate better ways of living through manipulation of various factors in the game environment.

The basic design objective in development the U-DIG Game was:

To be simple, directly comprehensible, to still contain significant parallels to the real world and to provide a base of knowledge for further understanding of the process.

Functional objectives were:

a) To have a visual display of the progress of the community upgrading in the course of the game.
b) To keep the accounting procedures as simple as possible in playing the game, using prepared tables (but not to depend on the availability of a computer).
c) To provide opportunities for using strategies similar to those used in real life.
d) To incorporate consideration by the players for the form of new community buildings and for the site.
e) To be a structure or tool for innovative future research.

The game was designed with a six block neighborhood using a Lego base with one Lego block representing two rental units. Red blocks represent all new construction after the start. Zoning has been established to control density and height limitations could be added.

When a blackboard is available, the neighborhood blocks are drawn on it and after each change in property ownership, the title is "recorded" by writing the owner's name on the lot.

In Version One, three to five teams of one to four players play in multiple sessions of three to four hours each. A board illustrating a neighborhood plan is used. When an opportunity to purchase occurs to a team, computer developed investment tables are consulted for aid in the decision to buy. Buying, selling, building and bidding all amy take place in the course of play. Year end pay-offs are made after income tax in a simple bookkeeping procedure. Interest rates and occupancy rates fluctuate. Mortgages are available at the current interest rate. Thus the economic rules are closely patterned after the real world, After an initial period of play, the players become familiar with the dynamics of real estate economics and the basis for decisions that determine the urban form.

In a second version, a news item is distributed that announces the elimination of property lines. Property owners own a proportional share of a block. They can now build dwelling units on top of units owned by others in a common structure that crosses streets within the same density limitations as the first version. Rules are set that establish ground coverage and the relationship on each level above ground. This is one version in which an experiment with a change in one factor in urban form determination is varied to result in a new form. The "quality-of life" merit of which can then be debated. Other rules may easily be changed to study the effects, thus the research possibilities exist.

The value of U-DIG lies in its worth as a tool for understanding existing urban situations (Version One) and as a research device to help develop a better quality of urban life (an example is Version Two). In Version Two, the game sessions indicate some of the problems of planning, phasing and blending a growing mega-structure with an existing urban fabric.

Investments or playing strategies can be devised based on the predicted rates of return given in the tables. Some possible strategies are:

a) Investing with little concern for a rate of return much greater than that possible to receive from the cash in the bank.
b) Investing with great discrimination, that is, waiting for the best rate of return which means waiting for the lowest rate of interest in a year of high occupancy.
c) "Trading Up" or always being alert for opportunities that through the sale of older property one can have the same equity in a much larger project.
d) Hoarding cash in order to be secure at a 5% increase each year.
e) Bidding always below offering price, and building and buying most heavily during years with a low interest rate.

Rigorous testing of strategies has not been done. Such testing would require many runs for a period of time to simulate fifteen or twenty years, about ten to fifteen playing hours. In order to test strategies, the game might be programmed so that one person could play the game on a computer time-sharing console. This would return basically to the simulation program modified for input by one person. It suggests another possible modification of U-DIG; to play with the computer doing the computations during the game. To do so would open up many more options such as, a change in the rent by the owner, bids at any o-er minimum price.

The game can be used in a variety of university classes in various ways:

a) A single playing session: to demonstrate a limited number of ideas such as the effect of the financial environment on the forms of the city, or how a mortgage actually functions.

b) Several playing sessions: to demonstrate and experiment with limited modifications of the variables of the game. Version One might be played with different ranges of rents and gross multipliers and interest rates by changing the variable values in the computer program. Version Two could be modified by adding building requirements to provide for many building patterns, such as a diamond shape building in plan that spans three adjacent blocks.

c) The structure might be presented to a class in architecture in a quarter or semester project. The investigation of existing parameters of play (or of construction in real life) would be the task of the students. With the existing conditions outlined, the student's ideas on "ought to be" or revised conditions, can become the basis for new rules to be tested by incorporating them in a game that is then played. The student's basis of investigation would be in four components outlined in the final section of this paper and the development of 'new rules' would be an opportunity (and obligation) to understand their values in order to express them in drawing up the new set of rules. The debates would center around improvement of the "quality of life" and how to attain it.

d) A variation on (c) is to challenge the class to devise a set of minimal rules that would require agreements by players to decide on their own rules, especially on the arrangements allowable in the Version Two game.

In (c) and (d) the class would investigate ways to evaluate the resulting forms. Among the factors of evaluation would be the amount and quality of natural light that is allowed into the various living areas, the density, the amount of open space for play and interaction, and the relationship of areas and activities. As a learning experience, this would tend to focus the attention of the student on the most relavent factors of architecture that relate to the quality of living. As this is done with stylized blocks to represent the building shape, the student thinking is pushed into the conceptual level of design.

In the above, the teacher's role should be a minimal one, with the responsibility for the decisions that affect the environment being on the game decision-maker's shoulders. The board could be rebuilt allowing street and other city patterns to be redesigned and the game would encourage class interaction and critique.

The structure of U-DIG is meant to be flexible in order to provide for innovative learning and research goals.

As a background for considering further developments, the major components of the U-DIG Game are identified.

First, an economic component is represented in the prepared tables and their understanding and use. This is the financial environment of the growth of the community.

Second, a technological component is embodied in the Lego block and its rules of combination. The Lego block represents two dwelling units and a part of a corridor. It is a structurally complete unit that has been designed to be combined as described by the rules of combination. The plumbing, mechanical and other architectural considerations have been assumed to be resolved.

Third, a legal component is the set of rules that parallel the legal requirement affecting the development of the community. It includes the zoning codes, building codes and property ownership laws.

Fourth, a social component is the most evasive one to simulate. Presently it is represented by the attitudes and agreements between players and underlies the other components. In Version Two, the social interaction is increased by the need to coordinate construction in order to consider the quality of living.

Each of these components might be an area of further development:

The economic component is a relatively well-defined area. The tables can be simply altered to change the range of any one or more of the financial variables. Before playing the game in a specific neighborhood, the existing factors can be inputed to make the tables and hence the game's operation more relavent to that neighborhood. Another use of the game is to investigate the effects of government subsidies in privately owned rental dwelling units by printing tables to reflect the subsidy, such as a lowered mortgage rate and a lowered down payment.

The technical component could reflect innovations in building systems. For instance, a newly designed building unit in a hexagonal form could be modeled and used in the game. Its development within the constraints of the game would be the result of decisions by each of the teams.

The legal component may be altered in order to test its effects on the form of the city. Version Two, the mega-neighborhood, is an example of this. The private property lines concept was modified. Property lines were eliminated thus allowing a new building form to emerge. Height, density, open space are other legal requirements that might be modified in order to view the form resulting from a "run" of the game.

The social component is the most ill-defined element as it represents the total diversity of human experience. This area of experiment might include playing of the game by members of a ghetto so that they might not only learn about some of the factors in community development, but also may better understand those unreachable owners of ghetto property so that they may better communicate with them. Coalitions or ways of cooperating to own and develop their community may be run in the game. Innovative means of ownership might be devised and tested.

Combinations of modifications of two or more of the components may be chosen to be studied in the game.

Another direction of the game may be to add more playing components. An enlargement of the number of blocks to a small town with several neighborhoods of different character, a commercial area, public areas, schools, parks, civic buildings, etc. Politicians, planners, school officials, architects and others involved in decisions that affect the form of the city might be added. In order to simulate the formulation and operation of zoning laws, a limited functioning planning commission and city council might be added.

U-DIG, the study of an urban process, is never ending. The game is a tool to help in the understanding of parts of the urban labyrinth.

RESOURCE ALLOCATION GAMES: A PRIMING GAME FOR A SERIES OF INSTRUCTIONAL GAMES (The POE Game)

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The significance of the Pelham Odd 'R Even game (we call it the POE game for short) is not the subject matter presented in the game, but the variety of subject matters opened up to students when they learn the POE game and others similar to it.

Before saying more about the fields of knowledge dealt with in such games, it should be acknowledged that the word 'Pelham' in the full name of the POE game refers to the Pelham Middle School in Detroit, Michigan, the school in the center of that city where this game was tested, refined, and developed. Pelham is an extraordinary school with really extraordinary leadership starting with its principal, Lewis Jeffries. The chairman of the mathematics department there, Gloria Jackson, and another exceptional mathematics teacher, William Beeman, made especially significant contributions to the development of the POE game, and many other members of the staff have been and continue to be involved in presenting it widely throughout the school.

The POE game deals with allocating resources, and the resources allocated are units of space. Playing the POE game opens the door to an approach to learning that may significantly alter participants' ideas about learning and thinking. Because the POE game is defined by rules that are very similar in structure to rules for other games that teach specific subject matter, after a player has mastered the POE game he or she will be ready to begin learning

... mathematics by playing the game called EQUATIONS,

... word structure by playing the game called ON-WORDS,

... set theory by playing the game called ON-SETS,

... symbolic logic by playing the game called WFF 'N PROOF, and

... language structure by playing the game called ON-SENTS. & NONSENTS.

These five games are like the POE game in that the basic pattern of play is to allocate resources. The resources in these games are symbols, imprinted on cubes or paper, that represent fundamental ideas in the subject field dealt with in the play of each of the games. When the rules defining such games are appropriately structured, the resulting activity can be a powerful instructional interaction. It is possible to organize around such games a learning environment that emphasizes interaction of peers and individualization of educational experiences. Students who vary widely in their skill and understanding of a given subject work together creating problems for each other and solving them by the way that they play the games so that each student has a highly individualized learning experience, appropriate for him at his current level of understanding of the subject. In the learning of mathematics, we call this kind of learning environment a HELM (Heuristic Environment for Learning Mathematics). The effectiveness of such a learning environment has recently been shown in a series of studies by a team at Johns Hopkins.[1] The studies show that a classroom structured as a HELM through the use of games and teams significantly increases achievement in the learning of mathematics, significantly increases interaction among students of different races and different sexes, and results in feelings by students that such classes are significantly more satisfying, less competitive, and less difficult than traditional classes. It is my contention that in such settings, ideas tend to be voraciously pursued. Students have something to do with the ideas that they are engaged in mastering; they don't merely hear them or see them expressed in print.

With these preliminary remarks, which have given some reasons why you should learn the POE game, which have hopefully motivated you to want to learn to play POE, let us turn to the serious matter at hand of learning to play the Pelham Odd 'R Even game. You will need to look elsewhere to learn the similar games that teach such diverse subject matters as mathematics, word structure, set theory, symbolic logic, and language structure.[2]

Permitted Connections

The beginning POE game is played on a 3x3 matrix which is called a network. All the equipment needed to play is a pencil and paper. Two or more persons can play; three-player games are best. After the goal is set, the players take turns writing F's, P's, or R's in the vacant squares until some player challenges or declares a force-out. In deciding whether to challenge, to declare force-out, or to write and what to write, whenever it is your turn, you will need to analyze the number of connections in the network at that time. The following is an example of a connection:

GOAL

Top

	1 P	2	3	
Left	4 P	5	6	Right
	7 P	8	9	

Bottom

The set of three squares, 1, 4, and 7, is a top-bottom permitted connection. This set of squares is a connection because any set of three appropriately-filled touching squares that runs either from the top to the bottom of the network or from the left side to the right side of the network is a connection; and having P's in them, these squares are appropriately filled. It is a top-bottom connection because it runs from the top of the network to the bottom. It is a permitted connection because it has 0 R-squares, and any connection that has 0, 2, or 3 R-squares is a permitted connection.

Required Connections

If R's are added to the network in squares 5 and 6, then a required connection and three additional permitted connections are added to the network.

GOAL

1 P	2	3
4 P	5 R	6 R
7 P	8	9

The three permitted connections added are the left-right connections, 156, 456, and 756. Why are they permitted connections? (Each has 2 R's.) Why are they left-right connections? (They go from the left side to the right side of the network.) The required connection added is 157. It is a required connection because any connection with exactly 1 R-square is a required connection.

F-squares

If an F is added to the network in square 3, are any connections added to the network? The answer is no, because neither permitted connections nor required connections have an F-square in them, and every connection is either a permitted one or a required one.

GOAL

1 P	2	3 F
4 P	5 R	6 R
7 P	8	9

Counted Connections

In determining the number of connections in a network, some connections must be counted while others may or may not be. The relationships between F-squares, R-squares, permitted connections, required connections, and being counted is summarized in Figure 1.

The POE Game

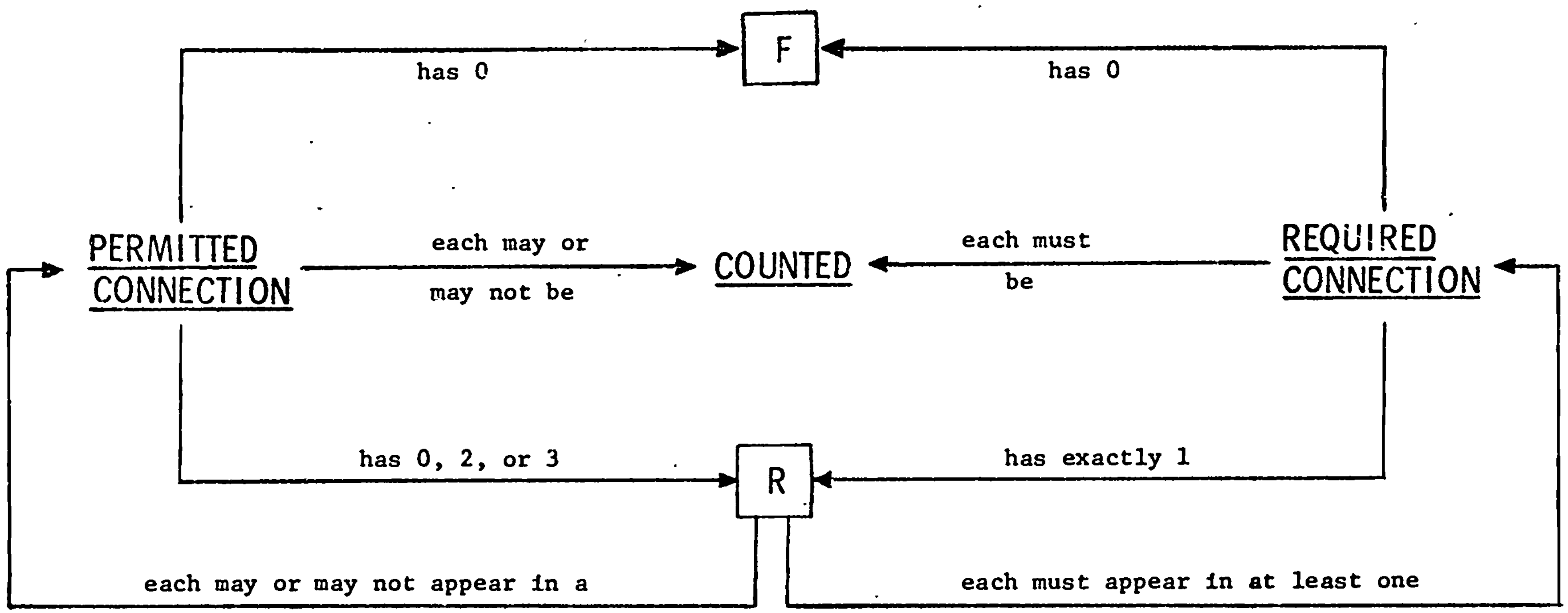


Figure 1

Each permitted connection has 0, 2, or 3 R-squares, 0 F-squares, and may or may not be counted, while each required connection has exactly 1 R-square, 0 F-squares, and must be counted. Hence, each connection consists entirely of R-squares and P-squares.

An important relationship between R-squares and required connections, indicated in Figure 1, has not been mentioned yet. For some set of counted connections of a network to be a solution to the goal that has been set, each R-square in the network must appear in at least one required connection. On the other hand, R-squares may either appear or not appear in permitted connections that are counted; this is up to the solution builder, since he may choose which permitted connections (if any) to count.

Goals and Solutions

The first player sets a goal in the beginning POE game by writing an O or an E on the GOAL line above the network. If he writes an O as the goal, any odd number of counted connections in the network that satisfies the rules of Figure 1 will be a solution; if he writes an E, any even number (except 0) of counted connections in the network that satisfies the rules of Figure 1 will be a solution.

If the goal set in the network we have been considering had been an E, would there be any solutions to the goal after the F was written in square 3.

E
GOAL

1 P	2	3 F
4 P	5 R	6 R
7 P	8	9

The answer is no, because R-square 6 does not appear in a required connection in any set of connections.

Suppose that after the F is written in square 3, a P is written in square 8. Are there any solutions then?

E
GOAL

1 P	2	3 F
4 P	5 R	6 R
7 P	8 P	9

Yes, there are many solutions in this network, 16 to be exact. With the P added to square 8, there are five permitted connections (147, 148, 156, 456, and 756) and four required connections in the network (157, 158, 486, and 786). Any even-numbered set of these nine connections that contains all four of the required connections is a solution. Hence, there is just one 4-connection solution, namely:

S1 157 158 486 786

There are ten 6-connection solutions. Examples:

S2 157 158 486 786 147 148

S3 157 158 486 786 147 156

There are five 8-connection solutions. Examples:

S12 157 158 486 786 147 148 156 456

S13 157 158 486 786 147 148 156 756

To bring out another feature of the number of connections in a network it is worthwhile to consider another example. Suppose that, instead of a P in square 8, a P is written in square 9. Are there any solutions then? How many connections are there?

E
GOAL

1 P	2	3 F
4 P	5 R	6 R
7 P	8	9 P

No, there are not any solutions because R-square 6 still does not appear in any required connection in any set of connections. The tricky part of this network is that it contains five required connections: 157, 159 left-right, 159 top-bottom, 459 and 759. The set of squares, 159, is a double connection, each of which contains only one R and is thus required. There are also four permitted connections (147, 156, 456, and 756), making a total of nine connections in all.

P-flubs

In the following example, after the E-goal has been set the players have taken turns writing F's in squares 2, 5, and 8. Then Player 2 writes an F in square 6. Hereafter the most recent move will be encircled as shown here. After the F is written in square 6, is it still possible to get a solution to an E-goal in this network?

E
GOAL

1	2 F	3
4	5 F	6 (F)
7	8 F	9

The answer is no, because after that move it is impossible to get to an even number of connections. By his move Player 2 has made what is called a P-flub. He has prevented anyone's ever getting to a solution, no matter how the remaining squares are filled in. When anyone writes a letter in the network, he is claiming that it is possible to still get to a solution. But in this case, Player 2's claim is false, and false claims are flubs which can be immediately challenged by any other player. That's one way to win in the POE game -- to correctly challenge a player who flubs. So you need to watch very carefully what other players write in the network, and challenge them if they flub.

Consider another example. The goal set is odd, the first three moves placed an R in square 1 and F's in squares 2 and 4, and the most recent move is an F in square 5.

0
GOAL

1 R	2 F	3
4 F	5 (F)	6
7	8	9

Is this move a flub? (Yes.)

What kind of flub? (A P-flub.)

Why is it a flub? (Because it is impossible to use the R-square 1 in a required connection. No solution is possible unless that is done, and it cannot be done.)

Notice that anybody except the mover can challenge. The mover is the player who has just written a letter in the network. Although players take turns moving, you do not have to wait until it is your turn in order to challenge. You can make a challenge at any time other than when you have just moved. A challenge is always directed to the most recent mover. It is a declaration that he has flubbed.

Burden of Proof

Once a challenge is made, somebody is going to have the burden of proving that it is possible to get to a solution. In general, the burden of proving that it is possible to get to a solution will be upon the player who is claiming that it is possible to do so. In this situation, where the challenger has declared that the mover made a P-flub, who is claiming that it is still possible to get to a solution -- the challenger or the mover? The mover is the one who is claiming it, so he is the one who has the burden of proof.

Will the mover be able to show that it is still possible to get to a solution? No, he will not; so the challenger will win and the mover will lose.

To sustain his burden of proof a player must write out as many 3-digit numbers as necessary to indicate the connections of the network that he is counting in the set that he is offering as a solution.

Joining

In a three-player game once there is a challenge and the challenger says what kind of flub the mover has made, the third player must join with either the mover or the challenger -- whichever one he thinks is right. Consider the following example. After the odd goal has been set and F's have been written in squares 3, 5, 7, and 8, Player 3 writes an F in square 6.

0
GOAL

1	2	3 F
4	5 F	6 (F)
7 F	8 F	9

Is this move a flub? (Yes.)

What kind of flub? (A P-flub.)

Why is it a flub? (It is impossible to get an odd number of connections after this move; it is impossible to get any connections.)

Who has the burden of proof? (The mover.)

Will he be able to sustain his burden of proof by showing that it is still possible to get to a solution with an odd number of connections? (No.)

If the third player -- we call him the joiner -- joins with the player who has the burden of proof, then the joiner also has the burden of proof. Otherwise, he does not. Suppose in this situation the joiner joins with the mover. Will the joiner have the burden of proof? (Yes.)

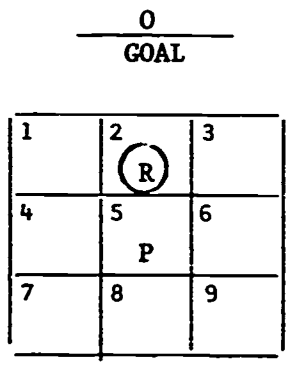
Whom should the joiner join? (The challenger.)

Why? (If he joins the mover, the joiner will have the burden of proof, and he will be unable to sustain it.)

So, in this situation, if the joiner joins the mover, they both lose and the challenger wins; if the joiner joins the challenger, they both win and the mover loses.

A-flubs

The kind of flub that the challenger says that the mover has made will determine who has the burden of proof and what he must prove. We have seen that for P-flubs the burden is cast on the mover. In the second of the three kinds of flubs -- namely, A-flubs -- the burden of proof is cast upon the challenger. The following example indicates why the challenger has the burden of proof for A-flubs and what he must prove. Suppose that after the goal of O is set and a P is written in square 5, Player 3 writes an R in square 2. What do you notice about this situation?



What should be noticed is that you can get to a solution with one more move. You can get to one connection -- an odd number -- that satisfies all the rules of Figure 1 by writing a P in square 7, square 8, or square 9.

Could the player who wrote the R in square 2 have avoided all such situations in which you could get to a solution in one more move? Did he have a move that would not have allowed such a solution? (Yes, he had many such moves. He could have written an F in square 1, or square 2, or square 3, for example.)

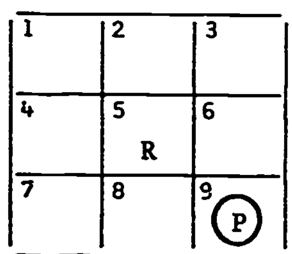
If by his move a player allows a solution in one more move when he could have avoided doing so without making a P-flub, we say that he has made an A-flub. He has unnecessarily allowed a solution by his move.

When the kind of flub declared is an A-flub, it is the challenger who is claiming that a solution can be built with one more move, so it is the challenger who has the burden of proof. He is also claiming that the mover was not forced into allowing such a solution; in other words, that the mover could have made a different move that would not have allowed such a solution and that would not have been a P-flub. Hence the challenger has two parts to his burden of proof on an A-flub challenge: (1) he must show that there is a solution with one more move, and (2) he must show that the mover had an alternative move that would not have allowed such a solution and would not have been a P-flub.

Consider another example. After the goal of E is set and an R written in square 5, a P is written in square 9.

E

GOAL



Is this move a flub? (Yes.)

What kind of flub? (An A-flub.)

Why is this an A-flub? (It is an A-flub because you can get to a solution with one more move -- a P in square 1.)

Is that alone enough to make the move an A-flub? (No.)

What else must also be so for the move to be an A-flub? (The mover must have had an alternative move that would not have allowed a solution with one more move and would not have been a P-flub.)

Who has the burden of proof on this A-flub challenge? (The challenger.)

If you were the third player, whom would you join? (You should join the challenger so that you, too, would have the burden of proof.)

Can you sustain your burden of proof? Consider the first part of it; is there a solution with one more move? (Yes, by writing a P in square 1, you can get to the solution consisting of the pair of connections 159 and 159. So to sustain the first part of your burden of proof, you could simply write: P1, 159, 159.)

Now consider the second part. Could the player who wrote the P in square 9 have made another move that would not have allowed a solution with one more move and would not have been a P-flub? (Yes, he could, for example, have written an F in square 9. So to sustain both parts of your burden of proof you could simply write: P1, 159, 159, F9.)

C-flubs

The third and final kind of flub is the C-flub. This kind of flub occurs whenever a mover writes a letter in a vacant square and in doing so fails to challenge when he could have done so correctly because the previous mover had flubbed. Thus a C-flub will always stem from a previous flub. If it stems from a prior A-flub, it is called a CA-flub; if it stems from a prior P-flub, it is called a CP-flub. The burden of proof for CA-flubs is on the challenger; for CP-flubs, on the mover. The following is an example of a CA-flub. After the goal of O is set and an R is written in square 4 and a P in square 5, Player 1 writes an R in square 3.

O
GOAL

1	2	3 (R)
4 R	5 P	6
7	8	9

Player 1 has made a CA-flub because he could have challenged the previous mover for making an A-flub and sustained the burden of proof. After the prior move, a P in square 3 would have allowed the solution consisting of the single required connection, 453. The prior mover could have avoided this by writing an F in square 1.

The following is an example of a CP-flub. After the goal of E is set and R's have been written in squares 1, 2, and 5 and an F in square 4, Player 3 writes a P in square 9. His move is a CP-flub.

E
GOAL

1 R	2 R	3
4 F	5 R	6
7	8	9 (P)

The reason that writing the P in square 9 is a CP-flub is that the prior move was a P-flub. The prior move made getting to a solution impossible because after that move the R-square 1 cannot appear in a required connection. Player 3 should have challenged the P-flub instead of writing a P in square 9. The prior mover would have been unable to sustain his burden of proof.

Force-Outs

If a player does not wish to challenge or to write a number, his third option is to declare a force-out. Declaring a force-out has the effect of casting the burden of proof upon every player to show independently that there is a solution with one more letter written into the network. The player who declares a force-out should be certain that he can write a solution by writing in one more letter, because he will suffer in the scoring if he cannot. The following situation is one that should lead to a force-out.

O

GOAL

1 R	2	3
4 F	5 F	6 F
7 F	8 F	9 F

After the O goal has been set, an R written in square 1, and F's written in squares 4, 5, 6, 7, 8, and 9, it is Player 3's turn. He should write a P in square 2 or in square 3. If he writes anything else, he will make a P-flub. If he challenges, depending upon the kind of challenge made, either (a) he will have the burden of proof and be unable to sustain it or (b) the prior mover will have the burden of proof and it will be sustainable. If he declares a force-out, he will be unable to sustain the burden of proof. So, to avoid these consequences, he should write a P. Suppose he writes it in square 2. Then, the next player (Player 1) should declare a force-out. Each of the players will then have the burden of proof, and they will each be able to sustain it by writing: P3, 123.

Scoring

A player scores 2 points if he is a challenger, a mover, or a joiner to the mover and

a) he has the burden of proof and sustains it, or

b) he does not have the burden of proof and none of those who have it sustain it.

A player scores 1 point if

a) he is a joiner to the challenger and

1) he has the burden of proof and sustains it, or

2) he does not have the burden of proof and none of those who have it sustain it, or

b) a force-out has been declared and he sustains his burden of proof.

A player scores 0 points if he has not declared force-out and

a) he has the burden of proof and fails to sustain it, or

b) he does not have the burden of proof and some player who has it sustains it.

A player scores -1 points if he declares a force-out and is unable to sustain his burden of proof.

The winning player is either the high scorer (when play is for a specified period of time) or the first to reach the winning score (when play is to a specified winning score).

Tough POE

After the players have mastered the beginning POE game in which only goals of O or E are set, they can move on to an advanced version called Tough POE. In this version additional goals may be set.

One option is to set a goal consisting of a capital letter A followed by a number. For example, the goal of A6 will designate a goal which means "at least 6", and any set of at least 6 connections that includes all of the required connections of the network will be a solution to A6.

A second option is to set a goal consisting of a capital letter E followed by a number. For example, the goal of E8 will designate a goal which means "exactly 8", and any set of exactly 8 connections that includes all of the required connections of the network will be a solution to E8.

In the following situation after the goal of E5 has been set, R's have been written in squares 1 and 3, F's in squares 4 and 8, and a P in square 7, the writing of a P in square 9 is a P-flub.

E5

1 R	2	3 R
4 F	5	6
7 P	8 F	9 (P)

Do you see why?

Big Tough POE

For those who want to make the game even more challenging, there is a still more advanced version called Big Tough POE. It is played on a 4x4 network with the appropriate change in definition of a connection as a set of four touching squares appropriately filled which connect the top to the bottom or the right side to the left side. Long before players get this far along into the complex versions of the POE game, they should also have started into the subject matter games that are similar to the POE game -- the game of ON-WORDS (to learn word structure), EQUATIONS (to learn mathematics), ON-SETS (to learn set theory), WFF 'N PROOF (to learn symbolic logic), and ON-SENTS. & NONSENTS. (to learn language structure).

Conclusion

In conclusion, let me recommend that those educators who believe that the uses of language, logic, and mathematics are fundamental intellectual skills, and who are interested in creating heuristic learning environments in which students discover a great deal for themselves, consider introducing the POE game into the culture of their classrooms. It is a simple game but extremely rich in potentialities for leading to the development of such fundamental intellectual skills.

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QUID-PRO-QUO
AN EXPLORATION INTO VALUE AND NEEDS IN PLANNING

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The purpose for designing Quid-Pro-Quo was to illustrate, in a gaming environment, the role of needs and values of the participants in health delivery planning programs. Many practicing planners, as well as the literature on planning, recognize the need of a program initiator to encourage the participation of representatives from those organizations and interest groups which eventually will be involved in planning, development, implementation, and the continued operation of programs. Every person who participates does so for potentially different reasons. These reasons might be personal, institutional or a mixture of both. In fact, in this game, we assume that each person responds to eight needs, one or two of which may be more potent than another at any given moment. The concepts of needs are abstracted and displayed as a basic means for facilitating communication between players.

The display of needs is done with a "needs rip-off" badge worn by each player. There are three parts for the badge: 1) an identification of the player and his role; 2) a display of the players' dominant "needs" pattern, color coded and in descending order of need potency; 3) a "rip-off" velcro need display strip on which the player places a colored velcro patch signaling the need(s) to be fulfilled in a transaction with whoever arrives next.

When one player (called A) wishes the cooperation in a coalition, information, or other forms of support from a second player (B), A "decodes" B's displayed "need" and offers B units of "need fulfillment" (eg., money like units). If the "need" is correctly interpreted, B will cooperate. This is important; if A correctly interprets B's "need" and can offer the units required

(If A has not depleted his limited resources) then B will cooperate.

Eliciting cooperation through "need" satisfaction is a basic component of Quid-Pro-Quo. Other structural elements are: a hierarchy of roles in each of four sectors involved in health delivery -- the politician, the public, the payor, and the providers; a demographic structure of a ten sector region with health care facilities (which are limited and need to be improved and expanded in the game); and, rules for forming projects to improve health delivery or oppose projects. Conceptually, the background scenario (demographic structure) could be computerized as a simulation and participants could experiment with the model providing exogenous inputs and studying the outcomes.

The roles of each participant are relatively open to interpretation and few, if any, limitations are placed on the type of individual or cooperative projects a player can initiate or participate in as a cooperative effort.

The secondary purpose of the game is to illustrate the different involvements of organizations in providing comprehensive health care delivery as activity shifts from initial recognition of a health delivery need, through planning, through implementation and into operational on-going activity. Though the game emphasizes the interpersonal aspects of planning and development, a substantial amount of information about health care planning is introduced.

Needs and values play a part in every game. In the large group games, such as CLUG, CITY (I, II, etc.), APEX, in which a player is assigned a role of responsibility (industrialist, mayor, city planner) that player will often display a set of values during the game corresponding to their "stereotyped" image of that role. It has been observed that in long games, it may be difficult for the player to hold to that stereotyped image and will substitute his (or her) own values. The player might interpret this "translation" of values as a greater understanding of the role played (greater tolerance for that position of responsibility). The pattern of values shift moves from a near paranoid concern for the competitive position of others to a realization that someone else has a similar problem, often resulting in a joint effort or the formation of coalitions against a common foe.

Individuals' values do influence how they play games. Because of the active participation required in many large games which do not overly restrict normal behavioral patterns, the real values of the participants often become apparent. Aggressive people move about more rapidly, some people slip off to the side and take passive roles waiting for others to approach them. Games which confront each individual or group with their patterns of behavior in planning are potent education devices.

The change in behavior sought in Quid-Pro-Quo is an internalized and overt recognition that:

(1) Every participant in a joint venture is there for potentially different reasons -- different needs are fulfilled.

(2) Planning in complex environments (eg., health delivery) requires an investment in relations which can be used to satisfy second party and third party need fulfillment in eliciting cooperative efforts.

(3) Coalitions are effective means for the mutual satisfying of needs for several participants in a common project.

(4) Economic, political, social, and technical trade-offs in complex social systems can be studied without having to suffer the consequence of a bad experiment.

TEACHING INTERNATIONAL EDUCATION THROUGH GAMING AND SIMULATION

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Gaming and simulation have found wide use in a number of areas, including the teaching of political strategies, diplomatic negotiations, school administration, and educational organization. However, relatively little has been done with simulation or gaming along cross-disciplinary lines to bring about a closer relationship between areas.

The writer teaches a graduate level course in international education which includes considerable material concerning international policies and theories in the field of educational institution-building and development. As part of the course, also, problems are considered regarding binational and multi-national negotiations prerequisite to the organization of educational assistance programs and in the subsequent educational development work.

Initially, when the course was inaugurated, it consisted of a series of lectures, interspersed with seminar reports and discussions. Although this approach proved to be adequate enough to present certain requisite ideas and concepts, several years experience indicated that much of what the students learned was grasped only in an academic and theoretical way. As James S. Coleman has said regarding the transmission of information in many schools:

> It is a process which . . . leaves out the most crucial step in learning: the necessary and almost sufficient condition of developing strong affect toward goals that require the content the school teaches--that is, the learning to act toward these goals.[1]

Moreover, it became clear to the instructor that the teaching methodology itself needed to be changed, to be made more interesting and challenging, if the course was not to remain "just another graduate course." The writer explored a number of different teaching techniques

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[1] James S. Coleman, Academic Games and Learning (Princeton, New Jersey: Educational Testing Service, 1967), pp. 269-70.

that appeared to have potential for use in his course. Considered and discarded for various reasons were approaches involving audio-tutorial and multi-media techniques, panels, individualization, reading reports, mechanical teaching devises, and the like. The one finally selected was the so-called "case study" approach, in which specific international cases in educational development were selected for study and analysis. This approach was utilized in addition to the previously mentioned seminar lectures, reports, and discussion, rather than in lieu of them, for the writer feels that each best serves a particular purpose and performs its own specific teaching function.

Several years experience using the case study technique in the course indicated a generally positive response, at least as far as the instructor could evaluate the situation subjectively and through the use of a structured questionaire. Even so, though, he felt that much of the work which the students were doing still remained semi-passive in nature: Students were participating, but at a vicarious and ex post facto level. They were undoubtedly gaining important and needed understandings from a study of the success and failure of educational programs at the international level, but rather as spectators in the sidelines. It is one thing, the writer reasoned, to watch a football game being played and quite another thing to be out in the field playing it. The intensity of each student's involvement in the study process would be much greater and the process would be much more meaningful for him, if some way could be found to make the students participants, rather than mere spectators and "arm-chair" analysts. However, field experiences in actual policy decision-making were wholly impossible and--given the level of competence of most beginning students--also very unwise, even if it were possible. Gaming and simulation were therefore selected as the nearest, most realistic, viable alternatives.

A number of topics are covered in the writer's course in international education. Of these, the general area of development assistance in education was selected as being the most appropriate in which to apply gaming and simulation techniques. A series of "Background Notes" was developed for a hypothetical country located somewhere in northwest Africa, called "Coast Land." The information contained in these "Notes" is quite similar to those developed by the U.S. Department of State as basic briefing materials for the use of its--and other Governmental--personnel prior to departure for a specific foreign state. Included first is a description of the physical features of the country, its climate, terrain, vegetation, etc. A section on the history of the country comes next, followed by demographic and ethnographic information about the inhabitants, their ethnic composition, literacy level, language, educational system, religions, social customs, and culture. In this connection, several hypothetical tensions and conflicts within the society also are presented. After this, comes a section on the internal politics of the country (i.e., the type of government, its structure, power figures, present policies, stated long-range objectives, and potential stability) as well as facts about its foreign relations. Finally, information is given regarding the economy of the country, its exports, imports, products, minerals, and other resources (present and potential). The problem thus becomes truly an interdisciplinary one and the students are forced to view it in this perspective.

The students need to have (as many of them do already when they enroll in the course), or rapidly acquire, at least a certain minimum knowledge about other disciplines and their general implications for education and educational development work. It should also be that the use of the exercises does not have as its purpose the transmission per se of factual knowledge and information. Rather, simulation and gaming are considered as concomitants to such transmission.

Once the preliminary details about Coast Land have been given, the students are presented several exercises in the class sessions that follow. Four of these are described here. The first involves the broad range of educational development objectives for Coast Land. The setting is a Planning Conference of officials of the donor country and is so structured as to be non-competitive. The second, an outgrowth of the first, requires the application of these objectives over an opposing plan submitted by officials of Coast Land. It thus entails negotiations and is competitive. The third again consists of a Planning Conference requiring the development of a plan for the expansion of higher education in Coast Land; and the fourth is a follow-up to the third and again involves negotiations over two opposing plans. It is competitive. Of course, the second and fourth exercises are based upon the presupposition that there will be a conflict between the respective plans.

Each of these exercises will now be briefly discussed. The first is called "The Planning Conference." This conference takes place at the headquarters of the International Aiding Agency, abbreviated as I.A.A., a hypothetical organization of Donor Country. A request has arrived from Coast Land for aid--rather imprecise and nebulous in nature--to develop its educational system. The request is solely for educational development and is not part of any larger development packet. The conferees must now decide what action to take on the request.

The rules of the exercise specify that they cannot completely refuse to give Coast Land aid. The only option available to them is the making of broad policy decisions as to what types of aid, and the amount within a set limit, that I.A.A. will be prepared to grant. The rules also provide that any decisions that are made must be consistent with Coast Land's potentials for economic development and seek to aid it. In other words, any proposals for the education of her people and the training of her manpower must conform to the needs of the country.

The number of students that can participate is flexible and is usually decided on an ad hoc basis according to the number enrolled in the course. Most often in the simulation are included student-conferees representing the following officials: the Regional Director of I.A.A.; two desk officers from Donor Country's foreign office, one concerned with political affairs in Coast Land, the other with economic; the Ambassador to Coast Land; a regional education officer of I.A.A.; perhaps even a military attache accredited to Coast Land; and maybe other officials. The conferees then develop a set of specific recommendations for giving assistance to Coast Land in its educational development. In order to arrive at these recommendations, the students are required to assess the educational and economic needs of the country and then to determine priorities. The competitive factor does not enter into all this, so there are no "winners." Indeed, the decisions reached by the conferees are based on a consideration of the various factors appearing in the "Background Notes," mostly those of a social, political, and economic nature. Hence subjectivity enters into the decisions to a great extent. There cannot, perhaps, even be any right or wrong solutions in the absolute sense, but rather poor ones and better ones.

The instructor feels, though, that some feedback regarding the consequences of the student-conferees' decisions is absolutely essential, if the participants are to gain the maximum insight and understandings from their experience. As Dale Garvey has written:

> [It is] an essential part of the simulation technique that the teacher use periods subsequent to each simulation as a time in which to compare the simulation activities with appropriate theory, and to indicate to the students how and when actions violated theory or failed to indicate good judgement or the application of all known information to the solution of a problem.[2]

For this reason, the instructor includes a follow-up to the activities. He assumes the role of the Director of I.A.A., and the conferees must then meet with him, to discuss and defend their decisions. During the course of the discussion, he explores the possible consequences of each recommendation they have made, and inquires as to its rationale. In addition, potential alternatives that could have been selected are discussed; and the students are asked to provide their rationale for discarding each one--if they indeed had considered it in the first place.

The second, a gaming exercise, is called "Negotiations." In it, a team from I.A.A. meets with officials of Coast Land in an attempt to negotiate the aid grant. Again, any reasonable number can play the game. In fact, some of the best "Negotiating" games have been with only two individuals, one of whom is an official from Donor Country, the other of Coast Land, meeting informally over tea to work out their basic differences.

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[2] Dale M. Garvey, "Simulation, Role-Playing, and Sociodrama in the Social Studies." Emporia State Research Studies, XVI, no. 2 (1967), pp. 11-13.

However, when larger numbers play it, there is represented on the side of Donor Country at least an I.A.A. Regional Director, an assistant in charge of educational development programs for the area, a fiscal officer, and one or two appropriate individuals (cultural or economic officers) from the in-country diplomatic staff. Coast Land is usually represented by its Minister of Education and assistants (officials respectively in charge of higher, secondary, primary, and vocational education), and an economist from the National Bank. The latter group in this case has been assigned the task of attempting to win approval for an educational development program which differs greatly from that which the donor country is about to propose. Each part of each country's proposed program is given a certain number of credit points. Each side's object is to score the greatest number of points within certain limitations, for too many points scored by one side or the other break up the negotiations and Coast Land goes to Donor Country's enemies for aid. In other words, each side attempts to secure as large a part of its program as it can without destroying the negotiations. A compromise on any issue counts half for each country.

Irrespective as to whether or not the negotiations are concluded successfully, a post-mortem evaluation is held. If the negotiations have been successful, the instructor evaluates the actions of each team both in terms of strategic victories scored as well as in the ways by which perhaps the team might have increased its overall point total. Compromises are evaluated with respect to their feasibility, compatability to the rest of the program, and necessity. In cases where the negotiations have failed the reasons for the failure are analyzed and alternative lines of attack are explored that might have brought a successful conclusion to the negotiations.

In a similar way, the students develop concepts and understandings relating to international aid and educational institution-building. The Ministry of Education of Coast Land requests Donor Country's assistance in expanding Coast Land College. Again, I.A.A. student-officials hold a conference and decide upon a plan to improve C.L.C.'s program. This plan likewise is evaluated afterward by the Director of I.A.A. (the course instructor).

However, another group of students are given a rival plan by the instructor, which supposedly the Rector of C.L.C. and the faculty have developed for their school in keeping with their own needs. (In reality, the plan serves as a means to safeguard certain vested interests which they feel might otherwise be threatened.) C.L.C.'s plan is given strong support by Coast Land's Minister of Education, a C.L.C. alumnus, although by any objective analysis, it meets none of the nation's present or projected manpower needs. Again, negotiations must take place which are evaluated similarly to those previously described.

Thus, in teaching his course in international education, the writer finds simulation and gaming a very useful technique in helping his students to develop skills and insights which might be useful to them in international work.

SOPHISTICATION INDUCED COOPERATION
IN AN OLIGOPOLY GAME

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Studies of behavior in situations involving both conflict and cooperation have evolved in several disciplines. In experimental games of the Prisoner's Dilemma variety, competitive behavior predominates and the inducement of cooperative behavior is difficult. Similar behavior is observed in more complex games. This paper reports the results of attempting to produce cooperative behavior in a simple oligopoly game by varying the level of sophistication of the subjects.

In economics, oligopoly is a market structure that reflects aspects of both conflict and cooperation. The number of sellers in an oligopoly is few enough that the actions of one affect the outcomes of others. This interdependence is indirect and occurs only through the partially controllable behavior of buyers. The sellers themselves are business organizations, usually large, within which behavior is essentially coordinative in determining market decisions on prices, products, and promotion.

Oligopolists compete with each other for a share of market profits. The total size of market profits in turn depends on the decisions made by all competitors. Maximization of total market profits requires joint action (illegal collusion) as if all sellers were a single seller. Competitive decisions to increase one seller's share operate to reduce the total profits to be shared. Oligopolists could compete themselves out of business. Somehow, oligopolists survive and oligopoly has become the dominant market structure in the United States. Oligopolists, it appears, live in a vague "middle ground" between the cooperative extreme of illegal collusion and the conflict extreme of self-destructive cutthroat competition. This middle ground is not well understood.

Description of the Oligopoly Game

The gaming simulation used for the experiment reported here was a three-person bidding game. Each player bid against two others in his industry for simulated automobile repair jobs that varied in size. At each bidding opportunity, a new job was drawn at random from a source containing twice as many jobs as needed for a run of the game. Each job was different and was specified by a required number of labor hours, a wholesale cost of parts, and a retail price for the parts.

Each player operated a repair garage which had given capacity and overhead. He paid a set amount for each labor hour used. Players were told their industry had been charging customers about double the set amount per labor hour plus the retail price of the parts. This was called the standard bid. Players were instructed to maximize profits, which meant to maximize the end of game difference (gross margin) between costs and amounts bid for all jobs won.

A run of the game consisted of fifty bidding opportunities, simulating two six-day weeks of garage operations. Runs were conducted over five classrooms days. Players sat in industry groups and revealed bids to each other simultaneously. They were told collusion was forbidden.

Results of Early Runs

Five runs of the oligopoly game had been conducted prior to the run described in this paper. These past runs are summarized in Table 1.

Table 1

Summary of Early Runs of the Oligopoly Game

Run No.	Subjects	No. of Industries	Possible Industry Gross Margin if at Standard Bids	Average Industry Gross Margin Actually Achieved
1	Businessmen	3	$3,668	$2,185
2	Students	9	3,635	2,312
3	Students	5	3,174	1,663
4	Students	9	4,052	2,577
5	Students	6	3,646	1,750

The results in Table 1 represent the behavior of more than 96 players. (Due to player substitutions, some simulated garages were operated by different persons during a run.) At standard bids, a firm, given the random sequence of job opportunities for its particular run, might expect one-third of the standard-bid gross margins in Table 1. Thus, expectations for firms ranged between $1,058 and $1,350, depending on the run. Of the 96 simulated repair firms, only 14 earned gross margins of $1,000 or more. Of these, the highest was $1,738, the next highest $1,209, and the remaining two less than $1,200. Average gross margins ranged between $585 and $859, far below standard-bid expectations.

The best peforming industry, in terms of joint gross margin, bid an average of 121% of standard, yet its gross margin was only $3,125 (split $1,165, $1,128, $832) compared to the $4,052 possible at standard bids. The failure by these subjects to reach standard gross margin levels despite high bidding is explained by uneven patterns of bidding and by high bids that did not win jobs. This industry achieved its results by covert cooperation. A bidding policy written after the game by one of the subjects in this industry stated in part, "During the first few days firms bids low enough to get the job. This resulted in cutthroat bidding in which I participated. Between the time of my first and second encounter with the game, I realized that no one was going to make any money. I decided the only way to raise the bidding without utilizing explicit collusion would be to submit outlandishly high bids in order to induce the other firms to do likewise. I did this when I had a backlog of several days of work, accompanying my bids with comments that the object of the game was to see who could make the most money. This policy continued until its objective had been reached. Remaining play was characterized by high bidding, at least well above cost accompanied by sporadic outlandishly high bids to see how high the industry would raise prices."

Only three other industries, of the total of 32, bid high enough to average more than standard bids. The average bidding level over all industries was 94% of standard and the total gross margin for all five runs was only 58% of what it would have been at standard bids. Clearly, conflict was dominating cooperation. Tacit collusion was either not attempted or not working.

A Run With Sophisticated Subjects

A sixth run was obtained with nine "sophisticated" subjects. These persons ranged from university instructors to full professors. All had or were obtaining doctorates in economics or business administration. All had previous research experience or interest in studying economic decisions by gaming methods. All were knowledgeable in market theory and the illegality of overt collusion.

These subjects immediately recognized that tacit collusion of some legal variety was necessary for oligopolists to survive in the "middle ground." By the end of the run, two of these three industries were able to earn gross margins in excess of the $3,867 that an industry in this run would have earned at standard bids. Of particular interest is the variation in strategies and consequences among these industries:

Industry 1. Industry 1 played the game "straight," that is, its players attempted to increase joint payoffs by tacit collusion within the described rules of the game. Industry 1 almost doubled the standard gross margin; it earned $6,408 (split $2,039, $1,701, $2,668). The three Industry 1 subjects bid on the average almost three times standard bids. Player 2's bids averaged higher than the others, yet he earned the least gross margin.

Bid-by-bid protocols (written statements of what each player thought he was doing as he made each bid) revealed that these three subjects clearly understood their mutual desires but seemed unable to agree on what profit level should be maintained. The statements also revealed serious errors in individual concepts of the positions and immediate intentions of others. Some of these misunderstandings engendered suspicions about the motives of others. Only late in the run did tacit collusion appear to be working.

Industry 2. Industry 2 suffered an immediate descent to cutthroat levels. This was due partly to an early arithmetic error by Player 2. During a weekend, halfway through the run, this player organized an explicit collusion. To conceal the presence of agreement, the scheme was keyed to the random draws of jobs. Also, a $10 cash side penalty for defection was discussed. This arrangement made a cartel of Industry 2. Specific jobs were assigned to individual players, but there was no assurance which jobs would be drawn from the random source. The scheme allocated one-third of the expected remaining hours of work to each firm. Formula bidding was established and a rule for increasing the parameters of the formula was agreed on. Bids and profits for Industry 2 then began to increase. However, this industry achieved a gross margin of only $2,636 (split $652, $975, $1,009), which was 68% of standard and was less than the highest industry in the previous five runs.

Under the collusion agreement, Player 3 had to go seven bids without winning. He reported his motive to defect was strong but he remembered the $10 defection penalty. (He had gone 11 bids without winning in the first half of the game.) Also, the protocols revealed some misunderstanding about the formula. Players used different bases for the formulas and not understanding their competitor's bids, they tried to discover the rules others were using. Apparently they had forgotten parts of their agreement, which was complex. The bid-by-bid protocols showed bid calculations but did not "confess" the collusion outright. The game administrator learned of the collusion only after the run when Player 3 confessed.

Industry 3. Player 2 immediately bid $1 million, then $1 million again on the next two job opportunities. On the fourth bid, collusion by secret agreement was established at the $1 billion level. The two players who were to lose at a turn were to bid a token amount over $1 billion. Player 1 double-crossed on the fifth bid, winning by $1 under $1 billion, then bid zero on the next opportunity intending to ruin the others. On the sixth bid, Player 1 wrote on his protocol, "having seen their faces, I go back to agreement." On the 11th bid, all having made a fortune, they all bid $1 intending to retire. The rules required rebids for ties. After seven rebids, all at $1, Player 3 bid $1.01 "to check the uninteresting system." Their original agreement had failed to collude on a way to retire. The other two flipped a coin for a final $1 billion, then Players 2 and 3 resumed normal bidding while Player 1 incremented his bids $1 billion per bid to a high of $12 billion before giving up hope of inducing collusion again. The remaining play mirrored, but more successfully, the informal collusion of Industry 1. Industry 3 was obviously the highest performing industry of all six runs, an accomplishment achieved by a strong leader followed by explicit collusion. However, this collusion was immediately plagued by reneging and inability to achieve continuity of motivation.

Discussion

Compared to previous runs, sophisticated subjects did indeed produce cooperative behavior. However, their very sophistication yielded individual and industry behavior dramatically varied from each other and from prior runs.

All runs were conducted in rooms where isolation of industries was not possible. Some interindustry visibility and competition was observed. The effect of interindustry competition as a determinant of intraindustry behavior was perhaps more significant in the run with sophisticated subjects due both to the seating arrangement (around a conference table) and to the professional interests of the subjects.

Conclusions and Implications

In runs with unsophisticated subjects, conflict behavior had predominated over cooperative behavior resulting in lower joint profits. Switching to sophisticated subjects induced cooperative behavior, yet this behavior was highly varied and was difficult for the subjects to achieve and maintain.

Conclusions suggested by these results are that collusion becomes more feasible the more knowledgeable the competitors, yet successful collusion requires more than mere motivation and intention by the parties -- it requires a well-understood method.

Given the illegality of collusion in oligopolistic markets, the implication of these gaming results for public policy is that law enforcement is aided by the difficulties competitors have in achieving and maintaining collusive agreements.

THE SIMULATION OF RATIONAL EXCHANGE: AN EXTENSION OF SCHILD'S MODEL

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Introduction

Two major reasons may account for the current popularity of exchange theory among sociologists: 1) its high explanatory power in the realm of social dynamics; and 2) its amenability to operationalization and testing. Predictably, as the usefulness of exchange-theoretical propositions in explaining interactional processes is increasingly recognized and publicized, there will be a concurrent demand for specific methodological techniques to test and/or extend the theory. The technique of simulation games appears uniquely appropriate to fulfill this demand. As Coleman has noted: "In sociology and social psychology, the recent theoretical developments most akin to this utilitarian, purposive approach used in games depend greatly upon the idea of exchange" (Coleman 1968, p. 40, emphasis mine). The reverse appears equally probable: i.e., empirical investigations of exchange principles (as set forth by Blau, Homans, Thibaut and Kelley, and others) may depend greatly upon the method of simulation games.

Strategies of exchange can form the central gaming element around which it is possible to develop and operate simulations that can vary widely with regard to the specific aspects of social interaction delineated for study. The prototype of such a game is a mixed-motive model, in which the players have some common and some conflicting interests, and in which winning strategies demand rational compromise. An ingenious game structure of this type was originally set forth by Schild (1966) and served as the basis for the Schild and Boocock "Parent-Child" simulation. Several variations of this game have been developed by the present writer (Osmond 1970a; 1970b) in order to examine exchange-theoretical propositions in different contexts. This paper will emphasize the potentials of the model for studying and/or demonstrating peer (symmetrical exchange) relationships as well as power (asymmetrical exchange) relationships. The major focus will be on the structural aspects of the game that maximize the probability of mutual exchange between players and that minimize the role of chance in the game.

Schild's Exchange Model

The "Parent-Child Game" (P-C) deals with a substantive example of social control processes. Its structure incorporates one of the most basic principles of exchange theory: if Ego is in a position to provide Alter with a benefit he needs, he can make Alter provide benefits to him as an inducement, i.e., he can modify and influence Alter's actions. In general, the P-C game simulates how parents make rules, how children obey or disobey them, and how parents react (Schild 1966, p. 1). Schild claims, on the basis of very consistent empirical evidence, that the game teaches rational exchange strategies. A summary sequence of the steps in the game is as follows: 1) Players choose partners: half play parents and half play adolescents; 2) Competition is among parents and among children, not between partners; 3) One game lasts 3, 4, or 5 rounds; all players' scores are recorded on a board by individual child and parent; 4) At the beginning of each round, each pair tries to reach agreement on the child's behavior on 5 given "issues" that are assumed to be important to adolescents; for each issue, there are 4 alternative "behaviors" for the adolescent, each of which is weighted so as to give a certain score to the parent and a score to the child; 5) If no agreement is reached within a time limit, the parent "orders" the child as to the way to behave; 6) The child then "behaves" by selecting, and placing face down in front of the parent, for each issue, the card on which his desired behavior is printed; he may violate any agreement and disobey any order; 7) The parent may "supervise" the child's behavior on a certain number of issues (by flipping cards over) and may "punish" (by subtracting points from the child's score) if agreements and/or orders are violated; 8) The parent's as well as the child's score, in the round, is determined by the child's choice of behavior cards; however, the child's score may be altered by punishment penalties from the parent; 9) Scores differ in weight from issue to issue for both partners; further, the relative importance of the issue (whether high or low) to each partner is determined by chance draw of a score card at the beginning of each round; 10) In subsequent rounds the steps are repeated but issue weights may change (by chance) each round.

"Generation Gap" (G-G) by Schild and Boocock is a Western Publishing Company version of the original "Parent-Child Game." Of consequence for our comparisons are two major alterations in the commercial version of the game: 1) there are 2 rather than 4 alternative behaviors for each issue; i.e., either the teen gets his way entirely or the parent gets his way entirely; 2) for each of the 5 issues, there is a different scoring weight which is determined by chance for each round and which, in itself, represents the relative importance of the issue to each partner.

The Dating Game

Schild's game structure was of special interest to the writer in terms of its amenability for creating a simulation of male-female courtship interaction. Exchange principles have been invoked specifically by a number of sociologists for their explanatory power in the realm of sex-role relationships and behavior. Even more indicative, Blau--whose brilliant treatment of exchange and power has yet to be tested adequately--views courtship as a "mixed-game" in the same sense as he explains the establishment of other social relations (1964, p. 82).

In the process of developing and testing what was initially a "Mixed-Motive Dating Game" and is currently a "Liberated Dating Game," several limitations of the application of Schild's gaming structure to this particular process became apparent. In the first place, the power element--explicit in the Schild-Boocock game--appears unrealistic to contemporary youth who insist on equality in their male-female interactions. Thus it was necessary to modify the gaming structure so as to equalize roles and to give a significance to team (couple) scores in addition to individual scores. Secondly, the G-G game--and, to a lesser extent, the P-C game--allows for a degree of chance in game outcomes that adds to game interest but detracts from experimental control. Thus, the reward structure of the game was altered both to extend behavior choices and issue values, and to give each possible choice-value combination an independent numerical weight for precision in scoring feedback. Thirdly, the tightness of the original simulation--with identical issues and value choices assigned over the entire group of players--is more isomorphic with social control situations than with those involving social attraction. Greater flexibility--and consequent relevance and player interest--was produced in the author's Dating Game (D-G) by allowing each couple to determine a unique set of playing issues and each individual to assign his own relative values to these issues.

What has resulted from the modifications and testings of Schild's model is a game structure that operates to produce symmetrical (peer) exchange interactions between playing partners--as opposed to producing asymmetrical (power) exchange interactions. This can be highlighted by a stepwise comparison of the structures.

Structures and Consequences

The following, contrasting procedures appear most critical in determining the type of exchange that emerges in game operation:

Generation Gap (G-G)	Dating Game (D-G)
1. Player Resources	
Unequal resources: parent defined as control agent; issue content refers to teen behavior	Equalized resources: couple selects issues; content may refer to girl and/or boy behavior
2. Goals & Rewards	
Individual scores emphasized: instructed that competition is among parents and among teens; "satisfaction" points posted for individual players each round; winners = high scoring parent and high scoring teen (seldom from the same "family")	Team scores emphasized: instructed that competition is between couples; "attraction" points posted by couple for each round; winners = high scoring couple and high scoring individual (often from same partnership)
3. Cheating-Penalizing	
Can be varied in emphasis each round; partner behaving is always the teen;	Can be varied in emphasis each round; partner behaving and partner penaliz-

severe penalties possible by the parent	ing also can vary each round (chance draw); relatively moderate penalties

4. Behavior Choices

Teen has 2 choices (either-or) on each issue; original game (P-C) allowed teen 4 choices	Girl or boy allowed 4 choices on each issue (the 2 middle choices reflect compromise)

5. Issue Weighting

Rank importance of issues (5 weights which represent scores) determined by chance draw; original game (P-C) allowed 2 ranks (either important or unimportant)	Ranked 1 to 5 in terms of importance as decided by each individual; scores depend on interaction of rank plus behavior choice

6. Strategy & Scoring

Strategy in terms of trade-off with each partner having preference part of the time; no compromise on individual issues	Strategy in terms of compromise which is possible on each issue and preferable (to maximize team score) on some issues
Maximum possible team points, penalties aside, depend upon luck of the draw (plus or minus 40%); winning team reflects chance as well as strategy	Maximum team points, penalties aside, remain relatively constant (plus or minus 4%); winning team largely reflects compromise strategy

Looking first at the consequence of individual versus team scoring, initial instruction to maximize individual scores results in participants' concentration on two procedures: behavior choices versus penalty possibilities. In contrast, instruction to maximize team scores results in different emphases: issue weighting plus behavior choice. Individual score emphases lead to a power game; team scoring is conducive to symmetrical, mutual exchange. Threat of punishment, or actual punishment--via penalties--is essential to the individual reward game, i.e. to power relations. With mutual exchange and team scoring, on the other hand, penalties may be optional, or weighted in various ways, or even eliminated without forfeiting game interest.

For the game to operate, at least two behavior choices and two issue weightings are minimum requisites. Operating at this level, however, would detract not only from participant interest but also from any learning and/or research possibilities. From this minimum the game designer may proceed in several directions. Increasing the number of behavior choices allows greater probability of mutual exchange between partners and, therefore, the possibility of rewarding team as well as individual play. Increasing the number of possible weights, or rankings as to importance of issues, permits more sophisticated scoring and, therefore, more precise rewards for strategic play. Any decrease in complexity here forces the designer to increase the role of chance or luck in the game in order to keep the players motivated through subsequent rounds. From the outline above, note that the "Dating Game" extends simultaneously both the number of behavior choices as well as the number of issue weightings. These extensions not only increase player involvement but also lead to greater exactness in measuring the rate of mutual exchange between partners. Players of the D-G have had no difficulty in calculating their scores from individual score sheets. However, a computerized version of the game (in process) makes scoring feedback almost immediate and opens possibilities for incorporating additional variables into the simulation.

The differences between a "peer" and a "power" game structure are most clearly distinguished when the above procedures are considered in terms of the various scoring systems. Again, as in the comparative outline, punishment penalties are assumed negligible for this discussion in order to compare basic scoring. As the G-G game is structured, a large part of any team score depends on the "match" of importance of the issues, a matter of chance. For example, if for all 5 issues in a round, the players match equal "satisfaction" points, the team score will be 30 points (vs. 42 possible points for a luckier draw) no matter what choices are made. Chance plays a less important role in the original P-C game. It is still true, however, that an unlucky match of issue importances can reduce the possible team points in this game by 13% over one round of play. Further, there is a 25% probability that such a match will occur. In the D-G, however, chance can reduce team scores by only 8% at the maximum, and the probability of this extreme is less than 4%.

As a result, the "Dating Game" team scores can be used as a valid measure of the extent of rational exchange behavior. In several three round plays (using 3 different groups with a total of 42 couples) the team (couple) scores invariably increased from round to round, with an average increment of 35 points per round on a typical team score of 1000 points.

In sum, the gaming structure of Schild's basic exchange model may be altered to produce variations in behavioral outcomes from unilateral exchange and power to mutual exchange and social attraction. Further, an extension of choice and weighting procedures yields a greater challenge to participants for learning exchange strategies as well as a more accurate mechanism for evaluation of such learning.

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SELF-ROLE CONGRUENCE IN SIMULATION GAMES

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Following a recent gaming session with High School, the players, college students in an introductory sociology course, were asked to redesign the game model in order to make it a more realistic simulation of the high school social system. One of the players provided an excellent summary of the self-role incongruencies which are the focus of this paper.

> "...it is very unrealistic to try and assume a character role of a very conflicting type of person. I played the part of a girl who was highly socially oriented. This was conflicting to my own personal role. I found it difficult to assume her role, leaving my own convictions aside."

The writer was a boy who rated himself high in academic and athletic abilities, but only medium in social ability.

Social psychologists Sarbin and Allen define self-role congruence as "...the degree of overlap or fittingness that exists between requirements of the role and qualities of the self." (Sarbin & Allen 1968:524) There have been a number of studies of self-role conflict. The general direction of findings indicates a relationship between self-role congruence and more effective role performance. The present paper sought to validate a similar hypothesis in a gaming situation. It was predicted that congruence between player characteristics and game role characteristics would be positively associated with effective role enactment, or, stated in negative terms, self-role incongruence would be negatively associated with effective role enactment. The research carried the logical process one step further by investigating how subjects in an incongruous role situation might seek to resolve their dissonance when given an opportunity to re-define the structure of the situation which produced that dissonance.

Procedure

Fifty-one subjects were assigned to one of six possible student roles in a series of gaming sessions with High School, (Coleman and Seidner, 1971), a simulation game which reflects certain elements of the social system of the American high school. Student roles in the game are defined in terms of assigned ability levels (high, medium, or low) in academic, athletic, and social activities, the three activities represented on the High School gameboard. Several days after the gaming sessions, subjects were asked to redesign the game to make it a more realistic simulation of the high school social system. Following this exercise, subjects were asked to indicate their perception of their own abilities in academic, athletic, and social activities on a three point scale (high, medium, and low) which corresponded to the ability levels assigned student profiles in High School.

The Independent Variables: Self-role incongruence was operationally defined as differences between the attributes possessed by the subject and the characteristics of the student role which the subject was assigned to play. Two types of self-role incongruence were identified. Sex incongruence resulted from a subject assuming the role of a student of the opposite sex. Ability incongruence was operationalized as the sum of the absolute differences between a player's estimate of his own academic, athletic, and social abilities and the assigned abilities of the student role he assumed in the game.

The Dependent Variables: Two types of dependent variables were examined in this research. The first, effective role enactment, was operationalized as esteem score, the outcome variable of the game. One of the determinants of esteem score, as provided by the structure of the game, is the ability levels of student profiles. Other things being equal, players tend to earn higher esteem scores when they invest in those activities for which their game profile has the highest ability levels. It was predicted that ability incongruence would interfere with a player's capacity to effectively assume the role of his student profile, thereby decreasing his esteem score.

Another classification of dependent variable was related to subjects' redesign of the game model. Each subject produced an essay which was content-analyzed. Through careful reading, a number of theoretically meaningful categories emerged. The category coding system included redesigns which incorporated: (1) autonomy, (2) branching, and (3) transfer. Examples of responses falling into each category will be presented with the data. The central question surrounding the analysis of redesign data was whether or not subjects who experienced self-role incongruence would seek to restructure the game in such a way as to reduce the dissonance they experienced in the gaming situation.[1]

Findings

Effect of Self-role Incongruence on Effective Role Enactment: Gamma was computed to determine the association between self-role incongruence and effective role enactment, operationalized as game score. As indicated in Table 1, the association between ability incongruence and role enactment was -.39 while the gamma for sex incongruence and effective role enactment was .26. This suggests that ability incongruence was inversely

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[1] The impetus for this direction of the research was provided by Dr. Frederick Goodman in a personal communication.

Table 1

Association between self-role incongruence and effective role enactment

	Gamma for ability incongruence and effective role enactment	
Total Sample		-.39
Sex Incong.	absent	-.28
	present	-.45

	Gamma for sex incongruence and effective role enactment	
Total Sample		.26
Abil incong.	low	.29
	high	-.50

related to game score, while sex incongruence had a slightly positive effect upon game score. In order to further examine the possible multiplicative effects of the two independent variables, the association between one independent variable and game score was specified by the other independent variable. When the association between ability incongruence and game score was specified by sex incongruence, and sex incongruence was absent, gamma was -.28. When sex incongruence was present, gamma was -.45. When the relationship between sex incongruence and game score was specified by ability incongruence and ability incongruence was low, gamma was .29. When ability incongruence was high, gamma was -.50.

From zero order associations, it appears that ability incongruence and sex incongruence operate in different directions upon game scores. Apparently ability incongruence tends to depress game scores, while sex incongruence acts to inflate them slightly. However, the combination of both ability incongruence and sex incongruence acts multiplicatively upon game score to depress it.

The differential effects of the two types of role incongruence on game score may be partially explained by the fact that sex of profile is not as important to the scoring system of the game as is ability level, which, in effect, determines how fast a player can advance along the activity routes on the gameboard. Nevertheless, it is possible that ability incongruence and sex incongruence may be two quite different types of self-role incongruence within the context of <u>High School</u>, and therefore elicit very different responses from players. Sex incongrence would appear to be more of an external incongruence which was involuntarily communicated to other players by virtue of the nametags worn by players indicating the sex of their student role. Ability incongruence, on the other hand, was more internal, and could go undetected by other players in the game as none of the other players could readily identify who was experiencing ability incongruence and who was not, unless the players knew each other quite well.

Social psychologists have suggested that tension is an intervening variable that links self-role incongruence to decreased role performance.

It is possible that this tension was more easily relieved in the case of sex incongruence by socio-emotional interactions with other players. Yet, time spent on socio-emotional or expressive tasks cannot be spent on instrumental tasks. In the present research, the major instrumental task was learning the game model. While the tension caused by sex incongruence may have been easily relieved in the gaming session, the socio-emotional interactions generated to dispel that tension may have interfered with players' understanding of how to win the game. Thus when faced with <u>both</u> ability incongruence and sex incongruence, players not only experienced dissonance from the necessity of assuming an unfamiliar role, but also may have been ill-equipped to effectively play that role because they lacked a deep understanding of how the game worked.

The effect of ability incongruence on effective role enactment appears to be more clear. The lower game scores associated with ability incongruence may have resulted partially from players' tendency to play themselves, rather than assume an unfamiliar role. It is also possible that subjects may have tried to assume their profile roles but, because of tensions generated by the incongruence, may have been unable to develop successful scoring strategies. It is likely that both factors contributed to lower game scores. To further compound the situation, a player <u>experiencing</u> ability incongruence may not have been as eager to relieve tensions through socio-emotional interactions because in so doing, he would be in the potentially embarrassing situation of exposing his "real-self" abilities.

<u>Effect of self-role incongruence on redesign of the game model</u>: The overall pattern of results which emerged from analysis of subjects' redesigns of the game model indicates that players who experienced self-role incongruence sought to reduce their dissonance by restructuring the game in a manner that would have reduced their conflict in the gaming situation. The clearest results emerged from analysis of the design category labeled "autonomy". This classification involved the amount of freedom players desired in structuring the parameters of their role and was coded into sub-categories of "more autonomy" and "less autonomy". The category designated as more autonomy included designs which would allow the player to design his own pay-off schedule, thus off-setting ability incongruence, or to actually assign his own ability levels. Players who fell into the category of "less autonomy" desired even fewer options for self-determination than the game now permits. The association between ability incongruence and redesign of the game model using gamma was .86 in the direction of more autonomy. The association between sex incongruence and redesign of the game for more autonomy was a negligible -.03. It appears that tensions created by ability incongruence were far from resolved by game play. All of the fifteen subjects who indicated a desire for more autonomy provided for the elimination of self-role ability incongruence in their redesigns, while only one mentioned the elimination of self-role sex incongruence.

A second category of redesign of the game labeled "branching" including designs which created more divisions within a single route, thus providing the player with more decision options. For example, a division of the academic route into separate tracks for "college-bound" and "vocational" would have been coded as a redesign incorporating branching. The associations between sex incongruence and redesign of the game model for branching of routes was again negligible (.05). However, the association between ability incongruence and redesign for branching using gamma was -.58. Evidently subjects who experienced ability incongruence did not want any further complications introduced into the game model.

The only category of redesign which showed any appreciable relationship to sex incongruence was a category designated as "transfer". This category included designs which allowed players to relate achievement on one route to achievement on another route through transfer of game points. For example, achievement points earned on the athletic route would automatically advance a player on the social route, much as being on the varsity transfers to a social life through increased prestige. The association between sex incongruence and redesign of the game for transfer was .29. This may have been related to the fact that pay-off schedules for achievement in the different activities, were, to some extent, sex related. Therefore subjects playing opposite sex roles may have experienced a desire to achieve in an activity appropriate for their own sex, which, within the context of the game, was not a profitable pursuit for their assigned role. The gamma for ability incongruence and redesign for transfer was .29.

Specification of the association between one independent variable and the various categories of redesign by the other independent variable yielded cell sizes too small to permit generalizations. An interesting pattern, worth exploring in future research, was the tendency for <u>lack</u> of sex incongruence to increase the strength of the association between ability incongruence and the redesign categories.

Implication of Findings

Although this research was exploratory in nature, results have implications for research with simulation games. Dr. Goodman's suggestion that subjects will tend to redesign the game model to validate their own conception of reality tends to be supported. Moreover, the general direction of their redesigns was predicted by researchers. These findings tend to support the notion that simulation games provide a microcosm of social interaction which may be useful in generating social interaction which may be useful in generating social-psychological theory.

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RESIDENT GENERATED ISSUES AND CITY LEVEL DECISION NEGOTIATION: A PROGRESS REPORT

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The Residential Environment Game, the subject of this progress report, is part of a research program at the University of Southern California to develop a set of environmental criteria which will guide planning, design, and management of the residential environment. The criteria will be based upon the needs, values, and preferences of those who use these environments.

Planners, designers, and environmental managers have traditionally used sets of standards as rationales which underpin their proposals for development, redevelopment, and maintenance of residential areas. Typically, these standards become the established method for the sizing or arrangement of elements of the physical environment. Perhaps the most important and commonly used source for such standards is Planning the Neighborhood (1948). This document, prepared by the American Public Health Association, set forth a recommended set of standards for guiding the planning of residential neighborhood environments.

In recent years a considerable amount of criticism has been levelled against the use of such standards. Major areas of concern have included the following: 1. the standards disguise professional value judgments which contain implied prescriptions for the good life as data having scientific substantiation, 2. the standards do not reflect the preferences of different user groups or provide for interchangeability or substitution of elements or services based upon needs of these groups, 3. the standards do not measure performance or adequacy of the urban system, and 4. the standards do not specify the appropriate residential unit. The conception of the neighborhood as a small, homogeneous, inner-oriented system focusing on the elementary school is not the only appropriate residential spatial unit in modern day urban life.

The goal of the research program is to find ways to promote a high quality residential environment which satisfies its population. To attain this goal the program is developing "performance criteria," derived from user preferences, which will aid municipal level decision makers by suggesting a range of acceptable results which must be achieved by the decision. A standard might specify street width, while a performance criteria might state the maximum time it should take to travel from home to shopping areas.

The Residential Survey

In order to find out what different user groups consider to be an environment which satisfies their needs, a field survey has been conducted. Since standards fail to consider the pluralistic nature of users of residential areas, the residential survey collected data using a multistage areal sample which stratified households by socio-economic status, ethnicity, and stage in the life cycle to insure inclusion of households from many different user groups. In addition to standard demographic items, the interview schedule for the survey employed both structured and open-ended techniques such as card sorting, map drawing, and semantic differential rating. Data from the 240 households in the sample included, 1. perceptions of residential areas, 2. activity patterns, 3. preferences for environmental attributes, and 4. evaluations of the residential environment.

Survey Data as Design Criteria for Simulation Games:

Analysis of the survey data to date has been limited to descriptive procedures. Many types of descriptive data can provide important information for the design of simulation games. Use of such data should shorten development time and produce simulation games which are more valid -at least for the target population of the survey.

Survey data may be employed in the early design stages, while other data sources such as the use of informants are helpful after there is some sort of playable game which they can help to "fine tune," as in the case of ghetto youths who revised the payoffs in the Ghetto game (Toll, 1969). The gathering of original survey data for design purposes only, is time consuming and expensive, however such data may have already been collected and analyzed as in the case where survey data from The Adolescent Society (Coleman, 1961) provided design criteria for The High School Game (Coleman and Seidner, 1971). The game designer may have increased confidence in his design decisions when survey data is used to guide them because of demonstrated reliability of survey items (some of which may be useful in later post-game questionaires), and size and representativeness of the survey sample. The use of quality data from surveys or other sources allows explicit rationales based upon scientific data to underlie design decisions.

In the residential survey respondents were asked to draw a map of their residential environment. These maps were then transcribed onto standard maps to that the area encompassed by the map could be measured. Findings revealed that the median area of these maps was ½ square mile, and 85% of the respondents drew maps having areas of 1/8 to

1 square mile. A scale model of a residential environment to be used in the *Residential Environment Game* was then built to encompass about 1 square mile.

The researchers also needed to know in what activities users of residential areas were engaged, and what environmental elements were necessary for these activities, so that these features could be included in the simulation game. Respondents in the survey were asked to tell the interviewer which activities listed on cards were among the things they did. The respondents were then asked about the frequency and duration of these activities. By multiplying frequency times duration for each activity, a variable of "total exposure per week" could be constructed. Values of this variable were then summed over the entire sample for each of the activities on the cards. To arrive at a smaller number of "activity types" for simulation game design purposes, different classification schemes were superimposed upon the data. Classification of activities into Work (including child rearing), Education, Recreation, and Environmental Improvement accounted for the 25 activities which had the highest values of total exposure per week. Environmental elements necessary for these activities include Schools, Industry, Recreation sites, Transportation, Housing and Health/Safety operatives. These activities and elements were then included in the design of the roles, issues, and policies of the municipal level, elements in the scale model of the residential environment, and in the indicators of environmental conditions and activities of residents in the user level of the *Residential Environment Game*.

New Games from Old:

Rather than attempting to create an entirely new game from the ground up, it may be much more advantageous to modify existing simulation games to fit the current needs of the designer. For some applications it may be more efficient to lift out entire sections of one game and "graft" them onto another game. For other applications, it may be more efficient to abstract out the central "core module" which drives a simulation game and apply new meanings to the parts. Many board games, consciously or not, use a core similar to the core of Monopoly. Typologies of games often reduce games to their cores for classification purposes and may provide helpful information about core modules which are available to the designer.

Advantages of beginning design with an existing simulation game may include reduction of development time, lower cost, increased playability, more rapid rule learning by players who were familiar with the original game, and continuity between work on the original game, such as validity studies, learning evaluations, theory testing, or other research - and work which will be done on the new game.

The Residential Environment Game: Modules and Grafting

The Residential Environment Game has a municipal decision making level of play and a residential environment user level of play which are driven by two core modules abstracted from games already in existence. The municipal level of the game utilizes the module from Policy Negotiations (Goodman, 1970). Different roles and issues have been provided which are keyed to user level activities and elements, and to the physical model of the environment. The usual playing form of Policy Negotiations as a school board presents only a special case of its core module which is a more general model of decision making processes. Its use of influence as power to affect decisions and prestige as ability to maintain role incumbency and therefore authority, make its core module useful for designing simulation games which model a wide range of group decision making processes.

The user level of the game employs the core from the High School Game (Coleman and Seidner, 1971). The usual playing form of this game as a high school is only a special case of its core module which is a more general model of the individual in a social context. Its use of individual ability levels in different activities as constraints on rewards in those activities makes it a useful tool with many applications.

The "Neighborhood Conditions" section of the Ghetto game (Toll, 1969) has been grafted onto the High School core module. It serves as a display device for environmental indicators, and has been expanded to include a transportation category. The physical model has been built to scale, as mentioned earlier, and is is used to display spatial and esthetic features of the residential environment which cannot be operationalized through the "conditions" section alone. The physical model has moveable sections which are changed as environmental conditiond change.

Data Triangulation: Survey and Simulation Game

The Residential Environment Game will be used to find out if user generated performance criteria are more effective than standards in the creation of a residential environment which satisfies different user groups. Two game structures will form the experimental treatments of the research design. In the "standards" treatment the municipal level decision makers will have only formal rules on which to base policy proposals, while in the "performance criteria" treatment the municipal level decision makers will be provided with information from the user level of the game about salient issues.

User satisfaction will be measured with a Semantic Differential rating scale which has been refined using the survey data. The respondents were asked first to rate their existing (real) residential environment and then their ideal residential environment on two identical lists of 42 pairs of polar adjectives such as "ordered" versus "chaotic." The data were factor analyzed and a factor structure emerged for each list which corresponded to the Osgood et al. (1957) "evaluative" dimension. Cannonical correlations were then computed to investigate the relationship between ratings of the real and ideal residential environment on a shortened list of 28 "evaluative" adjective pairs. Results indicate higher cannonical correlations between real and ideal rating lists for whites than for blacks or Mexican-Americans when class was held constant, however overall evaluations (mean scores) for existing residential environments vary positively with social class when ethnicity is held constant. For future use, Robinson's A (Robinson, 1957) should replace Pearsonian r in correlational computations, as it is theoretically more appropriate to measure exact agreement between the real and ideal scores without adjusting the linear predictions.

Through many plays of the Residential Environment Game, the researchers expect to duplicate the survey findings in the "standard" treatment and to increase the satisfaction of all user groups in the "performance criteria" treatment.

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ECONOMIC IMPACTS OF ENVIRONMENTAL DECISIONS: A ROLE FOR SIMULATION MODELS

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Population and economic activity have rapidly increased in the last hundred years, particularly in the economically-developed nations of the world.

The technological innovations which succeed one another at a rapid pace have permitted the diffusion of many commodities on an unprecedented scale. This process has intensified the pressures on the available resources. A great deal of concern has consequently developed over the feasibility of maintaining a trend which imposes more and more demands on a shrinking resources base. It is out of great necessity that man must find the optimum feasible allocation of scarce resources to achieve the satisfaction of so many needs in an expanding population.

Many times and in different ways, scientists are pointing out the serious shortcomings which this development may impose on present and future human welfare. Biologists and ecologists are asserting that something is wrong in the way human technology has affected the environment. Demographers express concern over the future of humanity when they observe the growth rates of population, etc.

A serious assessment of the situation would conclude that there is a critical need for planning future activities in a way which may permit the optimal use of human and natural resources.

The institutions responsible for the formulation of policy are normally elected through the political system of society. They bear the moral responsibility of providing their citizens with adequate living conditions.

Economics has a body of theory which may be utilized toward this end. The exploitation of our natural environment is analogous to the use of any productive asset, namely, there is a life expectancy of the resource, maintenance and operating costs.

But the theory and the analytical tools are far from perfect. Economic planners are often faced with a choice of planning procedures which may not adequately answer their questions. Some procedures may be

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suitable toward one end and not adequate for another. They must devise flexible mechanisms to adapt to changing circumstances, adopt management systems, meet current and urgent human needs, etc...

The Role of Simulation Models

Not all models can explicate the behavioral aspects of an economy. Sometimes the situation is too complex to involve a rigorous, soluble mathematical formulation. Namely, the incorporation into the model of too many variables in a variety of nonlinear forms does not allow for solving it analytically and therefore its general properties cannot be deduced. However, we can content outselves with particular solutions and still have an overall plan.

Planning by simulation is then an attempt to reconstruct "the anatomy and physiology" of a prototype system, in order to understand its functioning and, consequently, to deduce future events provided the modeled system continues to operate as it had in the past. The planner has no control over the magnitude and sequence of economic events. He has the ability to select institutional and structural measures (changes) which can enhance the workings of the system. He may be able to optimize on these decisions, but, in general, however, the planner assumes no control over future economic events.

The success of simulation models for planning depends heavily on the use of large quantities of data and therefore computer techniques.* The model must emphasize the algorithm which mathematically duplicates the physical responses of the system and estimates the resulting economic net benefit. The planner must manipulate, to his advantage, all controllable variables which exhibit the ability to be used adequately within the model and those which do not. Perhaps the best way to determine the adequacy of a simulation model is the testing of it against known historical events prior to its development. For instance, a simulation model for a certain agricultural project may be tested against the historical record in the sense that it must adhere to past experiences with water supply, weather conditions, transportation difficulties, and so on.

The availability of computers allows the planner to incorporate a great deal of information into a simulation model. This allows for a fairly adaptable and realistic representation of the system. But we cannot expect a great deal if the conditions of the system change drastically. In other words, the simulation model "duplicates" the system as it is and, if amenable to modification, can be used to measure the impacts of modifications to the system. If, during the planning period wherein the simulation model is used, there are substantial changes in the relations of production, the institutional structure, or any other

*For example the mathematical model developed at MIT by Peter S. Weissman et al to computer simulate the Menhaden fishing industry.

serious modifications the model is no longer useful unless it is modified to reflect these changes. As a matter of fact, to plan•, involves the notion of wanting to introduce alterations into the system, and by simulation the modifications can be evaluated.

Concepts and Principles for Environmental/Economic Planning Models

Traditionally natural resources have been identified as the elements of the natural environment needed for the production of certain basic commodities (farm, forestry, fishing, water, mineral products) and, to a much lesser extent, of certain services such as recreation and water transportation.

With the advent of heavy industrialization and the expansion of the service sector, the contributions to GNP of natural resources as commodities has decreased substantially. Roughly, the contribution of this group in 1970 was 11% of the GNP. The extent of this reduction is indicative of the expansion of other activities. For this reason it is necessary to broaden the concept of natural resources to better address present and future problems.

The traditional resource concept requires the introduction of the concepts of "amenity resources" and "open space resources". Amenity resources" are a special combination of natural resources which in their total evaluation add up to convenient location for economic activity and family living. They may be a certain topography, climate, seashore, etc. "Open space resources" are those areas that offer breathing space and recreation facilities for urban dwellers, such as parks, beaches, rivers, countryside, etc. In approaching a definition of Environmental Resources one must include not only the traditional economic factors of production (capital, land and labor) but also the elements in nature involved directly or indirectly in the production process. These may be in the climate, the different soils, water bodies, and the vast amount of living organisms on this planet. Thus, the concept of Environmental Resources may be defined as the combination of the available means in the productions, distribution and consumption of goods as well as the complex of climatic, edaphic, and biotic factors. Their interactions and trade-off will determine the quality of life of organisms and their ultimate form of survival.

Against this short introduction four suggested principles for environmental economic planning are posited without further elaboration:

1. Environmental resources belong to all of society and no group of people should exploit them to the detriment of others.

2. The value of environmental resources is expressed in the degree of usefulness the resources have for humans.

3. Whenever an activity that utilizes environmental resources is proposed, planners ought to derive the greatest possible advantage that the resources may yield.

4. Man's intervention in nature ought to recognize the biological, chemical and physical limitations of the environment.

These principles should underlie any model for environmental/economic planning and the following is a brief description of a general model to relate economic and environmental impacts to decisions about "land use".

<u>An Ocean Related Resource Model</u>

A mathematic model that can represent the interactions of many of the vast array of marine resources is needed. Two criteria were established to measure the usefulness of the model <u>for our purposes</u>: (1) that it be simple and (2) that it embody the general principles applicable to the elements that comprise the marine environment. We start from a state of equilibrium and then introduce an exogenous shock to one subsystem - the spillovers then affect other subsystems as a result. To quantify this model (not reproduced here) we have specified a recursive set of equations. The method employed is step-wise recursive -- it consists of a recursive system of equations subject to a series of constraints. For example, as the solution to the system progresses from the first to the second equation, the first endogenous variable is determined by only predetermined variables. A constraint is placed on the resultant value of the first endogenous variable (Y_1):

$$\text{if } Y_{1t} < \overline{Y}, \text{ then } Y_{it+1} = Y_{it} \text{ for all } i > 1$$

In the second equation, the first endogenous variable and the predetermined variables determine the second endogenous variable. Identical constraints can be placed on each step in the recursive process. This method can also be generalized to include steps from linear to nonlinear relations for some critical value of the relevant variable.

The method is useful in environmental analysis for two reasons. First, recursivity allows us to depict the serial nature of causal chains in an ecological system. Second, the different thresholds allow us to account for a system's ability to absorb exogenous influences up to some critical level, and to include shifts in, say, a predators range as it numbers increase. This process could be reiterated until the simulation had been carried out for the prescribed number of periods. The flow chart (not reproduced here) indicates that more than one decision rule may be entered. If all entries have not been considered, the program would then generate another simulation. When all rules have been considered, a cost/revenue analysis is performed on the results, and a tabular comparison can be displayed. The results are then evaluated and either a new decision rule is entered or one set of results is chosen. When a final "best" set of results is chosen, the computer would then retrieve the previous "best" result and compare that to the most recent computation. The "best" of the two is then returned to storage and the comparison displayed.

One example of the model's operation is as follows. Say we intend to model the system of marine resources off Santa Barbara, California. Local planning authorities might be assumed to make the decisions which determine the amount and quality of sewage dumped into the ocean. Also assume that the quantity of kelp harvested is determined by private decision maker. For simplicity's sake, consider these to be the only exogenous variables. Also, assume that the plankton content of the water and plankton destruction of kelp, via incident light starvation of the haploid stage, are endogenous to the system. The stock of kelp and all initial values for the other variables are predetermined at the start of the simulation.

The program then requires that we establish some decision rule to simulate the decisions. In this case, we would specify how much sewage discharge would increase for each period of the simulation as a result of "land use" decisions and the amount of kelp to be harvested. Decisions on each could be separate and allow for a more realistic situation. Next we would specify values for the initial stock of (1) kelp, (2) plankton, and the per period flow of (1) sewage and (2) kelp harvest.

The period 1 sewage flow would then be computed by the sewage sub model. If the discharge were less than some critical level it would not (appreciably) affect the plankton level and period 1 initial values for plankton would equal period 0's. Kelp stock would change only by the amount of the harvest. If the sewage flow exceeded the critical level, equation 1 would reflect the effect on the plankton level. If this new plankton level did not exceed its critical level the kelp stock would again change only by the amount of harvest. Should plankton increase beyond its critical level, then it would adversely affect the kelp stock and this negative effect would enter in computation of the period 1 kelp stock. The process continues until the horizon fixed by the planners is reached. In this manner, it would then be possible to incorporate possible long-term impacts into current decision making.

Summary

The example model is based on the principles listed above and demonstrates the need for planning in a very simple case: one where a private decision maker directly affects a marine resource (kelp) and a public agency indirectly affects the same resource. Without planning, the sum of the two impacts on the resource could destroy it. With planning by simulation, the resource can be protected yet utilized in a manner to produce the highest human value over time consistent with the biological, chemical and physical constraints.

VALIDATION OF AN AFFECTIVE SIMULATION GAME

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I INTRODUCTION

Planning and Planning Style

Planning in a modern context deals with the illumination of alternatives and the assessment of the social consequences of each alternative. The choice theory of planning (14) exposes the choices planners make in selection of alternatives, the impacts to be assessed, and in the selection of criteria by which to compare impacts and establish preferences. Planning style can be distinguished by the planner's orientation to the public in terms of whose values are included in plans, who participates in decision making, and who benefits. A taxonomy of different styles include rigid and flexible.

	RIGID	FLEXIBLE
Whose Goals?	One set of objectives, elite, traditional, etc.	Values and objectives of various subgroups.
Who makes Decisions?	Professional planners, elites, single interest groups.	All citizens affected participate in planning.
Who Benefits?	Narrow assessment of costs and benefits. Beneficiaries are limited sector of the elites or traditional community.	Full range of consequences assessed for each group. Benefits for the collective good.

Flexible style is seldom practised. One impediment is the attitudes planners must adopt before the flexible style will actually operate. These include acceptance of various value orientations, participatory planning and determining benefits for the collective good.

Simulation Games for Planners

With some exceptions, planning games have planners, professionals and politicians making the decisions, thus reinforcing the rigid style in planner education. Gutenswager, (10) however, discusses the potential of simulation games to critique rigid style and the appropriateness of existing hierarchies.

Nuerland- Simulation Game for Modifying Planning Style

Nuerland, a simulation of Colonialism imposed on a tribal society in Southern Sudan, was designed to modify planning style by providing a negative experience with rigid style. The structure of the first part of the game gives the players an experience with the importance of cattle to the Nuer life style. Communication with dead members of their lineage, marriage contracts, seasonal alterations of wet and dry seasons, the search for pasture, conflict and feud resolution, every possession of life and means of life support and satisfaction revolve around cattle. In the second session, players interact with the model of the colonial (rigid) planning style. The variables of planning style (whose objectives, who decides and who benefits) are very narrowly defined for colonial planning, with goals that are aloof from the cultural values of the Nuer, non-mutual goal setting, a high-power relationship of the colonial administration with the Nuer, and external beneficiaries. This rigid model is operationalized in the game by introducing colonial legislation as new rules which prescribe different behaviors for the tribesmen. It is important that dissatisfaction with rigid style is not directed toward a villian whose victimage will divert attention from necessary changes in the social hierarchy. Attention should be directed toward examining the rules of the game which sustain a hierarchical structure.

II VALIDATION OF AFFECTIVE SIMULATION GAMES

Types of Validation

Validation of a simulation game should be in terms of its usefulness in reaching particular goals. (32) (5) Two broad goals of simulation games are research and teaching. Validations of simulation games for research are best accomplished through establishing isomorphism, that is, does the model conform to the "real world". Validations of Inter-Nation Simulation (INS) are accomplished by comparing the assumptions of the model to existing theory and data. Validations of simulation games for teaching include empirical, predictive, theoretical and face. Empirical validity is the closeness of fit of the game structure or outcomes to a real life measure. Boocock compared the player's final game position with their reported real life behavior for an empirical validation of Generation Gap. Predictive validity would predict future behavior from positions or scores in the game. In Boocock's study, one player carried out decisions similar to game behavior several weeks after playing Generation Gap. Theoretical validity is the degree to which the game structure or outcomes conform to some theory. Russell found that the simulation game

Adolescent Society confirmed one aspect of Coleman's research on the social system of the high school-- playing a role that was not highly valued in a particular social context affected the subject's evaluation of the desirability of that role.(16) Face validity is related to verisimilitude, the players' reactions to the overall plausibility of the game model and structure. The present research proposes a validity study of players' perceptions of the game model and structure, and a determination of whether the simulation game is adequate in communicating the full range of implications arising from a rigid planning model.

A Validation Approach

The present game is proposed for use in the area of planner education. The game is designed to provide the opportunity for negative experiences stemming from interaction with a model of rigid planning style. The planning students as players would experience a difference between tribal life and a colonial administration imposed from above. These experiences should enable students to better "feel" what an established social organization might "feel" as recipients of projects already formulated by expert planners of different cultural orientations.

It appears that the most useful validity measure for the game is face validity, i.e., the test of whether the rigid planning style is perceived as a negative experience by the players and whether playing the game results in a change in orientation toward flexible planning style. A further aspect of validation, the comparative usefulness of the game with respect to other affective techniques, is not considered in this research. Conflicting results for both learning content (15) (5) (8) (2) (3) or changing attitudes (6) (9) (11) has been reported and is a matter for which further research should be addressed.

Instruments

One simple measuring device for the perception of the rigid model is through the use of a semantic differential rating. This is adapted from Neil Rackham's in-game assessment device used to measure the level of satisfaction from a game period. Items for assessing player perception of and satisfaction with rigid planning style will be nested into a scale with Rackham's items.

A statistical regression instrument will attempt to measure the preference for flexible planning style between game players and non-game players. The instrument is based on a multi-variate linear model which gives an empirical estimation of an individual's preferences for the variables of planning style by analyzing preferences of a number of planning alternatives with different combinations of the variables. This procedure has been used in the areas of interpersonal learning, clinical analysis and judicial decisions.

The device utilizes multiple regression analysis to "capture" the relative weights a person gives to the accomplishment of various objectives. An instrument based on this technique would provide mathematically calculated measures of revealed preferences. The method utilizes the solution of a multiple regression equation of the following form:

$$Y_j = a_{0i} + a_{1i}X_1 + a_{2i}X_2 + a_{3i}X_3 \ldots + a_{ni}X_n$$

A solution for the a's gives a quantitative measure of how each subject (i) weights various attributes (the X's) of given alternatives (the Y's). Thus a subject's policy is "captured" mathematically by calculating the relative importance given to each of several variables.

To experiment with the appropriateness of this technique, an instrument was devised using five variables: income, growth rate, income distribution, literacy and modern versus traditional lifestyle. Thirty scenaries were created, each describing a planning alternative, i.e., the results of choosing a given action. The subject is not told what the action is, but rather the soical and economic consequences are described on a card. Consequences are indicated by values on the five variables listed above. The subject then ranks the cards according to his preferred ordering. In quantifying the variables, the technique of magnitude estimation scaling is used in a manner similar to that employed by Sellin and Wolfgang's Measurement of Delinquency. (17) This is essentially a ratio scaling method. The results of one experimental exercise with the instrument are listed below comparing myself (SIDEC) and an environmental scientist from the National Academy of Science (NAS).

	VARIABLES					
	Per Capita Income	Growth Rate	Income Distribution	Literacy	Trad/Mod Lifestyle	R^2
SIDEC	.83	.33	.26	.18	.13	.79
NAS	.91	.09	.12	.03	.04	.81

The relatively high weight given to income by both subjects shows the dominance of this variable. However, the weights assigned to growth rate, income distribution and literacy indicate strong differences in the implied preferences for these attributes. The high R^2 appears to indicate a great amount of consistency in spite of the large number of combinations. In addition, it suggests that the linear model is acceptable. A validation instrument using this technique was designed to measure evaluations of planning styles through the use of four variables:

X_1 = Makeup of Planning Ministry (Who makes decisions?)
X_2 = Incidence of Malaria
X_3 = Level of per/Capita GNP (Who benefits?)
X_4 = % Nomadic vs Modern lifestyle (Whose values?)

Model: $Y = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4$

where Y = score assigned by subject to given alternative. (normalized)

GROUP Y BEFORE		GROUP Y AFTER	
Alternatives	Average Score	Alternatives	Average Score
A	.34	A	.10
B	.03	B	.31
C	.17	C	.26
E	-.16	E	-.19
F	.24	F	-.13
G	-.70	G	-.51
H	.15	H	..34
I	.07	I	-.23
J	-.51	J	-.28
K	.50	K	.49
L	-.38	L	-.43
M	.38	M	.51

Group equation before

$$Y = .03 - .15X_1 + .40X_2 + .79X_3 + 1.12X_4$$

Group equation after

$$Y = .05 - .35X_1 - .06X_2 + 1.30X_3 + 1.42X_4$$

The pilot test on the instrument showed the need for:
1) a written introduction to the instrument when administered to a group.
2) at least one hour to complete the instrument, and
3) an increase in the number of cards so that the data points from alternative proposals could yield statistical significance.

Expected Results

It is expected that a low level of satisfaction, that is perceiving the rigid style as oppressive, will correlate with modification of planning style in the direction of flexibility. Likewise, a high level of satisfaction from interaction with rigid style will not correlate with modification of planning style toward flexibility. For the validation instrument, the difference in regression coefficients between treatment and control group will be measured. A pattern of regression coefficient differences is expected with the same amount of explained variance, reflected in the R^2.

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AN ALLOCATION DECISION-MAKING MODEL

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This paper describes and examines a method of representing in a computer simulation model the decision-making process used in selecting goods.

The model can be better understood in the context for which it was originally developed. The Department of Health, Education, and Welfare is responsible for the management of a program that donates surplus Federal personal property for use in education, public health, and civil defense. HEW's principal function in this nationwide program is to allocate surplus property as it becomes available from various Federal sources. Allocations are made to State agencies for surplus property on request. These agencies in turn distribute the property, as requested, to the schools and health institutions within their State. The State agency has a free choice of property, both in quantity and in kind, subject to availability and competing demands. Its operations must be financially self-supporting. Even though the property is donated, the State agency bears the cost of transportation, warehousing, clerical support, and returns of uncalled-for property.

Client institutions support the program by paying service charges to their State agency for goods received. These service charges are the sole source of revenue to the agency since it is not supported by tax appropriations.

Figure 1 shows a general model of the allocation process indicating the relationship that exists between State agency and the HEW allocator. The decision-making criteria and the manner in which they are applied by different requesters under different circumstances are the principal focus of this paper. For the purposes of this simulation, the allocator exercises no human judgment, but applies a prescribed allocating rule or algorithm appropriate to the situation. Property offerings are constructed in the model by generating from real-life frequency distributions each of the six essential characteristics of property. These are: kind; condition; value; weight; quantity available; unity of measure.

In operating the simulation model, property offerings are generated in succession for a sufficient number of times so that inferences and conclusions drawn from the means and distributions are statistically valid within desired confidence limits. There are sixteen requesters in the model, representing the gamut of independent characteristics felt to have the greatest effect on selection decisions. These characteristics are: the aggressiveness of the requester in terms of varying propensity to request property of marginal utility or condition; the requester's resources, which will temper or bolster his acquisitiveness; his proximity to his sources of supply, since distance translated into transportation cost represents his largest single item of cost; his entitlement share which constitutes his idealized "fair share." In the present panoramic model design, each of these four characteristics is represented at two levels, thus yielding sixteen possible combinations. These sixteen requesters approximate the spectrum of all real-life requesters.

The overall selection process is shown in Figure 2. The hypothesis that selection criteria are applied in succession is implicit in the model. The hypothesis further suggests that decision criteria are applied in inverse order of importance. "Importance" in this context is a value judgment made by the requester based on his assessment of the consequences. A rank order of criteria will ensue. It is further suggested that decision criteria may be applied in groups rather than in individual sequence. If there is more than one criterion in a group, the decision to accept, reject, or accept provisionally, for further examination, is deferred until all criteria in the group have had an opportunity to be applied. The weight of criteria within a group will vary according to the circumstances. Any one criterion therefore may attain overriding importance if its value at the moment attains exceptional weight, swamping the effects of the other criteria. A corollary is that groups tend to grow larger in numbers the further down the priority scale of importance they find themselves. As a consequence, this suggests that the more the total number of criteria that have to be invoked and applied to the decision, the more the outcome of the decision approaches the toss of a coin.

These propositions will now be examined in some detail in the design of the property selection model. Although the decision-making process is described here in terms of property selection, it is felt that the model is generalized enough to apply to many other selection processes such as buying clothes at a department store or recruiting candidates for a job, substituting, of course, different appropriate criteria.

In the present model, by far the most important single criterion is the degree of utility that the property offering has to the prospective acquirer. Utility itself, without consideration of any other quality that the property may have, is a purely subjective value judgment unique to each selector. Thus surplus arctic clothing, for example, may have very high utility to Minnesota with its icy weathers, whereas it is of no utility at all to Florida. The judgments of utility of course will vary from one requester to the other. It is felt, and so reflected in the model, that these judgments are primarily affected by the individual requester's aggressiveness, as defined for these purposes. If the history of each of their classifications of property examined were to be arrayed, they would appear typically as in Figure 3. Assuming consistency of behavior, this would provide the basic frequency distribution needed to generate (by uniformly distributed random number) the particular classification assigned for that offering by the requester. The requester can now apply this newly developed information as the first selection screen. The probability of each of the three possible decision outcomes is indicated on a scale of 1 to 100 in Figure 4, varying according to aggressiveness of the requester. Consistent with experience, the "reject-outright" zone becomes larger, and the "accept-outright" zone becomes smaller as utility diminishes from high to low. A random number determines the exact outcome in each case as before. If the offering survives the examination with a tentative acceptance as the outcome, then the second criterion group is applied. In this case, it is found in the combination of utility and condition. Its reach is shown in the three-dimensional array of Figure 5. This one is typical of Requester #1 who is the most aggressive and has the largest resources. The zones of outright rejection and of outright acceptance are as shown. As may be expected, the higher the utility and the better the condition, the greater the probability of an outright acceptance. The opposite is also true. For those requesters who are conservative by nature, or whose smaller resources compel them to be careful as to the consequences of a poor choice, the outright rejection zone would be proportionately larger and the outright acceptance zone would be correspondingly smaller.

If a selection has not been made after applying the second group of criteria, then the third group will have to be brought to bear. The three members are: profitability; entitlement status; and level of inventory of the kind of property being examined. The inventory level incidentally may be expressed in either physical space available, or in terms of dollars invested in that particular class of property.

The three criteria in this group were selected by consensus to rank equally next in importance after utility and condition. To reflect their influence in the model on the decision outcome, a universal scale is constructed. The x-axis is graduated from zero to 100, positive to the right and negative to the left. The y-axis is scaled from zero to 2, upwards positive and downwards negative. This represents a subjective and relative desirability score assigned by the requester. Thus for profitability (see Figure 6) an aggressive requester calculating a profit of 50% above break-even, would assign a positive desirability score of 1.2. Conversely, he would be disposed to accept a loss of as much as 20% on the transaction without allowing that much of a loss to deter him from asking for the property if other factors seem to be advantageous. By contrast, the conservative requester will demand a higher degree of profitability for a given level of desirability that he may be induced to attach to the offering. Furthermore, he will tolerate an expected loss of no more than 10% before deeming the item totally undesirable.

In a fully detailed model each individual requester would have his own characteristic set of curves, reflecting the history of his past behavior in applying these criteria over a large number of decisions.

The entitlement status of a requester is the percentage under or over of his "fair share" that he has attained at the moment (Figure 7). The aggressive requester is relatively indifferent to the importance to this criterion as long as he finds himself at, or comfortably above, 100% entitlement. Only when he is quite low compared to where he should be does he allow this factor to attain significant influence in urging him to make an affirmative decision on an offering. The conservative requester, on the other hand, is much more sensitive to deviations from the ideal of 100% as can be seen from the curve.

The status of the inventory of the kind of property under examination is affected more by the resources of the requester than by his temperament (Figure 8). The requester with large resources does not allow himself to be deterred from requesting the offering merely because the inventory level is relatively high, i.e., above 50%, at least not until he is crammed to overflowing. With his large resources, he can afford a policy of replenishing vigorously as soon as his stock falls below 50%. On the other hand, the requester with more modest resources cannot afford this affluence. He follows a more cautious policy of not replenishing until he is down to about the 25% mark. Conversely, when he reaches and starts to exceed the 75% mark, he becomes more and more cautious.

The net result of applying the three criteria individually may now be obtained. The individual desirability scores are summed arithmetically (see Figure 9); the resulting score determines the outcome depending where it falls in the acceptance zone. If a partial quantity results, the fraction to be requested is pre-related to the partial zone.

Two features of this procedure should be noted at this time: no decision is reached until <u>all</u> criteria have been applied. The sequence, therefore, in which they are computed is immaterial since each is assured its opportunity to affect the outcome. Secondly, the effect of a given criterion existing at an extreme value along its range, can be overwhelmingly strong. In contrast, when extreme values do not exist, the criteria are comparable in effect. This is consistent with real-life experience wherein for example, the presence of empty bins will induce a positive decision, notwithstanding, a low profitability that might be attached to that offering. The converse situation would also be true.

This concludes the description of the essential features of the decision-making model. It illustrates the method employed to bring all relevant factors to bear on the selection decision in proper relationship to each other, varying in degree according to the circumstances of the selection.

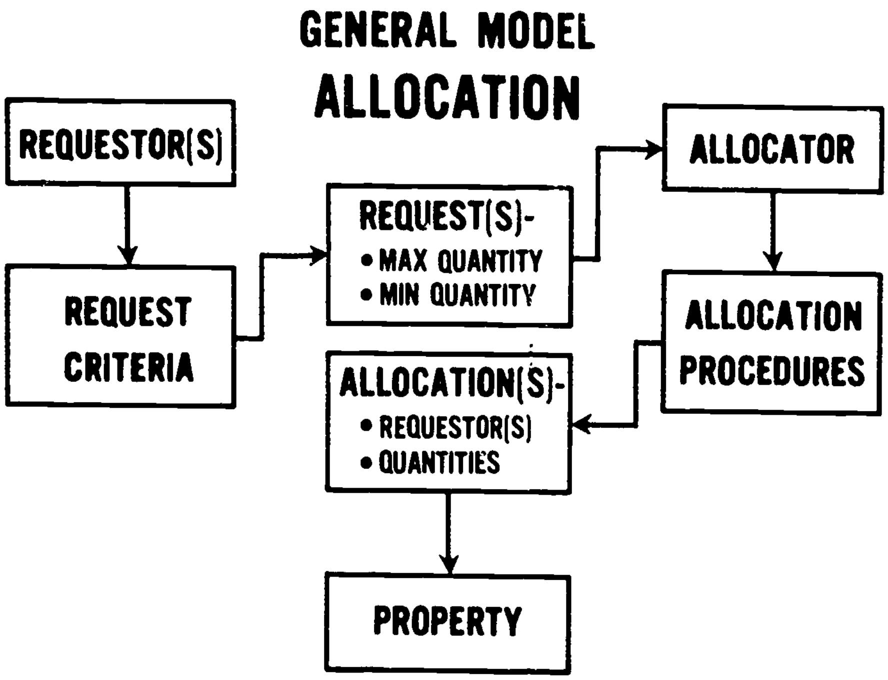

Figure 1 ALLOCATION FLOW

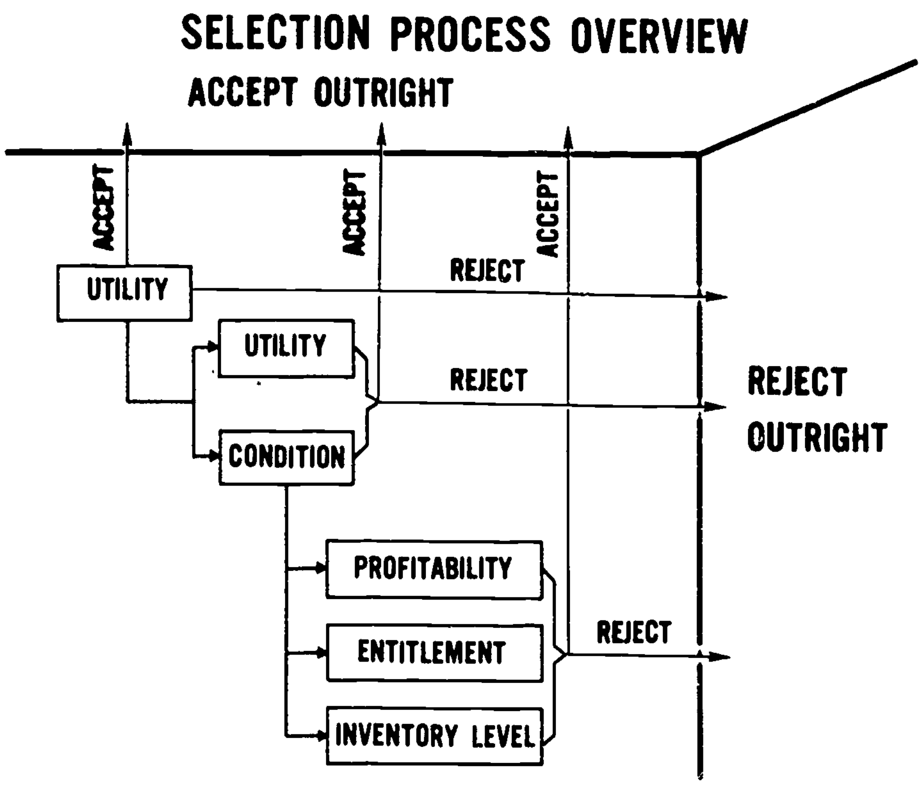

Figure 2 SELECTION PROCESS OVERVIEW

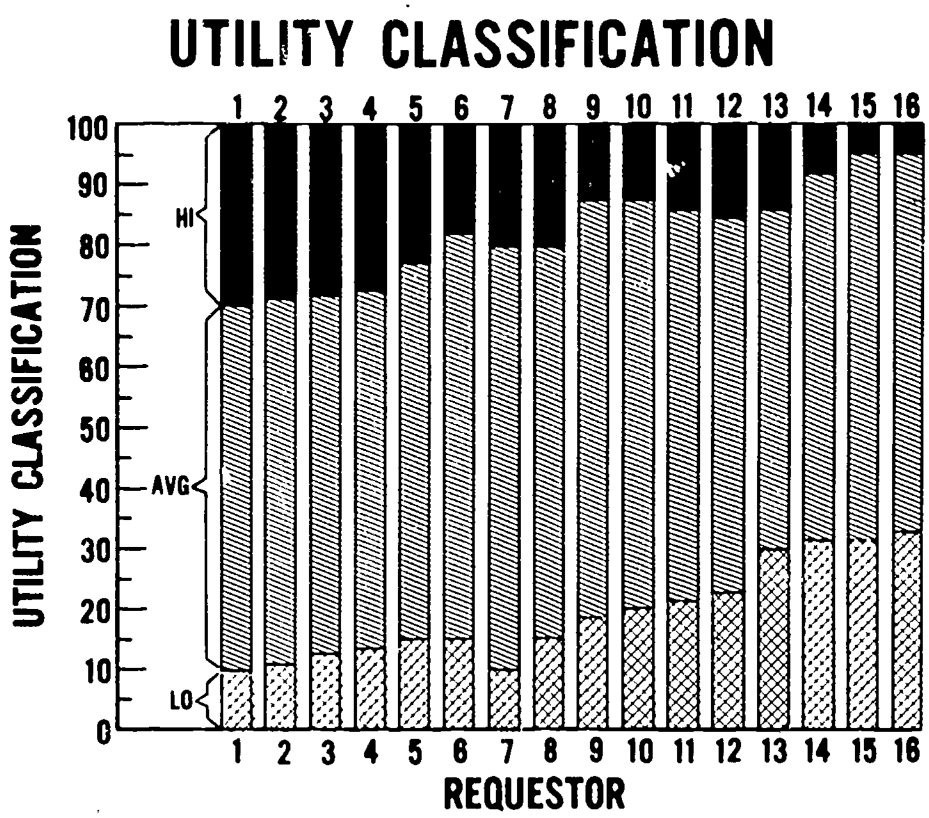

Figure 3 UTILITY CLASSIFICATION

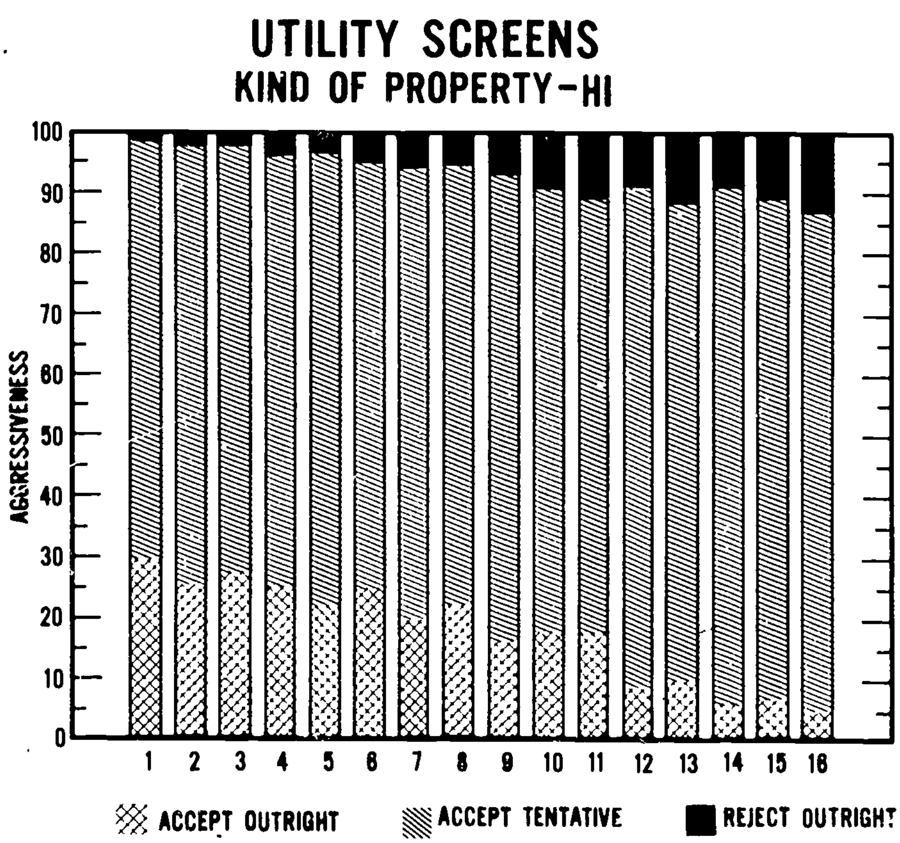

Figure 4 . UTILITY SCREENS

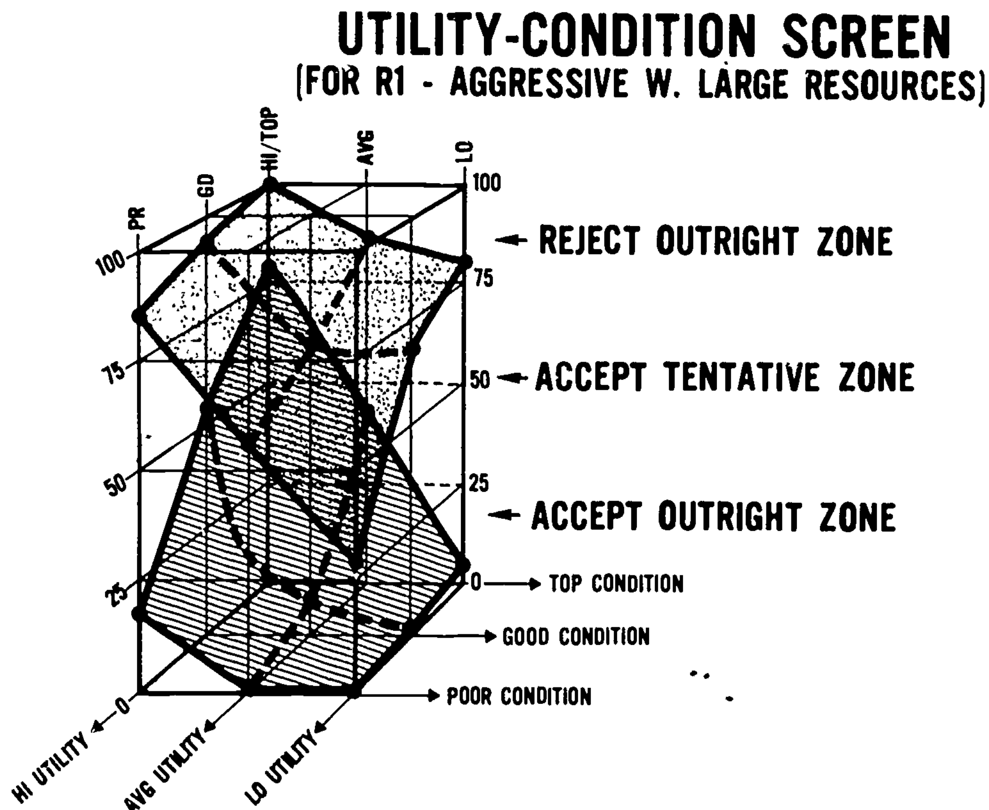

Figure 5. UTILITY/CONDITION SCREEN

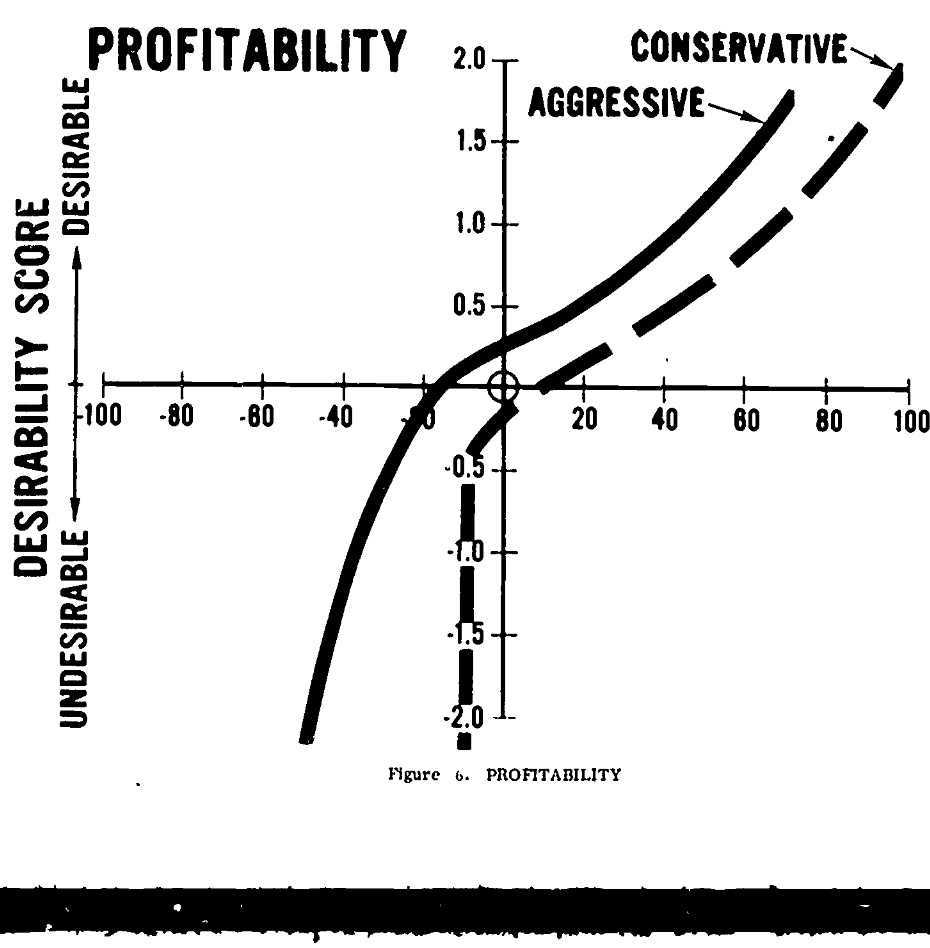

Figure 6. PROFITABILITY

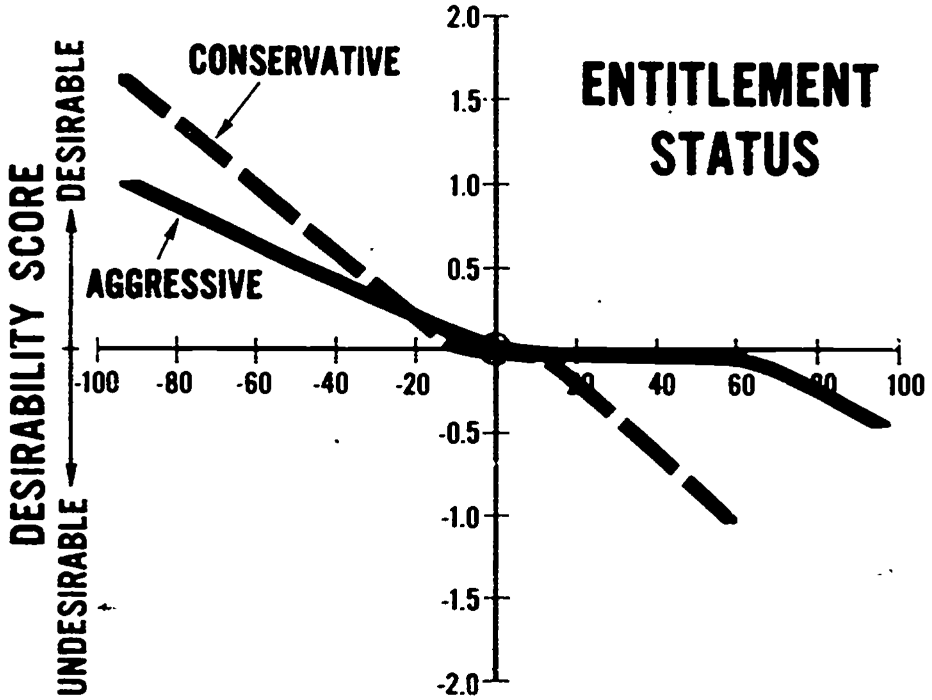

Figure 7. ENTITLEMENT STATUS

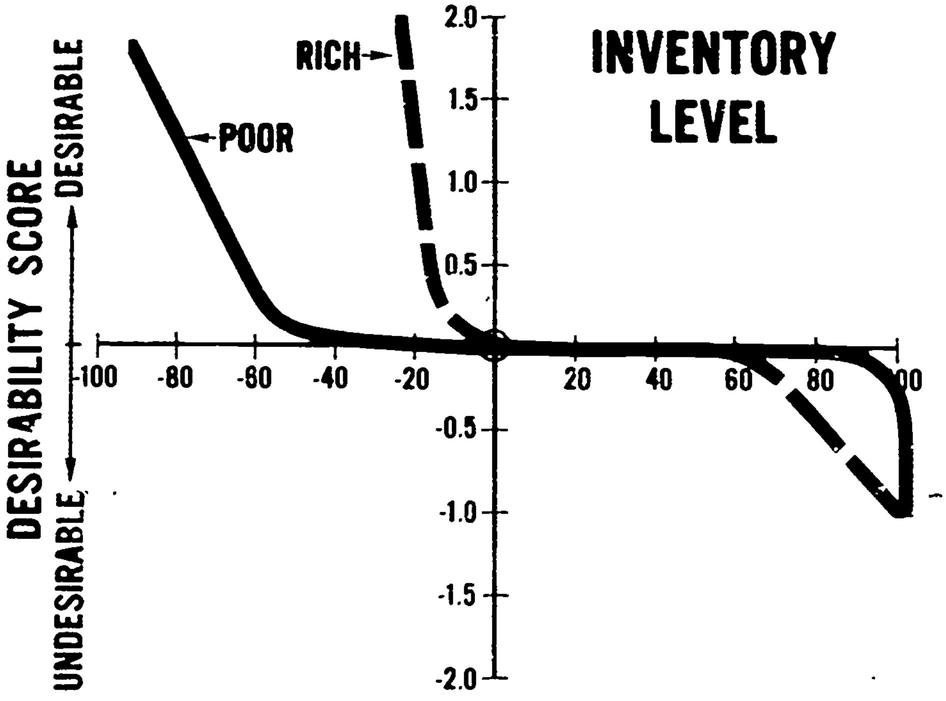

Figure 8. INVENTORY LEVEL

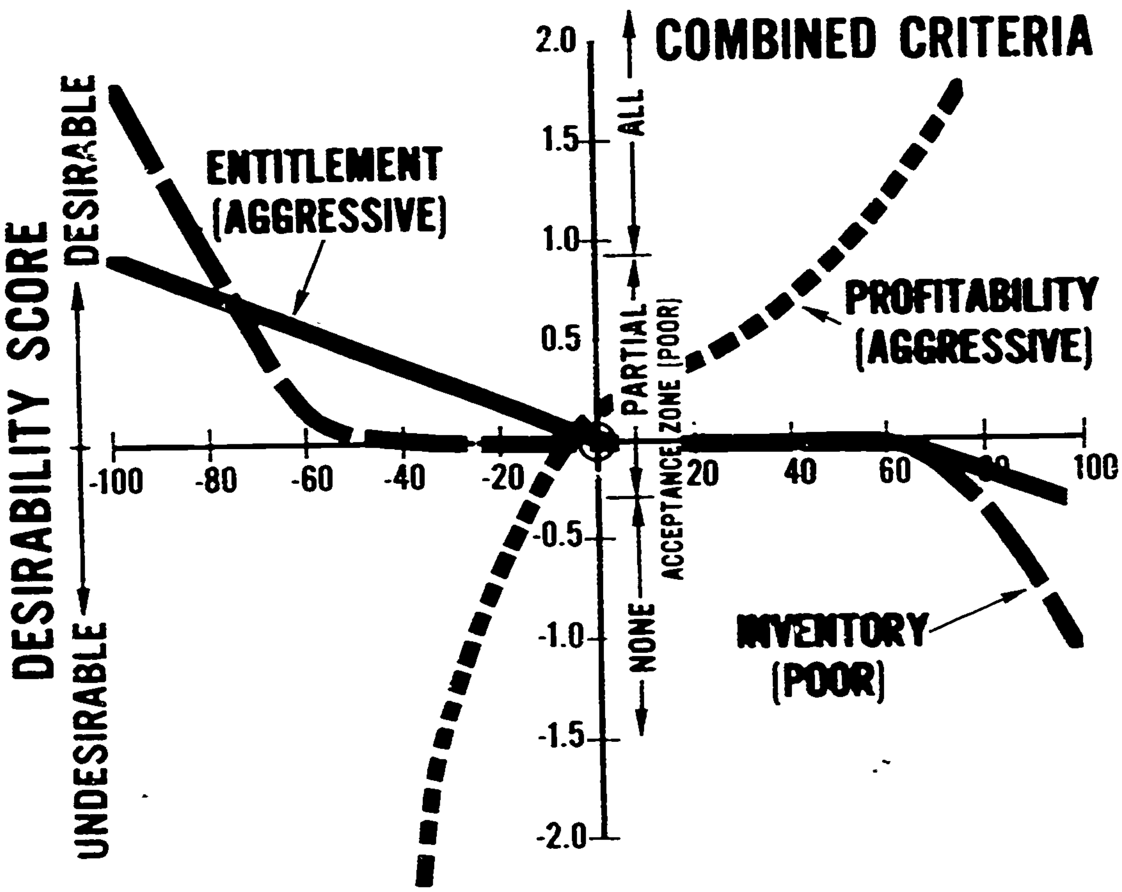

Figure 9. COMBINED CRITERIA

LEARNING GAMES AND STUDENT TEAMS: THEIR EFFECTS ON CLASSROOM PROCESS, STUDENT ATTITUDES AND ACHIEVEMENT

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The purpose of the present study was to investigate the independent and combined effects of a learning game and student teams on classroom process, student attitudes and achievement in mathematics.

Learning games are defined as activity structures in which the players (i. ., students) use a body of knowledge as a resource in competition with other players to achieve a stated goal (e.g., use vocabulary skills to place first in a class spelling bee). Such games have been used on an ad hoc basis by many teachers as a means of making interesting the dull task of rote learning. Allen and his colleagues have encouraged more systematic use of the technique by developing a series of learning games based upon a resource allocation model for teaching mathematics (EQUATIONS), word structure (ON-WORDS), set theory (ON-SETS) and symbolic logic (WFF'N PROOF). (See Allen, 1972, for description of the model and the various games.) The rationale for the efficacy of the resource allocation games as learning environments is that,

> "When the resources to be allocated...are symbols representing the fundamental ideas of a field of knowledge, the resulting activity can be a powerful instructional interaction. A learning environment can be designed to emphasize interacting peers creating and solving highly individualized problems for each other. In such a learning environment when they are imbedded in games as resources to be used, ideas tend to be voraciously pursued. Players have something to do with the ideas that they are engaged in mastering; they don't merely hear them or express them in print." (Allen, 1972:1)

In essence the games place students in a situation which includes an interdependent task structure and which actively involves them in applying the knowledge to be learned.

A unique feature of the resource allocation games is the tournament used to structure competition. Students of approximately equal ability compete individually in small groups of two or three players. A group hierarchy based upon ability is identified and, after each round, winners and losers in adjacent groups exchange places, with the winners moving up and the losers moving down. Thus, the probability a given student will receive positive reinforcement (winning a given game) is approximately one-third and the reinforcement immediately follows the appropriate student behavior. Both probability and immediacy of reinforcement have been shown to be critical factors in learning (cf. Skinner, 1969).

The second instructional technique investigated here, student teams, is highly related to games. Allen has suggested that teams be used as an integral part of his games (Allen, Allen & Ross, 1970). The rationale for using student teams stems mainly from the work of Coleman and others on adolescent subcultures (Coleman, 1959; Spilerman, 1971). Coleman argues that by structuring team competition in the classroom, peer forces can cause individual students to become more interested and involved in academic tasks, producing concomitant increases in achievement. DeVries, et al. (1971) found a normative peer climate more oriented toward academic involvement in classes using cooperative work groups as compared to students using individual study but no achievement differences were identified.

A second observed effect of student teams is increased student peer tutoring (Wodarski, et al., 1971; Hamblin, et al., 1971). When the reinforcement an individual student receives depends on his team's performance, it is to his advantage to increase the academic skills of his teammates via peer tutoring. The above mentioned studies of student teams have shown team reinforcement to be superior to individual reinforcement for creating student learning. However, the reinforcement was based upon a taken economy with material backup and did not involve interteam competition.

Recent research has provided evidence of the efficacy of the games-teams combination for learning (Allen, et al., 1970, Edwards, et al., 1972). However, no studies have investigated the independent effects of games and teams on either student learning or classroom process. The present study was designed to fill that vacuum.

Method

Subjects, Design, and Procedure

The subjects were 110 seventh grade students in four mathematics classes at an urban junior high school; 43% of the students were blacks and 47% were males. The experiment was a 2x2x3 randomized block design, with the three factors being task (games vs. tests), reward (team vs. individual), and ability (low, middle, high). The students were classified into ability levels on the basis of their previous quarterly math grade, with one third of the students in each ability level. They were then randomly assigned to task and reward conditions within ability levels. The resulting four treatment groups were almost exactly equal in average ability.

The four math teachers who participated in the study were two men and two women, and were all in their first or second year of teaching. The experiment lasted four weeks (twenty school days); the classes met for fifty minutes per day. At the end of the second week the teachers exchanged classes, so that each treatment group was taught by both a man and woman.

Experimental Treatments

The two levels of the task variable were identified as "game" and "tests." Students in the two task conditions received similar instruction for three days each week, but on Tuesday and Fridays, the "tests" groups were administered quizzes on the material they had been taught, while the "game" groups played the learning game Equations. This game requires the players to use a given set of digits and symbols (generated by rolling marked cubes) to construct algebraic expressions equal to a specified number. In each "game" classroom there were ten Equations games being played at the same time, with three students in each game. The students were initially assigned to game tables on the basis of their mathematics ability. After each day's play, the winner at each table exchanged places with the loser at the next higher table. This "bumping" procedure kept the game tables homogeneous in ability while taking into account new learning by the students.

The two levels of the reward variable can be identified as individual-reward and team-reward. The team reward classes were divided into teams of four students in such a way as to have a maximal variety of student abilities on each team, with all the teams about equal in average ability. Teammates were encouraged to help each other during practice periods, although each student performed individually on the game or the quizzes. A newsletter was distributed to the students on the day after each game or quiz. The newsletter listed individual scores, team scores, and team rankings, on the most recent game or quiz and (cumulatively) for the "season." The team-reward students were told their math grade would depend partially on their team score. In the individual reward classes the students were not divided into teams and the newsletters listed only individual scores.

Dependent Variables

Data were collected on three groups of variables: classroom process, student attitudes and student math achievement. Classroom process measures included:(1) classroom observations of student behavior during the practice sessions;(2) sociometric items on which students indicated what other students they considered as friends and which students they had helped or been helped by;(3) the Learning Environment Inventory (LEI), a student self-report scale of several dimensions (Difficulty, Satisfaction, Cohesion, Mutual Concern, and Competition) of the classroom climate.

Four student attitude scales were administered. The four-item scales measured the student's attitude toward: attending the class, receiving the newsletter, working with other students, and general interest in the class. Two math achievement tests were administered. One was a forty-item standard math test of skills with the fraction and decimal operations (both of which were taught during the four week period). In addition a divergent solutions test, especially designed to test the math skills required to play Equations, was included. Except for the classroom observation data, all measures were administered on the final day of the experiment.

Results

Classroom Process

The classroom observations of student behavior during the practice sessions were classified into two categories: "peer-tutoring" and "other." Significant effects were noted for both the task and reward factors ($p < .001$ for both) in the direction of creating more peer tutoring behavior. The sociometric choice data were analyzed in two ways. First, the mere number of students listed were counted. The reward factor affected significantly ($p < .01$) the number of students with which the respondents worked (the team reward students working with more of their peers). The same effect w. noted for the task factor, although with less intensity ($p < .05$). ther the reward nor task factors had a significant effect on number of riendships. The second mode of analysis for the sociometric data examined the number of cross-race or cross-sex selections. To summarize very briefly, significant reward effects were noted for both the cross-race and cross-sex selections. That is, students in the team-reward conditions worked with and considered as friends a significantly larger proportion of students from the opposite sex or from another race than did students in the no-teams condition. The task factor (i.e. games vs. no-games) showed no consistent effect on either the level of cross-race or cross-sex selection.

For the measure of classroom climate (LEI), the task factor revealed significant effects on three of the five climate dimensions, with the games classes viewed as less difficult ($p < .001$), less competitive ($p < .05$), and more satisfying ($p < .001$). Two significant main effects were noted for the reward factor with the team-reward classes being perceived as more competitive ($p < .05$), and as exhibiting more mutual concern ($p < .001$) than the individual-reward classes. One important task by reward interaction (for competition) was also observed. The interaction indicates that three of the four conditions had nearly identical levels and the no-games, team-reward students reporting a significantly ($p < .05$) higher level of competitiveness in their class.

Attitudes and Achievement

A consistently significant task effect ($p < .01$) was noted across all four attitude scales, with the games students being more positive towards their class. A significant ($p < .05$) and positive reward effect was noted for only one of the four attitude scales, namely the "general interest in the class" scale. No significant task or reward main effects were observed for the standard math test measure. A significant ($p < .05$) task main effect was obtained for the divergent solutions test, with the games classes scoring higher on the test.

Discussion

In general, introducing games into the classroom had the effect of creating a less difficult and more positively reinforcing classroom experience for the students. This, in turn, created more positive student attitudes toward the class and some performance improvement on a game skills-specific math test. The use of student teams, in contrast, had some effects on classroom process, but had no impact on either attitudes or math performance. Placing students on teams also created more helping among students, particularly among students from the opposite sex and/or different races. While both games and teams had a significant effect on the students, they created quite distinct changes in the classroom.

The games-teams combination had a more widespread effect on the classroom than did either games or teams. The class which was exposed to the combined treatment was characterized by greater social integration, greater student peer tutoring, an improved social climate, more positive student attitudes, and some increase in math achievement.

The lack of significant achievement differences on the decimal-fractions computations test seems due to the length of the experiment (4 weeks). The conditions for increasing achievement were created (peer tutoring, classroom climate, and positive student attitude). If the classes had been able to continue, presumably achievement difference would have emerged. A second study conducted by the authors supports this contention (Edwards, DeVries, & Snyder, 1972). In this experiment the games-teams combination (using Equations) was implemented in two seventh-grade math classes for a nine week period. Pre-test and post-test differences were compared between these two experimental classes and two control math classes. Significant differences were noted on three measures of math achievement, with the games-teams classes having greater gains on all measures.

The results of the present study lend support to the advocates of learning games with teams as teaching tools. However, much work remains to be done in evaluation of learning games. The effects of games and teams should be investigated for a variety of the learning games now available. Other relevant extensions of the current study would be an examination of the effects of length of time a game is used, as well as the level of intensity of its use (e.g. play once a week vs. once a day) on students.

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An Evaluation of A Simulation Combining Television and the Computer for High School Government Classes

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The purpose of the present study was to evaluate the effects of a simulation involving 900 senior high school students and combining the technologies of computer simulation and educational television.

WNVT/Channel 53 was going on the air March 1, 1972. After three years of planning, the new channel would offer a limited school broadcast service during the spring for the Northern Virginia Schools. Full school service would begin in the fall.

WNVT/Channel 53's official school representatives from its six school systems (since grown to nine) were eager to demonstrate that their new regional educational resource would be used in innovative and dynamic ways, in ways that were sound pedagogically but that would attract the attention of students, teachers, staff and the wider community.

School representatives identified the twelfth grade local government course as a curriculum area that could use additional resources. Choosing a simulation in local government involving students in the decision-making process was a logical outgrowth of the committee's deliberations.

A computer model simulating a three-jurisdictional system was available. The computer component added another dimension to the mix. Social Studies curriculum supervisors were enthusiastic about introducing the use of computers as a factor in social decision making for high school students.

Adapting a computer model, heretofore played in a single location in a highly compressed time span, to a television model covering 23 participating schools in a 2000 square mile area was a heady and risky undertaking. To mount a major production effort as a first venture with a station still installing equipment compounded the risk. The following is a report of the results of this undertaking.

Method

Sample. The sample consisted of approximately 900 twelfth grade students from 23 high schools in five counties of Northern Virginia. All were enrolled in local government classes in their schools. Only the above average students in each school were chosen to participate. The selection process presented problems in terms of identifying comparable nonsimulation groups against which comparisons could be made. Within a given school a nonsimulation class taught by the same teacher as the simulation class was sought. If none were available, then a government class taught by another teacher in the same school was obtained. In all only eight such "control" classes could be identified. Of these only three returned both pretest and posttest questionnaires.

Design. The evaluation design involved obtaining pretests and posttests from the simulation participants and then obtaining similar data from comparison groups which were exposed to "other" nonsimulation instruction. No attempt was made (nor could be) to specify of what the "other" instruction consisted. The aim was simply to gather data from nonsimulation students which would provide a basis for evaluating pretest-posttest changes observed for the simulalation participants.

The Simulation. The Tri City simulation is a derivative of Environmetrics City model. In playing the gaming model, users participate in a hypothetical three-jurisdiction urban system. They make all the decisions at the local level that affect city operation, growth, and change. That is, the participants, in becoming the decision-making elements in a simulated three city system, make the private and public decisions that cause cities to function.

As in the real world, game participants have control over a number of resources (time, energy, intelligence, money, power, and influence). They use these resources to achieve goals they set for themselves. No participant receives an explicit score-card on how well he performed, but there are implicit indicators telling him how successfully he achieved his self-established goals. For instance, a person attempting to maximize economic profit receives a balance sheet and income statement at the end of each simulated year. Whether or not he earns maximum profits may measure his success for him but not necessarily for anyone else.

The importance of this point should not be overlooked. TRI-CITY is an open-ended game. While players are assigned roles as "bureaucrats," "social advocates," "entrepreneurs," etc., and are members of economic or social or governments teams-they are assigned neither personalities nor goals. These they choose for themselves. This makes for highly individualized experiences within the play of the game. These differences in perception are analyzed and highlighted during the all-important debriefing session.

The participant in the TRI-CITY makes decisions as an individual player, as a member of a team, as part of the local urban system. His personal resources as an individual player are time, energy, and intelligence. His team resources are money, land holding, and political power. As part of the total system, a participant can influence system-wide decisions.

Computer Decisions

Although the computer is used primarily as a bookkeeper, it also makes two types of systems decisions: those for the national system as it affects the local system, and those for the local system that would be too burdensome or routine for the players if they had to make them.

As public decision-makers, teams may:

1. Raise local taxes from various sources (property, sales, net income).
2. Receive Federal-State aid (by department).
3. Draw up a county budget and vote on it.
4. Appropriate funds for operating departments for current capital items.
5. Grant subsidies for special projects.
6. Purchase land for public use.
7. Construct municipal service units (which represent hospitals, police and fire stations, etc.).

8. Maintain municipal services.
9. Hire and assign municipal service employees.
10. Build utility plants and extend utility lines.
11. Construct and maintain schools.
12. Hire and assign teachers.
13. Build, upgrade, and maintain roads of various capacity levels.
14. Build and upgrade terminal facilities.
15. Purchase parkland.
16. Zone land and change zoning.
17. Appeal zoning changes.
18. Hold referenda for bond issues.

System-Wide Decisions

The teams, as a group, may pursue a variety of system-wide objectives in the play:

1. Experiment with comprehensive planning.
2. Build the "City Beautiful", whatever that means to them.
3. Plan and operate new towns.
4. Operate a Model Cities Program.
5. Establish a welfare system.
6. Create a public housing authority.
7. Establish and enforce a legal structure.
8. Alter the normal rules of play to suite other system-wide objectives.

The method of, or purpose for, system-side actions is entirely up to the players.

Adaptation to Television

Each of the 23 participating schools was assigned either an economic or a social role. In addition, each school appointed five governmental representatives, and one newsman to attend weekly government sessions at WNVT/Channel 53 studios.

Although each school belonged to one of three political jurisdictions, it had economic or social interests in other jurisdictions as well as its own. This realistic complication was one of the most difficult to comprehend, but it also created heated interaction among the jurisdictions.

At WNVT/Channel 53 studios, the three governments met in strategy sessions for three hours each Monday morning. Social advocates petitioned councilmen for more growth, or for no growth, for a satellite city, for more low-cost housing, for zoning easements to encourage industrial development, for tax assessments to discourage industrial development, for better roads, better schools, higher income, the gamut, that is, of typical local pressures on typical local governments. Lobbyists took councilmen to lunch: councilmen held secret sessions to evade the press; classrooms arrived en massee with picket signs to protest taxation without representation, or to plead for a Culture Center. The press acquired a nose for news (called 'snooping' by council members).

Following the morning sessions each council met in front of the cameras for forty minutes for public deliberations. These three forty-minute deliberations were videotaped in toto. Then the Broadcast Journalists took over.

The Broadcast Journalist roles were a unique adaptation of TRI-CITY to the television medium. Auditions were held from which six high school students (two from each jurisdiction were selected.

Immediately after each forty-minute session two Broadcast Journalists replayed and analyzed the video-tapes which had been simultaneously taped on 1/2" VTR's. From these playbacks the students made all editing decisions, reducing the total two hour broadcast (i.e., forty-minutes times three jurisdictions) to a half-hour edited version, selecting those portions of the council sessions they felt to be most significant and important to classroom participants. The final version included summaries and analyses by the same journalists who got on-the-job training in script-writing and news announcing. The half-hour edited tape was broadcast on WNVT/Channel 53 on Tuesdays, back-to-back from 7:00 a.m. to 5:00 p.m.

Quite naturally, charges of "distortion" were occasionally hurled at the broadcasters. This was an anticipated peripheral learning experience, real, rather than simulated.

Television became, then, a tool in the hands of the students. It provided classrooms with a sense of participating in something larger than their own classes and gave classroom students an opportunity to know the students from other schools. In addition, those who came in the studios learned something to about the mechanics of television, a valuable 20th century experience.

Because of the geographic spread of the participating schools preparing and delivering the computer out-put in time for classroom analysis and study on Wednesday was a major logistical maneuver. A key revision in a repeat will be to slow down the processing of this vital game component. Game operators were under crushing pressure to process the decisions between Monday at 4:00 p.m. and Tuesday at 6:30 a.m. This unreasonable burden can be lightened by careful planning in the future.

Measurement

The evaluation questionnaire was based primarily on the research by Lee and O'Leary (1971) with INS. These researchers had found that the greatest impact the simulation had was on attitude and personality and not in the area of cognitive skills. Other research with simulation games have shown attitudinal change as the major outcome of such experiences (cf. Livingston, 1972).

The attitudes measured by the questionnaire included: political efficacy, political cynicism, tolerance of ambiguity, trust in people, appreciation towards complexity of local government, attitudes toward log-rolling, and attitudes towards politicians. The first four scales were taken from Robinson and Shaver (1969) and the log-rolling scale from Livingston (1972). The remainder were constructed by the author. All responses were given on a 9 - point Likert scale.

In addition to the pre- and post-test questionnaire, a weekly evaluation form was filled out on Tuesday and Friday by students in class. The purpose of these in-process measures was to obtain data on the quality and importance of television to the total activity.

RESULTS

Perhaps the most significant point that can be made in reflecting on this large scale project is that it worked operationally. The logistics and management problems associated with such an effort led Dr. Peter House, the designer of Tri-City, to suggest that the WNVT/53 be given the Cecil B. DeMill award for their efforts.

The results of the questionnaire evaluation were not as successful. Only 10 of the 23 schools involved returned both pre- and post-test data for at least one class; data for 3 "control" classes were also obtained. Statistical comparisons of pre- and post-test means within each of the classes revealed almost no significant changes. The few that were obtained could readily be attributed to chance. However, a significant nonresult in terms of political attitudes is worth noting. None of the simulation classes became more negative as a result of the simulation. In fact, the trend of the changes observed was for the simulation classes to become more positive toward politics and for the "control" classes to become less positive. (The three control classes covered units on local governments.)

Data obtained via the weekly questionnaires designed to yield information on the contribution of television to the total effort led to the following conclusions. First, the TV broadcasts on Tuesday were considered by the students as one of the more important activities during the week. However, the reason for the importance of television changed over the five weeks of the simulation. Initially, the TV broadcast were judged to be important both for a sense of involvement for classroom participants and for providing information for decision making. For the latter, the TV braodcast decreased in importance over the duration of the simulation.

Informal evaluations of the simulation experience by students were quite positive and emphasized the advantage of actually becoming involved in running a local government. An overwhelming majority of both students and teachers indicated that participation at WNVT in the television sessions was a major factor in maintaining interest in the simulation. As a result, in future game plays it would be arranged for increased attendance at the studios in some kind of rotating basis.

Side benefits as a result of the simulation were the cooperation fostered among participating schools, cross-school student interaction, and exposure to the use of television and computers for social studies.

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EVALUATING CLASSROOM SIMULATIONS AND GAMES FROM A CONSUMER VIEWPOINT

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The need for more systematic procedures in evaluating classroom simulations and games has been frequently acknowledged but seldom heeded. Until recently, most of the instruments appropriate for evaluating classroom simulations and games were those which had been developed for specific experimental research studies. The bulk of these instruments, however, were specific to particular simulations or games and were not generally applicable in other instances. Following Stufflebeam's (1971) concept of educational evaluation, the methodology of experimental design is but one component in the methodology of evaluation. In this respect, systematic evaluation of classroom simulations and games necessitates the accumulation of a variety of evidence other than that provided by experimental design.

Pioneer efforts toward more systematic procedures for evaluating classroom simulations and games were made by Stadsklev (1970). He recognized that the ever-increasing availability of commercially produced simulations and games was creating decision-making problems for school personnel. Stadsklev's "Game Analysis System" facilitated the evaluation process for school personnel by presenting the evaluator with a series of criteria to be rated on 11-point scales.

Building upon these ideas, Henderson and Gaines (1971) developed a 39-item "Simulation Evaluation Form" that employed partial branching so that distinctions between simulations and games might be observed. Their instrument was organized around criteria of time, space, cost, applicability to existing curricula, prerequisite learner behaviors, and degree of attainment of objectives.

A somewhat different approach to the problem of evaluating classroom games was proposed by Gillespie (1972). Her system was based on a careful analysis of the parts of a game--problem, choices, moves, rules, organization, and conclusion. Specific criteria were drawn up and applied to each game part along with guiding questions. It is interesting to contrast Gillespie's system with that of Henderson and Gaines since each tends to emphasize different aspects of evaluation methodology. Gillespie's system might appropriately be characterized as an "internal" evaluation, analyzing the inner-workings of the game. On the other hand, Henderson and Gaines' system might best be characterized as an "external" evaluation, focusing on external factors such as cost, ease of use, and so forth.

The purpose of this paper is to report on the development of a new evaluation system (Gaines, 1972) which represents an extension of the previous work of Henderson and Gaines. The new form, "A Guide for Evaluating Classroom Simulations and Games,"[1] incorporates some of the categorical headings suggested by Glass (1972) in his prototype format for evaluating educational products. It needs to be noted that Glass' prototype format is rather general, and properly so, since it was designed to be used in evaluating any educational product. The form described in this paper, however, is specifically geared to one type of educational product, the classroom simulation or game.

"A Guide for Evaluating Classroom Simulations and Games" consists of seven categorical headings or sections.

<u>1.0 Description of Simulation/Game</u>. The first section serves primarily as a means of identifying the simulation/game with respect to its title, author, intended audience, and so forth. No evaluative decisions are built into this section although the identification of the intended audience might well be an influencing factor if it were markedly dissimilar to the audience the evaluator might have in mind.

<u>2.0 Clarification of the Role of the Evaluator</u>. The aim of this section is to assist the evaluator (and those who may read his subsequent evaluation) to establish the frame of reference within which he will be operating during the evaluation. The evaluator first lists irreversible decisions or those which are beyond his immediate control, then the reversible decisions or those which are within his power to make.

<u>3.0 Goals Evaluation</u>. This section requires that the evaluator carefully examine the simulation/game for explicit and implicit goals or objectives. Additionally, the evaluator must determine whether or not these goals are worthwhile for his purposes and if there is any evidence that indicates the simulation/game is likely to reach its goals. The questions in this section are branched so that particular responses are met with a "caution," "reject the simulation/game," or "proceed."

4.0 Alternatives to the Simulation/Game. At this point the evaluator may have already decided to reject the simulation/game. If so, then the evaluator should proceed to the last section which deals with recommended actions. On the other hand, if the evaluator has cleared the simulation/game on the preceeding section, he should then list any reasonable alternatives to the simulation/game. Thus, the evaluator needs to consider other means of reaching the same ends as those of the simulation/game. These alternatives, if any, will be subjected to the cost analysis along with the simulation/game itself.

5.0 Cost Analysis. This section helps the evaluator to estimate the various costs of the simulation/game, namely, instructor time, student time, hardware, and software. As a result of working through this analysis the evaluator must consider these cost factors in relation to his limitations in time, facilities, and budget. If alternatives were identified in the previous section, these too should be subjected to the cost analysis. This would allow the evaluator to make relative judgments regarding their cost-effectiveness.

6.0 Intrinsic Evaluation. This section, perhaps more than any other, requires that the evaluator carefully examine the simulation/game. The first criterion under intrinsic evaluation deals with the technical clarity of the simulation/game's instructions to the teacher, rules, and procedures. Next, the entering behaviors required of the learners are catalogued. Finally, the continuity and validity of the learning experiences provided by the simulation/game are evaluated.

7.0 Summative Judgments. The final section involves a recapitulation of the major strong points and weak points of the simulation/game. The last item asks the evaluator to state his recommendations for action.

In sum, the evaluation of a classroom simulation or game requires that many types of evidence be systematically collected so that decision-making can be carried out in an orderly fashion. In an evaluation it is important to collect evidence regarding a product's goals, rival alternatives, costs, and intrinsic merits.

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FOOTNOTE

[1]A copy of this instrument may be ordered for $1.00 (cost of duplication and mailing) from the author, Department of Elementary and Secondary Education, Louisiana State University in New Orleans, Lake Front, New Orleans, Louisiana 70122.

REALISTIC ENVIRONMENTAL PROBLEM SIMULATION

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REALISTIC ENVIRONMENTAL PROBLEM SIMULATION (REPS) is an indirect outgrowth of SIMULEX II, A Procedure for International Simulation prepared by the Department of Political Science at the University of New Hampshire, in conjunction with the New England International Studies Association and the New Hampshire Council on World Affairs. Modifications of SIMULEX II were made by staff members of the University of New Hampshire working under a contract with the Institute for Environmental Education. They developed a role simulation for a watershed problem in the Contoocook River Valley. Under the contract, the simulation rules were modified and the preparation required for the simulation was made and certain materials were published. Several role simulations have been conducted in environmental problem areas subsequent to the Contoocook River Valley simulation. These simulations have lead to development of a process for the selection and development of the problem, thus a research process has been enhanced and procedures have been tried out which enable a recap following the simulation. This document represents the state of the art in REPS.

Before moving to the details of role simulation, it is important at this point to differentiate between role simulation and games. The two have many similarities, however, several differences do exist. A more comprehensive statement might be that there is a continuum of types of games and simulation; some games closely resemble simulation and vice versa, whereas others are very different. The following paragraphs highlight some of the differences and similarities.

Both are similar in that they have rules. Rules provide for timing, actions, the evaluation of actions, a record of actions, and final results. The devices necessary to carry out the rules are often very different, however, essentially they are there. A second similarity exists in that control personnel are required to manage defective games or role simulations. These similarities account for the major aspects of such enterprises.

The differences deal with more detailed aspects of games or role simulation. The subject material related to games or REPS is in contrast. Games are hypothetical in nature and role simulations are real. The dealings which are carried out among players varies also. In games, the dealings are carried our usually indirectly from one player to another, that is to say, the record of the player actions is usually something such as a board or wall chart or a physical entity of some sort. The players, therefore, deal with the physical entity and through it, each other. In REPS action is taken through communications, which provide for a direct dealing with other players. The record of dealings is maintained as a subsidiary concern. Therefore, the status of a role simulation may be in doubt at a given time because a physical entity such as a board or chart may not be observed readily to determine the relative positions of all players or teams. This in itself is closer to reality than a chart or board. The timing in games and REPS also is in contrast. In games, the amount of time required for moves or between moves is not considered to be of great importance usually. In contrast, in a REPS, the timing of the game relative to real life is in a particular ratio; for example, one month in real time may be simulated as ten minutes or fifteen minutes during the REPS. Another area of contrast is in the preparation to participate in the game or REPS. Usually in playing games, the background, hypothetical in nature, is easily assimulated, that is to say, brief description and the rules of the game determine how a player plays. In contrast, a great deal of research is required to play a role in REPS.

REPS has many educational merits. These merits are not exclusive to REPS, but they certainly do provide an exciting combination. It should also be noted that the merits are expressed from the students' point of view. One of the things that impresses and motivates the students most readily is the fact that they are participating in a study of something that is real. A correlary to this is that they have helped determine what it is that they are going to study. Secondly, the study is inter-disciplinary in nature. In fact, it is often very difficult to identify the various subject headings that a student is pursuing at a given time because the combinations found in real problems are very complex. Another merit of the program is that the teacher can learn along with the students. Very often teachers in normal situations are handicapped by the notion that they must know everything that the students are to learn. Experiences related to REPS indicate that perhaps this notion is neither desirable or necessary. One of the greatest examples that a teacher can provide to students is the teacher in the process of learning. The students are allowed to work under a variety of conditions and circumstances while pursuing the various aspects of a REPS. They, of course, do a lot of their research as individuals, however, when they are participating in the simulation they work as teams, and as their ability and confidence increases with their team, they learn how to listen to other people while motivated by a desire to contribute. In this process of interaction, the students learn also to compromise. In fact, they spend a great deal of time doing this to establish a position for their team. Since the simulation is carried out by sending and receiving messages, communication is emphasized. At first, messages are sent at a very brisk pace, the communicators concentrating on what they want them to know and do. Usually, they pay very little attention to those messages they are receiving. In 30 minutes of unlimited message sending and receiving, students quickly realize that others do not understand what it is the students wish to have them understand. At this point, the students develop a very serious and purposeful attitude towards helping others to understand what it is they want the others to know. During the research phase, the students become aware of the many skills required to solve problems. As the simulation progresses, they understand the importance of having the skills. Perhaps, one of the most important outgrowths of the simulation is that the students are allowed to determine that they have to acquire skills to solve problems. Once a student has determined that he has a need to develop skills to deal with the realities of life, his capability for growth is greatly enhanced. He is very willing to amplify his own powers by pursuing broad and diverse cultural objectives.

An interesting by-product of the simulation which was not originally envisioned is the understanding of cognitive and affective domains and their relationship. A great deal of emphasis in education today persists in the cognitive area while the affective areas are somewhat shortchanged. Once the student has a significant exposure to REPS, he perceives the importance of considering objectives in the affective domain, that is, he sees the significance of many aspects of his life style as it is developing and as it is being modified.

This report is divided in several sections. Each section involves a process and product. The first section described the selection of the REPS, and how the background is developed for that REPS. The second section contains the rules for the simulation and descriptive material on the control and participation roles. A broad variety of circumstances may be dealt with effectively. REPS have been completed in as little time as one day, and on the other hand they may take as long as a month and a half. The options which exist based on our experiences are explained in this Appendix.

SELECTION

The REPS on the selection of a proper subject. Many factors enter into the selection process, but the most important single factor is the interest of the participants. Therefore, the subject or problem to be considered for the REPS must be something that interests the participants. At this point, we have not had any REPS that have failed because of a poor subject or problem selection. The problem usually enlarges itself to fit the number of participants and the maturity of the participants. It would probably be difficult to select a problem which could be simulated by less than 15 students if the problem is to be covered satisfactorily. So, it is fairly difficult to choose a problem that is too small. Because the selection process requires a compromise on the part of all individuals involved, it probably is worthwhile to consider the selection for a period of time. It would be unwise to introduce the subject with a few moments notice if the participants did not have a basic awareness of their environment. That is to say, you can't spring a problem on a relatively unsophisticated audience.

From the following two examples, the reader should be able to get a feeling for the selection. A land use problem which was to be studied for approximately two weeks on a full-time basis by 20 people was selected over a period of about three days. Only four or five people participated in the selection process, however, those doing the selection had a broad experience and students and teachers were both represented. The most rapid selection process experience thus far took approximately 20 minutes. Ten teachers in a one day in-service program selected an environmental problem for study which the community was well aware of. In fact, it was a focal point in the local press. The selection of this particular problem was a natural for the group. These examples represent a wide range of approaches to the selection process. One that might occur more frequently would be to briefly, in a matter of minutes, introduce the idea that people can play roles to simulate an actual problem, and then ask the students to spend some time discussing with their parents a problem that might be important to the community in the area in which they reside. The following day, a class period could be devoted to discussion of the types of problems which were brought out by the parents and students in discussion the previous evening. Those items which the students are most enthusiastic about would be the items to pursue. Often, the items brought up in discussion represents facets of a larger problem.

Usually the items discussed are symptoms of the real problem or are phenomenon that may be readily observed at very low levels of awareness. If the topics can be narrowed down in a day's discussion, further thought might be devoted to the problem at the next class meeting after the students have had an opportunity to further discuss the selection with their parents.

There appears to be a risk factor at this point on the part of the teachers. Whenever discussions not based on lesson plans or text books develop in classrooms, the teacher runs the risk of not having very much information on the subject at hand. A teacher might feel this is risky business, however, it represents one of the best opportunities for student's to see someone thinking on their feet or better still, it represents an opportunity for teachers to learn from students. This occurs more effectively when teachers are listening.

The selection process continues as the symptoms which are observed are translated into a set of causes which begin to define an environmental problem. At this point, the discussion should turn to who is causing the problems. An effective way to handle this is to simply list those people or functions which are causing the problem. If it could be determined that a person or organization is allowing a problem to develop or to continue to exist, then the group should look to see who allows that person to continue doing the wrong thing. As the discussion continues, more and more names of people, jobs that people perform and organizations that control the things that people can and cannot do will appear.

When it appears difficult to obtain more names or description, let the discussion turn to classifying those items which appear on the list. Usually four or five major classifications emerge. These majro classifications represent the teams that will participate in the REPS.

ORGANIZATION AND RULES

The basic organization is shown in the figure below. Five functions are performed by a control group in association with the simulation teams. The control group consists of an umpire, a recorder, a conference coordinator, a media simulator, and a team of messengers.

All communication during the simulation takes place via written message. The umpire judges the messages. Messages originate from the teams and are carried by messenger to the umpire. The umpire validates the message by writing "valid" in the lower left corner of the message blank. The judgment of whether or not the message is valid is determined by considering its rationality, i.e. is the message one that would be submitted by a person playing the particular role or is it something not in the realm of possibility. The umpire also makes judgments affecting the operation of the simulation. That is to say, if a particular stimulation or reorganization of some sort is needed during the game, the umpire can stop the game to affect the necessary repairs.

The recorder keeps a running log of the messages and the order in which the messages are dispersed. When the recorder gets the message from the umpire who has validated it, he will put a number on it indicating the order in which the message was received by him. He will also, for further reference, put the time at which he received the message to the nearest minute. Then he will deliver the message to a messenger who, in turn, will distribute it to the various teams.

Under certain circumstances, a team may wish to communicate with another team secretly. Under these circumstances, the team originating the message should write "secret" next to the word subject on the message form so that the recorder will know it's a secret message. When the recorder receives the message, he will distribute it immediately through the messengers to the indicated recipient. The recorder will hold the remaining copies of the message for a period of fifteen minutes and then have the messengers distribute the remaining copies to the remaining teams who have not received them.

The media controller simulates the manner in which the media would cover the particular events transpiring. The principal function would be to combine the effects of several individual messages on a situation and comment on it perhaps in an editorial way. Secondly, should the simulation fail to become dynamic and active, the media can stimulate it by introducing messages that would throw new light on situations which should be developing.

The conference coordinator accepts requests from various teams when they wish to meet with other teams. A conference may be held between two teams. The time limitations on a conference are five minutes. The coordinator will send a message indicating when the conference will be held and where it will be held, and the time he indicates as the beginning of the conference determines the end of the conference, i.e. five minutes later. It is important that the participants arrive on time with a spokesman in order that the conference will move swiftly under the direction of the conference coordinator. The short duration of the conference precludes many topics being discussed, therefore, the conference should be for a particular purpose.

The messengers continually circulate and act as extensions of the umpire in many cases. They carry messages back and forth and try to clarify the game situation for the various teams. The particular emphasis is on the rules and how to interpret the rules. The rules for the realistic environmental problem simulation are as follows:

1. During the simulation the members of the teams must stay in the rooms designated for the teams. No communication among teams may take place directly except in cases of conference which are prearranged.

2. During the simulation, the period of time representing one month transpires in ten minutes. That is to say, during every hour of the simulation, one half year has transpired.

3. Conferences may be called by sending a message to the conference coordinator. The conference coordinator will reply to your message with another message indicating the time and the place of the conference. The conference may last no longer than five minutes, therefore, do not try to take on too many things in a five minutes period. Conferences are limited to discussions between two teams.

4. If you have press releases which you wish an immediate simulator to handle, please fill out the message form with the material you want covered

by the press and direct it to the media simulator.

5. All messages will be sent to all teams at the same time unless the messages are marked "secret". If the message is marked "secret" in the box marked "subject" by spelling out in capital letters "secret", then the recorder will only send that message to the person you designate, however, after a fifteen minute delay, that message will be sent to the remaining participating teams. When you receive a copy of the message back that you have sent, you will know that everyone is in possession of the secret information you sent previously.

INTRODUCING SIMULATION GAMES INTO SCHOOLS: WHY IS IT DIFFICULT?
(A Provocation of Paragraphs)

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1. Why, after the substantial theoretical and practical advances in simulation games* of the past decade, is their use in elementary and secondary schools rare? This question is of interest if you believe, as I do, that games are educational and that the educational effectiveness of schools needs improvement.

2. Analysis of the problem has led me to two related answers, or, more modestly, two hypotheses:

a) The educational philosophy implicit in the use of games is in conflict with the educational philosophy held by many, perhaps most, teachers and school administrators;

b) Lacking recognition of this conflict, the simulation gaming fraternity has not adequately dealt with this problem in communications with teachers and administrators.

3. It is true that some schools (or some teachers) use games; the problem is why this number of schools (or teachers) is so small.

4. Games in classrooms raise a basic philosophical issue in education because they restructure the learning situation. They do this by radically altering the roles of students and teachers, roles as perceived by most teachers, and as enforced by the school system (or culture).

5. Though subject to qualification and future amendment, some well-worn claims for games are worth noting here:

a) they are enjoyable (usually),
b) they can involve a diverse group of students simultaneously,
c) they are an active rather than passive learning method (and noisy, too),
d) they supply rapid responses to player behavior,
e) they substitute a simulation of the non-school "real world" environment for the school environment,
f) they eliminate (temporarily) the traditional teacher role of authority figure and disciplinarian.

Admittedly, these statements can be true only when games are used well. Poor use, such as having game consequences influence grades, will negate much of their potential.

6. I question the extent to which many teachers and administrators accept the goals implicit in the use of games. Some implicit goals are:

a) learning should be an active, not passive, process ("we learn by doing" and "doing" is more than listening, reading and writing),

b) children should be given many opportunities in school to learn from their own behavior,

c) the disciplinary and authority roles of the teacher (and administrator) should be minimized,

d) individual differences should be respected and stressed instead of pursuing the concept of uniform levels of achievement,

e) children should be encouraged to assess and evaluate their own behavior.

Because these goals, and others implicit in games, are not held by many, or most, teachers and administrators, few teachers and administrators welcome games.

7. The introduction of simulation games, therefore, raises an issue of basic educational philosophy. If gamers do not fully appreciate the significance of their actions, they will not have - have not had - much success.

8. Should schools be run primarily in order to socialize children and to transmit a body of information or should schools be run primarily to provide opportunities for individuals to develop their own potentials? The inclusion of "primarily" saves the choice from being an unrealistic one; the idea of using games in schools effectively raises the question of which emphasis is desired.

9. Gamers interested in schools should face this issue, as should other educational innovators, and then focus their energies on appropriate strategies. They should discuss it thoroughly among themselves before attempting to spread the gospel. Perhaps a variety of educational philosophies held by gamers will be uncovered.

10. Game literature should make clear the significant questions of educational philosophy that the use of games precipitates.

11. In another effort to aid the appropriate introduction of games into schools, manuals should distinguish between readers who have used games and those who have not. The problems of communication with both groups can more readily be solved if they are considered separately.

12. Further, game manuals - and other literature - should make clear the time and trouble costs of using games. Games are time-consuming. A few in the gaming fraternity have paid attention to this question, but overselling continues to predominate.

13. Further, game manuals - and other literature - would be improved if the fraternity could achieve some uniformity in terminology. In communicating with the cognoscenti, it is possible for the context to define the terms; for the uninitiated, the use of many undefined terms raises, at best, the spectre of cult, and at worst, prevents communication.

14. Further, gamers should develop introductory games either by designing "minimum-structure" games or by simplifying and making more introductory the "basic" version in a game that includes both "basic" and "advanced" versions. If this is done, the basic game would always be followed by the advanced game, rather than as at present, wherein the basic game is frequently played without going on to the more elaborate version or versions.

15. But, most important, the simulation gaming fraternity should honestly face the problem of educational innovation in the light of the conflict in educational philosophies which the use of games uncovers.

16. In summary, my answer to the question, "Why is it difficult to introduce games into schools?" is, "Because we know not what we do."

*In this essay, "simulation games," "simulations," and "games" refer to the group of tools that includes Consumer, Crisis, Dangerous Parallel, Democracy, Economic System, Generation Gap, Ghetto, Inter-Nation Simulation, Life Career, SIMSOC, Sitte, Starpower, Sunshine,........

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THE LABORATORY CLASS AS A SIMULATED SCIENTIFIC COMMUNITY

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In virtually every undergraduate curriculum in such behavioral sciences as psychology or sociology, there is at least one laboratory course. Sometimes the instructional laboratory is part of a course where the other part is lectures directed at certain subject matter content. In other colleges or universities the laboratory course is a self-contained entity. In either case, the instructional laboratory is usually designed to give students experience in the design and conduct of experiments. This experience is gained in a variety of ways dictated by the educational philosophy of the instructor and those developing the curriculum, as well as the resources that are available for such a course.

Simulation is used to structure the elementary psychology laboratory course at the University of Michigan. The simulation is made viable by the use of computer data-generating models which will be described in more detail shortly. At the outset, however, I should like to emphasize that the computer is used to facilitate the simulation; it is not in itself, the simulation. The simulation is concerned with the total structure of the classroom with the organization of activities that may or may not utilize the computer.

The classroom structure of the elementary psychology laboratory course is that of a scientific community where each student plays the role of an individual researcher. The student participates in activities designed to parallel those of a scientist in a real community. For example, the student is directed toward a particular problem area. As we develop this course further, it will be possible for him to select a problem area from a finite set. He becomes familiar with at least some of the literature in that area and examines current theories and research bearing on it. He is acquainted with some of the costs associated with conducting research in that field, and he is informed of the resources that he has available to him. These resources, usually in the form of points, are designed to parallel those known to exist in the real world. He proposes research that he would like to conduct, bringing to bear what he is learning about the subject matter of the area, research design principles and his available resources. He designs a research program, not merely isolated experiments. He argues for his research strategy articulating how he believes such a strategy will accomplish his stated research goals. Upon receiving his "contract," he proceeds to implement his strategy by conducting the experiments he has proposed. He updates his knowledge about the area by re-examining or modifying later experiments based on what he has learned from his own research and that learned from other "scientists" in his community. He communicates his updated knowledge to the rest of the "community" in the form of research reports written in a format acceptable for publication, through formal presentations at "conventions" and through informal bull sessions with other members of the community. In this communication, he not only articulates his research goal, hypotheses tested, and experimental designs, but his method of data analysis and his conclusions. On the basis of updated knowledge, he plans his next experiments taking into account the costs of such experiments, and the cycle is repeated. One of his final scientific communications may be that of a review paper that summarizes the state of knowledge of his scientific community in a particular area. It may be a report to a sponsor. Within a two-month period he will have designed and analyzed the results of around ten experiments that he himself conducted on several problem areas.

The simulated scientific community is facilitated by the use of computer data-generating models. The student rehearses all of the major roles of the scientist except the very time-consuming and expensive data collection step. (Even this step can be included in some problems and in some sessions of the course, but the simulation does not depend on its inclusion.)

At the University of Michigan we are beginning our fifth term with the development and use of the Experiment Simulation Supervisor, EXPER SIM. EXPER SIM is a program written in Fortran by Robert Stout, a graduate student teaching fellow who is also working on his Ph.D. in mathematical psychology. It is implemented on the IBM 360 equipment of the Michigan Terminal System. At present there are three models on the system which are supervised by this program. Three others are in the process of being placed onto the supervisor program. All data-generating models have the following features as far as the undergraduate user is concerned. The writer has written a brief problem description or scenario which is designed to acquaint the student with the problem area. He has also listed several variables related to that problem area which can take on different values, (discrete or continuous). The student generates an hypothesis within the area so defined by the problem description and then "designs an experiment" by specifying the number of experimental groups, the values of the variables in each of the groups, and the size of each of the groups. An independent variable in this context is defined as one in which the values are different from group to group. A control variable is one in which the value is held constant across groups. Choices of dependent variables have been limited in our first three models, but in our later ones the student has certain decisions to make regarding the choice of dependent variables. Variables which are ignored by the student take on either constant or random default values. The computer reacts to the student's design by generating numbers which can be plausibly interpreted as raw data. The student then summarizes these results using analytical tools that he is learning. He comes to conclusions about the results of his experiment, makes inferences in terms of the hypothesis he is testing, communicates his findings to the scientific community (his classmates), and plans and carries out his next experiment. The time required for such activity is very short because the long time-consuming step of "real" data collection is omitted. Further, he can think and work within problem areas that may be impossible for him to deal with in the real world because of his lack of specific data collection techniques or the lack of such resources for instructional purposes.

Sitting in the computer is a data generating model developed by a graduate student which is largely based on real world knowledge and reflects the research interests of the advanced student. We have attempted to make such models concur with what is known in the real world but this is not really necessary. The student has the job of understanding the world as revealed by the data-generating model. He goes through the same cognitive problem-solving steps that a scientist must engage in in understanding his world. Whether or not the data-generating model concurs with the real world is simply a matter of our preference but not necessary for the simulated scientific community because the purpose is to teach strategies for discovering rather than convey specific information about particular subject matter. In the behavioral sciences knowledge about the "real world" is often incomplete. We have so far chosen to have such models conform to at least one body of literature as closely as possible, but given our purposes, that is really an arbitrary decision. The models are probabilistic and therefore, the very same design inputs do not generate the same raw data.

Let me emphasize here that it is the use of computer data-generating models that makes a simulation of a scientific community a rich experience and a feasible one for a one-term laboratory course. In traditional courses, the experiments that students can conduct are limited to those that do not take much time or require expensive instrumentation or access to large subject pools because the emphasis in such courses is on teaching students how to collect data. Even when the intent is also to teach hypothesis development and experimental design the data collection step because of the time and resources required often dominates the course. We do not underestimate the value of learning how to collect data. We simply believe that it should be sequenced at a later point in the student's undergraduate career when his research interests have more of a focus. The traditional laboratory course often delays or restricts the student from understanding the total scientific process because an inordinate amount of time is spent on learning to train rats or getting equipment to work. We believe such time and resources are better placed on the more advanced student who clearly understands all of the steps of the scientific process and who can place his struggles within the total framework.

If there were more resources and time it is possible to conceive of a simulated scientific community that includes the data collection step. All that the computer does is speed the generation of data in response to a student's experimental design according to the specification of the model. Indeed, if we extend resources and time far enough the student leaves the formal classroom and enters the real scientific community as an apprentice and as a participant. In training the student for that role, we believe the simulated scientific community is a better introduction because of its emphasis on the total role of the scientist. Further, many of our students will never engage in research in the real scientific community. I argue that coping with the problems of synthesizing information, planning research programs, anticipating outcomes, and communicating results are important facets of an undergraduate liberal arts education, more so than inordinate time spent on technique of data collection.

Now let us turn to the nature of the computer data-generator. On the one hand, I have tried to de-emphasize its role by asserting that it is but a part of the total simulated scientific community; it is not the simulation itself. This is an important distinction. On the other hand, I have alluded to its power in conserving time and resources in creating rich educational environments.

The type of data-generator models that are being placed on EXPER SIM lie between two other kinds of data-generators that have often been used for instructional purposes. One kind of data generator is context free. Examples of this kind are the table of random numbers, balls in urns, and numbers generated by specified mathematical functions. These data generators, although perhaps useful in teaching statistics or other analytical methodology are limited for use in behavioral science methodology. There are probably those who will take exception, but I believe behavioral science tends to be done in the context of a problem. The effect of context on problem solving styles is large enough to question the validity of attempting to teach scientific methodology in totally context-free environments. The EXPER SIM models can be based on algorithms that make use of mathematical functions, but the behavioral scientist is relating observations of phenomena to these functions. He is not merely exploring functions. Tying algorithm to behavioral phenomena makes it possible to build more realistic problems for student scientists to explore.

The other type of data-generator used for instructional purposes is data banks. Here the numbers given the student in response to his experimental design are not generated from an algorithm but are essentially pulled from a file. They are "real" in the sense that somebody collected them. I don't really want to argue against the use of data banks as the data generator in a simulated scientific community. They have some nice properties. For example, it is conceivable that a student can leave the simulated scientific community and enter the real community with discoveries he has made in exploring a data bank. This is a transition that he is less likely to be able to make in merely exploring data generated from a model.

The role of student scientist is unaltered in a simulated scientific community whether he is exploring a data bank or data generated from a model.

The biggest disadvantages arise in the constraints placed on the development of a variety of problems for students to explore. There are many problem areas in the behavioral sciences in which data are simply not stored in banks. The use of data banks as the data generator for the simulation places unnecessary restrictions on the variety of subject matter that can be explored by student scientists. Whereas random number tables as data generators lack context, data banks are restricted by context. Both can serve useful purposes in the structure of a simulated scientific community, but the simulation will be limited if the data generator is based on either alone.

The idea behind EXPER SIM is that a library of data-generating models can be developed such that a student can select a problem area to explore much as he would select a book from a shelf. These models can be associated with a wide range of subject matter in the behavioral sciences. Further, they can be built with varying degrees of complexity.

Perhaps most important, data-generating models open up yet another dimension that can be incorporated in the simulated scientific community. That is, it is conceivable that student scientists can move from exploring models to modifying those they have explored and observing the consequences to actually developing models on their own. We have not pushed our introductory students in this direction as yet because we do not have the software that would enable our students to place their models on the computer without knowing how to program. Since we have 250 students in the course taught by graduate students who, by and large, do not program, the bottleneck between model building and programming the model is too great given our resources.

However, using the models as a student or as an instructor does not require programming knowledge.

At present our graduate students develop the models and work with a programmer who places the models onto the system. Our first three models are relatively simple. They are concerned with (1) the etiology of schizophrenia, developed by David Malin, (2) imprinting, by D. W. Rajecki, (3) motivation in a routine task, by Susan Mueller. Additional models that are more complex are currently being placed on the system. They are concerned with the following: (1) the effect of drugs on learning and memory by Howard Eichenbaum, (2) social facilitation by D. W. Rajecki, and (3) Pavlovian conditioning by Richard Nussloch. The later, named PAVCO, was developed at MacAlister College where Mr. Nussloch was an undergraduate and the only graduate student mentioned above who programs. It has been my intention to separate the role of model builder from the programmer. In doing so, this opens up model building as a viable educational exercise for our graduate students that is not contingent upon programming knowledge. As the interface between model builder and software is improved, model building can be incorporated into the structure of the course.

The cost of using computer data-generating models for instructional purpose is miniscule compared to the cost of building and maintaining a traditional instructional laboratory. At U. of M. students design and analyze the results of around ten experiments at a cost of less than $10.00 per student. They learn to submit their jobs in both the batch and interactive modes, thereby being introduced to the computer in a relatively painless way. A given job in batch process consists of about a dozen cards, many of which can be used for later experiments.

I would like to mention similar activities in other parts of the country. Richard Johnson (Johnson, 1971) at Earlham College developed the Datacall game which not only uses simulation technique to structure the classroom and computer data-generating models, but a decision procedure that awards points to students who have designed experiments that yield statistically significant results. John Thurmond and Art Cromer (Cromer and Thurmond, 1972) at University of Louisville have developed some very rich models which they use in conjunction with real demonstration experiments in a more advanced undergraduate experimental psychology laboratory course. Alfred C. Raphelson (personal communication) at University of Michigan's Flint Campus is using our motivation model in conjunction with a data bank of motivation data in the laboratory section of his motivation course. LaVerne Collett's (Collett, et al, 1971) FEHR City Practicum is a very rich model of a hypothetical school system. The simulated scientific community model is structured enough to give direction to a course and yet flexible enough to be developed for a variety of different purposes to conform to the objectives of instructors.

The important feature of simulation is that learning activities are integrated into an identifiable role and are not merely arbitrary assignments. Laboratory reports are not simply feedback devices to the instructor but means of communication to other members of the class. Experiments are not esoteric exercises but the result of problem-solving strategies designed to reach a research goal. The instruction is individualized in that each student is responsible for his own designs, experimental results, and reports, and yet the values of peer interaction are gained by the community structure of the classroom.

The computer is used as a powerful tool to facilitate the simulation. We've only begun to tap its potential in designing rich educational environments. Yet the simulation model for the structure of the classroom keeps the computer function in proper perspective. The student gains knowledge of the total scientific process by engaging in a wide range of scientific activities that is made possible because time and resources no longer constrain such course design.

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SIMULATIONS IN INTRODUCTORY BEHAVIORAL SCIENCE COURSES

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Arthur Chickering of Goddard College recently commented that "higher education and society are mired in frustration and conflict."[1] This frustration is especially evident among those who either must take or teach lower level introductory social science courses. Many freshmen and sophomores take these courses as much to fulfill requirements as to explore new areas of interest. Often motivated only by the need to pass the final examination, the student finds the course an unrewarding exercise. Meanwhile, the student's basically negative response may adversely affect the instructor so that he tries to avoid such teaching assignments and obtains little professional satisfaction when he draws them. In the final analysis, both students and teachers are unfulfilled.

Compounding this problem for the teacher is the recent arrival on the college scene of large numbers of students from low income families. Many of these youths enter college through either open enrollment plans or special programs aimed at minority and other disadvantaged groups. Typically, these students come from intellectual and cultural environments which differ radically from those of the traditional college student.

It is clear that standard techniques suitable for teaching advanced students already committed to specific disciplines are insufficient to enable the instructor to teach the unmotivated or to stimulate those with limited experience in academic environments. The traditional lecture and discussion method cannot do the job alone. The average college instructor is not a consistently exciting performer on the podium and therefore relies on an already developed interest in the subject matter to elicit attention and understanding. Discussions are most useful and meaningful if students already have some feeling for abstract concepts and can relate them to relevant experiences. For the most part, younger college students have yet to develop this ability. Finally, most introductory courses require the presentation of new definitions, concepts and theories, a complete understanding of which includes an affective as well as a cognitive element which lectures and discussions fail to provide.

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1. Arthur Chickering, Education and Identity; Jossey-Bass Inc., San Francisco 1969, p.79.

College teachers wishing to cope with both the old frustrations and the new challenges offered by an expanding and increasingly demanding student population must develop new teaching techniques and approaches. For the past several years the Behavioral Social Science Division of De Paul University has done much to support and encourage those interested in innovative teaching.[2] Several instructors have been incorporating into their introductory courses a series of well designed games and simulations which appeal to affect as well as intellect.[3] When students participate in the development of these simulations, creating and researching the roles they are to play, their involvement adds new meaning to information which might otherwise be ignored or passively stored until exam time.

Affect plays a dual role in eliciting student interest. For one thing, the ability to relate affectively as well as cognitively to an abstract concept adds depth to a student's understanding and strengthens his interest in the subject matter. Complete understanding of a concept such as power, for example, includes the ability to both appreciate the feelings accompanying the possession or lack of power, and to understand the kind of activity these feelings might engender. Mature adults can emphathize by referring back to their own experiences. Young undergraduates cannot. The teacher therefore must help students develop this ability by giving them the opportunity to experience these feelings in simulated situations. The situations are simulated, but the gut reactions are often very real.

Secondly, emotional involvement in a particular issue will arouse curiosity and interest. This involvement can be elicited either by enabling the students to role play or by dealing with issues which they already consider relevant when they come to the course.

Some games and simulations used in these courses are commercially produced; others are developed by students and teachers in the classroom. "Starpower", a game in which "a low mobility three-tiered society is built through the distribution of wealth in the form of chips"[4] has been found particularily useful in introductory political studies. Participants are given the opportunity to travel from one level of society to another by acquiring increased wealth through judicious trades. The distribution of chips, as well as the rules governing the trades, however, favor the wealthy, thus making it difficult for any but a few to make the move upward.

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2. The Dvision is a unit of De Paul College which administers the University's interdisciplinary general education program. Faculty in the division represent the Departments of Psychology, Economics, Geography, Political Science and Sociology.

3. Those providing the support and encouragement are Dr. Martin Lowery, Dean of De Paul College and R. William R. Waters, Chairman of the Behavioral Social Science Division. Instructors involved include Jane Ratcliffe, Geography, Albert Galowitch, Sociology, and Nancy Klein, Sociology.

4. R. Garry Shirts, "Starpower", Western Behavioral Sciences Institute, La Jolla, 1969.

Once the society is established, the wealthy acquire the right to make the rules for all three groups.

Although students are initially informed that the three individuals with the highest scores will win the game, the fact that (1) members of each group wear symbolic identification tags (squares, circles, and triangles), (2) that groups periodically need to make unanimous decisions in allocating bonus points, and (3) that the squares (top group) acquire the right to make the rules, focuses attention on the group rather than on the individual. By the end of the game, most participants are more concerned about group than individual benefits, as is illustrated by the division of bonus points which are generally designed to protect the integrity of the group rather than to help individual members advance.

This course is designed to introduce students to basic political processes found in all social systems and to develop an understanding of the concepts used to analyze and explain these processes. The four core problems discussed in the assigned text,[5] the creation of a common identity, the development of effective instruments of power, the establishment of legitimate authority, and the distribution of resources, are vividly illustrated during the course of this game.

A sense of identity is fostered by group interaction to solve common problems, and by the joint reaction to shared pressures posed for the two lower groups by the activity of the squares, and for the squares by the emerging resentment of the other groups. Students find that their symbols become for them an integral part of their identity, and the recognition of this fact enhances significantly their understanding of the meaning of the term.

The fact that legitimacy is conferred on the powerholders by those who must obey the rules is vividly illustrated for the square group which frequently finds their society disintegrating in front of their eyes when members of the circle and triangles revolt by refusing to continue the game. Students in power positions find that power means more than having control of the resources most valued in a society. They find that powerholders need to develop interpersonal skills, the ability to assess the needs and probably reactions of those with less power, and the understanding that, in the final analysis, their position is only secure as long as the resources they control are considered valuable by the rest of society. Powerholders, furthermore, experience that marvelous sense of competence that comes from being on top, and, in addition, are frequently shocked to discover that they have not even noticed the unhappiness of other members of the society.

Those without power also have valuable, if less comfortable, learning experiences. They find that continual failure and the inability to acquire a fair share of the valued resources frequently lead, on the one hand, to lack of confidence , a low

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5. Charles F. Andrain, Political Life and Social Change: Wadsworth Publishing Co., Belmont, 1970.

level of expectation, and a negtive self image, and, on the other, to an intense feeling of frustration, hostility, and sense of betrayal. Students frequently withdraw from the game, become lethargic, and develop what one participant described as that"I don't care feeling."

The discussion at the conclusion of the game, during which its affective impact on the members of the groups emerges, is of course the most valuable part of the exercise. Students analyze their actions, motives and responses to the structure of the games, the rules and the behavior of others. The interaction of all these variables becomes strikingly clear. Class participation in the discussion reaches an all time high. And instructors find that, throughout the rest of the course, they are able to illustrate vital points by referring back to this shared experience.

An introductory interdisciplinary problem solving course offered by the Division illustrates the value of simulations created jointly by students and teachers. In this case, the instructors present the problem to be solved and investigated, and the students determine, create, and research the relevant roles. This course, which focuses on a different social problem each quarter, is taught by sociologists, economists, geographers, anthropologists, and political scientists.

Each instructor focuses on the facets of the problem most relevant to his particular discipline. The roles students choose are in part determined by their interests, and in part by the particular section of the course in which they are enrolled. Thus in one quarter the problem analyzed was the proposal to build a new expressway in Chicago. Political science students focused on the government agencies and officials involved in this kind of project, whereas sociology and anthropology students looked at the impact of this road on the various groups affected.

In addition to the research engaged in by the students individually, all sections of the course met periodically to hear members of the community discuss their views and analyses of the problems under investigation. In the course analysing the expressway, students heard representatives of the planning agencies working on the expressway, leaders of homeowners groups opposed to the road, and others hoping to use that issue to get help in other areas of concern to them.

The individual research, the exposure to groups involved in the controversy, and the examination of the relevant facets of each particular discipline, culminate at the end of the course in a simulated attempt to solve the problem. The expressway simulation involved a city council hearing, the negotiation and manipulation of various interest groups, an appraisal of the project by a federal government agency, and finally, the effective veto of the proposal by the failure of the governor to ask for federal aid. This experience not only gave students valuable experience in decision making, but it also helped to illustrate vividly for them the many and complex variables involved in a social problem. Furthermore, students found it much easier to remember facts which they researched in order to solve a problem rather than memorized in order to pass an exam. The intricate relationship of state, local and federal government in highway construction which usually makes for dull reading in the average textbook, became vividly clear to all the participants looking for ways to either block or facilitate the building of the expressway.

In addition to the benefits discussed above, one should not underestimate the value of one additional payoff. In the course of playing a game or creating a simulation, students become transformed from a collection of individuals, many of whom do not know each other, into a participatory problem solving group. Political theorists, educators, sociologists and psychologists provide much theoretical support for the notion that active participation in classroom projects is a valuable learning tool.

Certainly motivation is sustained when one, as Clark Abt so graphically puts it, makes "classroom learning into a team sport."[6] Students of small group behavior point out that such behavior will change most rapidly if the persons expected to change can participate in deciding what changes shall take place.[7] This would appear to be true in a classroom where students participate in determining what needs to be learned. Industrial studies have also indicated that workers produce more effectively if they participate in decision making relevant to their work.[8] And political theorists from Rousseau and J.S. Mill to Saul Alinsky, point to the educative value of participation in decision making.

Additional support for the contributions to be made by the kind of learning situation provided by simulations and games comes from both educators and learning theorists. Piaget contends that intelligence is born of action.[9] John Dewey suggests that the initial stage of thinking is experience. Jacques Barzun states that "teaching is not a process, it is developing an emotional situation."[10] And Gestalt field theorists, pointing out that experience is most important in learning, define experience as "an interactive event in which a person comes to see and feel the consequences of a given course of action through acting and seeing what happens."[11]

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6. Clark C. Abt. Serious Games; The Viking Press, New York, 1970, p.25.

7. Carole Pateman, Participation and Democratic Theory; The University Press, Cambridge, 1970, p.63.

8. Ibid., p. 52.

9. Abt, op. cit., p.5.

10. Jacques Barzun, Teacher in America; Little, Brown, and Co., 1945, p. 43.

11. Morris L. Bigge, Learning Theories for Teachers; Harper and Row, New York, 1964, p. 102.

We are presently attempting to develop an instrument to measure the intellectual benefits which we feel can be derived from a more active kind of learning situation. At this point we can say student response indicates that both interest and motivation are enhanced and sustained by well timed periodic use of simulations and games. Those of us teaching social sicence at De Paul University hope to develop in our students an understanding of the many and complex variables operating in social and political systems. We hope to teach students to identify and define problems, to operationalize concepts, and above all, to think. Psychologists Olton and Crutchfield, in defining thinking, suggest that it involves the "generation of original ideas, looking at a problem in a new and different way if one gets stuck, asking insightful questions, and seeing the implications of crucial facts and events."[12] In the final analysis, this is waht participation in a simulation enables the student to do.

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12. Robert M. Olton and Richard S. Crutchfield, "Developing the Skills of Productive Thinking", in Robert F. Biehler (ed.) Psychology Applied to Teaching; Houghton Mifflin Co., Boston, 1972.

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UNDERSTANDING PLAYSCRIPTS THROUGH PRINCIPLES OF GAMES

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A recent graduate student at Bowling Green State University defined drama as "the celebration of Man's ability to understand himself."[1] My purpose here is to discuss with you some recent developments in playscript interpretation which I believe may lead us to a richer and deeper understanding of the drama.

Although it might seem axiomatic to suggest that in the theatre every playscript is unique, most traditional methods for playscript interpretation, being derivative of Aristotetian principles of classification, tend to lay more stress on the similarities among plays than on their more unique features.[2] Most ask the reader/director to classify scripts according to their genre (farce, comedy, melodrama, or tragedy) or style (Neoclassicism, Romanticism, Realism, or Absurdism). Further they suggest that plays be broken into parts: exposition, complication, climax, and deneument for example.

Beyond their inability to describe the more individualistic features of playscripts, other weaknesses have also become rather well known. It is apparent that many abstract category labels are virtually impossible to define in any operational sense. Often categories are not mutually exclusive or even independent. Finally those systems seem to emphasize form to the neglect of content causing the student's natural interest in what is going on in a play to be suppressed by the need to teach him the basic elements of form. But perhaps the most compelling weakness of all is that the process of interpretation can begin only after an elaborate and often difficult classificatory system has been committed to memory.

Before we get into the actual mechanics of playscript interpretation, however, I think it would be helpful to trace briefly the creative process of the theatre. When that process is fully understood the importance of playscript interpretation to the study of the drama may be more apparent.

Somewhere in the vague reaches of a playwright's imaginative observations of human behavior an idea emerges. Motivated by a desire to communicate that idea, or simply by a desire to affect an audience, the playwright abstracts that idea and those observations into dialog, or a playscript. At this point the playwright's work is finished even though the work of art is not. It is crucial to understand that a playscript is not a finished work of art. It is merely a sketch or outline, or better, a commanding form which prescribes the parameters and tolerances for a play which will emerge ultimately as a work of art when it is staged for an audience.[3] In order to transform that playscript into a play it will be necessary for other artists, under the guidance of a director, to reconvert the dialog into abstracted forms of human behavior. Put simply, the process involves compressing behavior into dialog, and then expanding it back out into behavior again. But even when the play is finally presented on the stage, the process is still incomplete. The theatrical process reaches its end only in the affect of a play on an audience. Samuel Seldon's perception of that idea was remarkably clear when he defined a theatre as "a place where an effect is produced on an audience."[4]

Actually we must be careful to understand that a play usually has many effects. In the first place it has a product effect: when the curtain comes down we are left with a general or overall impression. It also has a process effect: the continuous changes we feel as we witness the play in progress. More than that, however, the play will have various effects on our senses, feelings, and cognitions.

We can now state rather clearly that the playwright abstracts human behavior in such a way as to have some specified effects on an audience. Naturally the specificity of the effects as the playwright understands them or is able to articulate them will be subject to a great deal of variation. It is likely that his motivations for writing the play may be no clearer than any of the other motivations which guide his day to day activities.

It should be clear from the foregoing that the theatrical process involves some highly complex problems in human communication, not the least of which is the problem faced by the director or student as he reads a play and makes his first feeble attempts to understand the effects the playwright set about to achieve. If it was difficult for the playwright to understand his own intentions, how much more difficult must it be for the outsider.

The problem is confounded when we recognize that plays are usually studied exercises in deception. And what is worse, important information is usually missing. We know what the characters say, but we do not know how they say it or why. We understand the playwright's story but we don't know why he wrote it. Nothing is certain. All that we understand about a play must be obtained through inference. Plays hold our interest and inspire our imaginations simply because of their uncertainties, their deceptions, and their dramatic ironies.

Hence the key to understanding the drama lies in our ability to unmask deception and to assign probabilities to uncertainties. The task of the playscript interpreter, then, is not unlike that of the detective; he must always maintain the posture that nothing is certain and that the most important questions demand the most risky inferences.

It is worth noting here that the work of the playscript interpreter tends to run counter to traditional norms in our social system. Generally we are taught not to question motivations and to accept behavior for its face value. But the good interpreter trusts no one, and deliberately seeks to uncover motivation. In that respect his work closely resembles that of the psychiatrist.

It would seem apparent, then, that the tools the psychiatrist uses to uncover motivations should be equally useful for the play analyst. Interest has been turned in that direction recently, and as a direct result, transactional analysis is rapidly becoming a popular tool of the theatre practitioner; particularly the director. When we examine Eric Berne's definition of a game, the reasons for its popularity in the theatre becomes obvious.

> A GAME is an ongoing series of complementary <u>ulterior</u> transactions progressing to a well-defined, predictable outcome. Descriptively it is a recurring set of transactions, often repetitious, <u>superficially plausible</u>, with a <u>concealed motivation</u>; or, more coloquially, a series of moves with a snare, or "gimmick." Games are clearly differentiated from procedures, rituals, and pastimes by two chief characteristics; (1) <u>their ulterior quality</u> and (2) the payoff. (italics mine)[5]

That definition, I would submit, may be used with equal appropriateness to describe the major features of a play. And to the degree that transactional analysis, or any other psychoanalytic tool is useful in uncovering "concealed motivations," so should it be useful in "getting at" what we in the theatre call "sub-script." Since the usefulness of transactional analysis is already apparent to many, I will refrain from describing its applicability to playscript interpretation.[6]

What I would like to do instead is to take the "game analogy" several steps further in an attempt to suggest how the notion of the "theatre as a game" may be used to lead us toward a richer understanding of the structure of plays.

Although Berne's definition of a game is obviously descriptive of plays, it is important to point out that games differ from plays in two very fundamental features.

In the first place, the outcome of a game is more or less unknown until the final play. Watching a play, on the other hand, is more like watching a replay of a game. Even though we may not know the outcome, we do know we are absolutely powerless to affect it in any way whatsoever. Although on the face of it this feature may not appear salient, it is absolutely crucial if we are to differentiate "life" from "fiction" or "art." Knowing we are powerless to affect the outcome we are therefore relieved of any feelings of personal responsibility and are, in effect, released to enjoy total vicarious involvement. This feature affords us the safety and protection we need to take those vicarious risks we would, under other circumstances, surely avoid.

Secondly, games differ from plays in that the latter are selective and the former are not. This differentiating feature, like the first, is also useful in distinguishing life from art. Art may be said to derive order out of chaos. It is generally selective; it is interested only in those features of the environment that it considers relevant. So, where it is likely for games to be onesided or dull, the same is not as true for the theatre. Usually the playwright selects only the most interesting moves or plays to be included in his playscript.

In other respects, however, the game analogy is remarkably appropriate. The method begins with an attempt to understand the fiction of the script and works toward an understanding of the more functional features: the structure, stylistic elements, and inferences regarding the playwright's intentions and probable effects.

Once the basic similarities and differences between games and scripts have been established, interpretation may begin using simply the general terminology ordinarily employed to describe games. For obvious reasons analysis should not begin until after the playscript has been read through at least once.

The student is told to begin by making easy and probable inferences and then to work toward the more difficult and less probable. Such features as the number of players, and their sex are usually regarded as fairly safe inferences, while at the same time they provide only minimal information useful in determining probable effect or intent.

Stressing the "nothing is certain" doctrine, the student is encouraged to remain continually open to all possibilities, to assign rough estimates of certainty to the more important statements he makes about the play, and to supply evidence whenever major inferences are made.

The following features should be thoroughly described in the analysis: the number of players, the segments of play, a rough sketch of the function of each player, the goals sought by each player, the strategy used to achieve them, the player's ability to achieve them, the rules or limitations of play, the utility features of the game, the outcome, the effects of the outcome on each player, a tactical analysis of each move, and finally a segment by segment analysis including each of the above features.

Since a playscript is selective and ordered we should expect some natural connection among the features. Therefore all statements should remain in flux; subject to change at any point in the analysis. It should be understood further that there is no necessary order to the features, and if required, the order may be reversed or changed, new features may be added, and old ones dropped. All that is necessary is that the analysis be deep and thorough.

The second and final stage of the interpretation focuses more directly on the social and structural features of the game. The attempt here is to ask questions which probe the relationships of the game features, the overall complexion of the game, and the game's relationship to its author and to social norms. The following are examples of appropriate questions: How important were each of the features of the game? Did the outcome depend more on strategy or chance? How expert were the players? How important would society consider the player's goals? How did the outcome affect us and our attitudes toward the players? How complex was the game? Were the rules those of normal social interaction? If not, how did they differ? Did the game provide support for standard social norms? What were the norms it did support? What is important about this game? Why did the author choose this game as a means for personal expression? Although those questions are traditional and are usually helpful, they hold no special claim to our attention. Their purpose is simply to provide as much relevant information as possible and to lead the interpreter naturally to statements which ultimately describe those things we traditionally label style, genre, and intent.

Together, the two interpretive steps should lead to a rich internal analysis of most scripts. As suggested earlier an even deeper probe may be made if the analysis is coupled with transactional analysis. And inasmuch as both of those methods are internal, it is essential that information about the author and the play's historical, social, and literary context be used as a further source of evidence.

To summarize, the game analogy offers several advantages. It is simple and requires little formal instruction. It starts with the fiction and leads naturally into a discussion of function, form, and intent, and rather than emphasizing the "form and content" dichotomy, it stresses their confluent relationship. Vague and troublesome categories and misleading dichotomies are avoided without the loss of any information which might be available through their inclusion. The analogy affords the flexability which allows it to embrace a wide variety of dramatic type. The analogy, particularly the second step in the process, should lead the director to the assignment of objectives to be sought and evaluated in the audience when the play is presented. Finally and perhaps most important of all the analogy does what very few traditional systems do; it focuses clearly and directly on the tactics, strategies, and goals of the characters in a clear attempt to dig into the ulterior or deceptive qualities of the script. And that feature alone makes it an extremely powerful tool.

FOOTNOTES

[1] Seth Hawkins, "Rhetoric & Poetic," unpublished Ph.D. Comprehensive Examination (Bowling Green State University, 1972).

[2] See any standard play directing text; also Aristotle, The Poetics.

[3] Roger Gross, "The Director's Interpretation of the Playscript," unpublished Ph.D. dissertation (University of Oregon, 1970).

[4] Samuel Seldon, Theatre Double Game (Chapel Hill: University of North Carolina Press, 1969).

[5] Eric Berne, Games People Play (New York: Grove Press, 1964).

[6] Ibid.; see also Thomas Harris, I'm OK, You're OK (New York: Harper and Row, 1967).

COMMUNICATION IN THE PRISONER'S DILEMMA AND IN A CREATIVE ALTERNATIVE GAME

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Steinfatt (1972) used 50 trials of a PD game and a Creative Alternative game to study several aspects of the game behavior of his subjects. Experiment I used just the PD game to examine the effects of communication on cooperative choices.

EXPERIMENT I

One problem encountered in studies of gaming behavior the effect of communication alone versus its effects when combined with the experience of several trials of the game being played. The first experiment attempted to separate these two effects. A PD game with the following matrix (Figure 1)

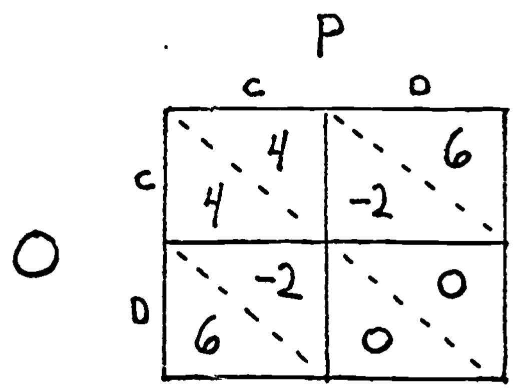

Figure 1. PD matrix for Experiment I

was used with eighteen pairs of subjects who were undergraduate students enrolled in Speech courses at the University of Michigan. All subjects were questioned for prior knowledge of PD games and game matricies in general for this study and the studies reported below. Two subjects were disgarded before play began due to familiarity with the game matricies. Subjects were paired from different classes and were re-paired if they knew each other.

Previous studies (Gallo, 1963; Gallo and McClintock, 1965) have discussed the difference between real reward and imaginary reward in game studies. A major point of these studies, as mentioned above, is that when a reward has no real value to a person it may be more interesting to invent a new game of maximizing the difference between oneself and the other player than to play in order to maximize one's own reward. Thus the cooperative-competitive measures used in studies of game behavior employing imaginary rewards may not directly generalize to non-laboratory settings unless those settings involve a strong motivation to maximize the difference between persons, as well as to maximize one's own rewards. Small amounts of money are occasionally used as real rewards, but there is always the question as to how valuable small monetary rewards are to a given person. Steinfatt used real rewards in his study but they were not rewards of money. After scoring the midterm exams for three classes, he subtracted 20 points on a 100 point scale from the score of each student in the classes. The students had been informed during the first half of the term that the midterm would be quite difficult and would be graded very harshly. At a different time during the term, all classes were also told that they would be expected to participate as subjects in an experiment sometime during the term. The subject matter of the classes did not relate to gaming. A few days after the exams were passed back to the students they were told that they would have a chance to both fulfill their requirement to serve as experimental subjects and to gain a few points on the midterm exam. All midterms were essay exams and all were handed back with only a single number on the front of the exam which represented the actual score minus twenty points. Several students were unable to participate in the experiment for scheduling reasons or because they had previous experience with game experiments. On the last day of class all students were told of the deception on the midterm scores and all were assured that the twenty points had been added back to each of their scores no matter what their game performances had been.

Most students agreed to participate in the study. Subjects played the game in a large classroom with the experimenter seated at one end and an assistant at the other end. Three pairs were run at a time. The assistant explained how to read a game matrix to the subjects and then seated each pair side by side in front of a table but facing slightly away from each other. The game matrix was in the middle of the table and each subject had a pencil and a score sheet in front of him. The assistant seated himself facing the subject and about 15 feet away. The tables were ten feet apart facing the assistant. Six pairs of subjects were randomly assigned to each of three conditions: immediate communication (IC), delayed communication (DC), or no communication (NC). Subjects in the delayed communication and no communication conditions were instructed not to talk with or look at the other player. After twelve trials, DC subjects were instructed that they should now face the other player and that they could talk freely about anything that they wished either during or between the trials. Subjects in the NC condition were not allowed to talk to or look at their partner for all 50 trials. After the 24th trial DC subjects were told to face away from each other, as they were originally, and not to talk or communicate in any way. The assistant was close enough to each pair to enforce the no communication periods, but far enough away that they could talk relatively privately if they kept their voices low. Subjects in the immediate communication condition followed the same procedures except that they were allowed to talk for the first twelve trials and instructed to remain silent after that.

On every trial each player made a mark in ink on his move sheet which he was not allowed to change once he had made it. When both players in all pairs indicated to the assistant that they had made their choice, the assistant signaled them to reveal their move to the other person. Six pairs were all male, six all female, and six were male-female pairs, with one pair from each category participating in each of six experimental sessions, and two pairs from each category being assigned to each experimental condition. Subjects were told before the beginning of play that the experimenter was busy correcting papers at the far end of the room and that when they were finished with the game, the assistant would tally the score for each subject and give him/her one poker chip for every 15 total points of his final score. Each pair was then to walk to the experimenter's end of the room together, where the experimenter would add one point to each person's midterm grade for each poker chip the person handed him. Then both subjects filled out a brief post-experiment questionnaire before they were allowed to leave.

These features of the experimental procedure were intended to set up a situation in which each subject would be motivated to do as well as he could on every trial without regard for the gains or losses of the other, but to include the possibility for side deals or kickbacks, since each subject could see from the setup of the experimental room that there would be ample opportunity to exchange poker chips if they choose to do so in route between assistant and experimenter. The probability of such an exchange was never mentioned or even hinted at by the assistant. In any PD game, there is no real advantage to be gained by any deal for side payments since by definition no outcome cell in a PD game may have a larger total payoff than the cell involving cooperative choices from both players. thus, for example, an agreement by player O to choose cooperatively while player P defects, in exchange for a "cut" of the 6 points P would gain, would not be a rational agreement since the total gain to both players would be 4 points compared with 8 points in the cell with both choosing cooperatively. For this reason it was expected that few, if any, side payment deals would be reached. The scores obtained from the move sheets when compared with the point totals recorded by the experimenter provided an accurate check on the existance of any side payments. None occurred in the PD game. The closest any pair came to a side payment was when one subject dropped a handful of chips, but gave a very firm "No, thank you" to the other player's offer to help him pick them up.

The results of Experiment I indicated no major sex differences in the number of cooperative choices either across or within communication conditions. This is in accord with Rapoport's finding that sex differences tend not to show up in runs of less than 100 trials. Data for the three sex categories were combined for the analysis of the communication conditions and are summarized in Table 1.

Communication Condition	Trials 1-12	13-24	25-36	37-50	Average for all trials	Average for trials 13-50
IC	84%	88	83	81	84	84
DC	31	70	64	56	55	63
NC	37	29	26	35	32	30

Note: All percentages are based on N=600.

Table 1. Percentage of cooperative responses over trials by communication condition

Analysis of variance on the data of Table 1 treating the trials factor as corelated and the communication conditions as independent indicates a significant trial X communication interaction ($p<.01$) and a significant main effect for communication ($p<.01$). The main effect for trials falls short of significance ($p<.10$). In the no communication condition the results are not substantially different from those found in low or imaginary reward studies of PD behavior. Since this study did not include an imaginary reward NC condition, it is not possible to compare the results to Gallo's (1963) finding that cooperation increased under conditions of real reward. The initial decline in cooperation followed by a recovery, found so often in PD studies, is evident in the NC condition. The first twelve trials of the delayed communication condition are not substantially different from the first twelve trials under no communication as would be expected. During trials 13 to 24 in the DC group, cooperative responses increased dramatically as communication was allowed. The high level (70%) of cooperation achieved by the DC subjects began to drop after communication was cut off on trial 25 and continued this decline in the later trials though remaining substantially above the level of cooperation before communication was allowed. The group allowed to communicate from the beginning of the trials to the end of the 12th trial made 84% cooperative responses on the trials when they were allowed to communicate, and then increased their level of cooperation after communication was cut off. Cooperation for the IC group dropped only slightly even toward the end of the trials. DC subjects were apparently influenced by the effects of the first 12 trials they played before communication was allowed since they never reached the level of cooperation of the IC group. Also level of cooperation appears to be more stable in the IC group than in the DC group after communication is cut off. Thus, cooperation seems to be higher and more stable when the players do not experience a high percentage of non-cooperative choices by the other person before they are allowed to communicate with the other.

Since each subject knew the results of each of his opponent's choices, the DC condition of this experiment is similar to the communication plus knowledge condition of Bixenstine, Levitt, and Wilson (1966). They found 83.5% cooperative responses in the first twenty trials after delayed communication was allowed for 15 minutes between the 20th and 21st trials of a six-person PD game. A level of cooperation of that magnitude was achieved by Steinfatt only under immediate communication conditions. It may be that the effect of the existance of the group increased the level of cooperation in the Bixenstine et al. study.

EXPERIMENT II

Steinfatt conducted a second experiment using different subjects from the same subject pool as used in Experiment I. Since there were no class meetings of any of the classes between the time the first and last sets of subjects were run over a two day period it is unlikely that any later subjects were exposed to the views of the game presented by earlier subjects. Post experimental questionnaires to this effect substantiated the lack of exposure of later subjects to earlier subjects outside of the experimental situation.

The second experiment was concerned with an entirely different aspect of the effect of communication on game behavior. The game used in Experiment II was a Creative Alternative game devised particularly for this experiment (see Figure 2).

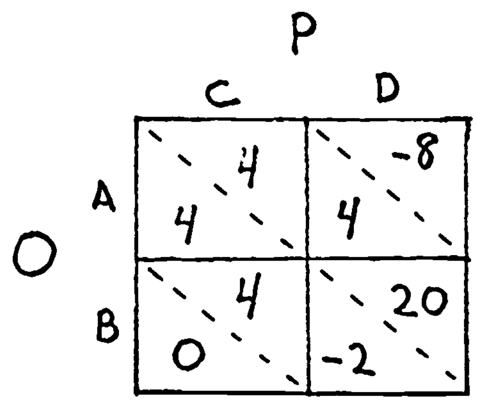

Figure 2. Steinfatt's Creative Alternative Game

The CA game is quite different from a PD game. First, it ic not semetric since the payoffs are not the same for P and for O. Secondly, either player in the CA game can guarentee himself a payoff of 4 units by making choice A for player O or choice C for player P. At first glance it appears that P is in a better position than O since P could get 20 units of reward and O can get only 4 units maximum on any one trial. This advantage becomes illusory on analysis since O has no reason to choose B. If O chooses A he guarentees himself 4 units of reward while if he chooses B he gets either nothing or loses 2 units. Thus O is going to choose A. P may or may not see this before the first move. If P concentrates on his own rewards and fails to analyze the game from O's perspective before the first trial, then P may choose D for his first response hoping that O will choose B. O of course chooses A, and after no more than three trials in a pretest involving ten pairs of subjects from other classes not in the subject pool of Experiment I, all P subjects extinguished on the D response. Imaginary rewards were used in the pretest. About half of the P subjects made all C responses over the twenty-five trials of the pretest. No P gave a D response beyond the fourth trial. Only two O subjects gave B as a response during the entire pretest. One stated that he thought the game was silly and boring and wanted to break the monotony.

The other was a female subject who stated she hadn't understood the way the matrix worked. She responded B only on the first trial. No communication was allowed during the pretest.

The CA game is a very boring, uninteresting game when played under these conditions. Pretest subjects were growing quite restless after the 10th trial. But supose a new element is added to the game. If subjects are allowed to communicate perhaps one of them will see a creative alternative to the constant AC response pattern. The third major difference of the CA game from a PD game is that one of the cells contains a joint total payoff which is greater than the sum of the payoffs for the obvious choice (AC) cell. The existance of this cell, the BD cell in Figure 2, has no bearing on the game behavior of the subjects when they cannot communicate. Would it have an effect if they could communicate especially if they were under high reward conditions such as playing for more points on a midterm?

All conditions for Experiment II were identical with Experiment I with the following exceptions: 1) Experiment II used a CA matrix and 2) subjects were paired by Dogmatism scores rather than by sex. All subjects were from the pool used in Experiment I, drawn without replacement. All of these subjects had taken a short-form Dogmatism test (Troldahl and Powell, 1965) before the midterm examination under unrelated circumstances. High and Low Dogmatism was defined by a median split of the scores. Subjects for Experiment II were paired by Dogmatism category into one of four Dogmatism conditions: High P, High O (HHD); High P, Low O (HLD); Low P, High O (LHD); and Low P, Low O (LLD). The three communication conditions from Experiment I were also repeated creating a 4 Dogmatism conditions X 3 communication conditions design. Two pairs of subjects participated in each cell of the design for a total of 48 subjects. Thus, eight pairs were run in each communication condition and six pairs in each Dogmatism condition. Forty trials of the CA game were run for all pairs. The principal dependent measure used in Experiment II was the ability to achieve at least three consecutive BD responses. The assistant treated all negative scores as zero scores when he handed out the poker chips, though he did not announce in advance that this would be done.

The results of Experiment II are summarized in Table 2. In the no communication condition no pair achieved three consecutive BD responses. After the first few trials in the NC condition no pair responded in any way except AC with one exception. The O player in one HL pair began to make an occasional B response after the 25th trial and on the 34th trial for that pair they responded BD. For the six remaining trials they responded AC.

Dogmatism condition

Communication Condition		HH	HL	LH	LL
	IC	0	0	1	1
	DC	0	0	1	2
	NC	0	0	0	0

Note: N = 2 pairs in each cell

Table 2. Number of pairs in each cell achieving at least three consecutive BD responses.

Again, no pair achieved even one BD response before the onset of communication. In the delayed communication condition three of the eight pairs began an unbroken pattern of BD responses on the thirteenth through the fifteenth trial which continued to the end of the trials. Communication was allowed for the DC group only on trials 13-24 and none of the pairs responded BD beofre communication was allowed. The five remaining DC pairs made an occasional B or D response but were characterized by a continuous pattern of AC responses. In the immediate communication condition two of the eight groups established a continous BD response pattern within the first five trials which continued on to the end of the 40 trials. The remaining six pairs were similar to the five DC pairs with only an occasional B or D response breaking up a continous AC pattern. In other words, all pairs, with rare exceptions, tended to fall into a highly consistent response pattern. When communication was not allowed this pattern was invariably one of AC responses. When communication was allowed, most pairs continued with this same AC pattern, but a few either switched to (in the DC condition) or began with (in the IC condition) an entirely new response pattern which was just as consistant. This new pattern was a continuous BD response replacing the AC response of the majority of the pairs. What happens in these BD responding pairs, according to the post experimental questionnaires, is that one player (in these five cases always the P player) sees the 20 points just sitting there in front of him with no way to obtain them, when he suddenly realizes that both he and the other could make more on each trial by choosing the BD response. He suggests this possibility to the other explaining a proposed split of the 20 reward units. In some cases P's proposed a 10-10 split and in others they proposed a 9 for P, 11 for O split to result in a total gain of 9 reward units for each player on each trial. Four of the five BD responding pairs agreed on a 9 for P, 11 for O split.

Three persons in the NC condition and five persons in both the IC and the DC conditions said that they thought about ways of getting the 20 reward units, but could not achieve this goal either because they were not allowed to communicate at that point in the trials or because they could not convince the other to go along with their plan. A study of the type of persuasion strategy which is effective in this type of situation might be interesting. What kinds of things can P do in this situation to increase his perceived trust in O's eyes to the point where O is willing to take a chance that P will not try to deprive him of his midterm points?

To summarize the findings of Experiment II with respect to the communication variable, communication is apparently a necessary but not a sufficient condition for reaching a creative solution in a CA game. Once reached, this solution is quite stable and does not disappear when communication is cut off. Low dogmatic subjects were much more likely to achieve a creative solution than high dogmatic subjects given the limited sample of this study. In no case in which a high dogmatic was in the P position did a pair reach a creative solution. No HHD or HLD subjects reached a creative solution while three of the four LLD pairs did so (see Table 2.) The tentative conclusion from these results is that when a High Dogmatic subject is in the P position, a creative solution is unlikely. Dogmatism seems to be related to the achievement of a creative solution, but not as strongly as the existence or nonexistence of communication. This finding would tend to support Rutheford (1966). "If decision makers tend to possess paranoid personality systems, with attendant belief rigidity and suspicion, their ability to adopt creative and innovative perspectives may be curtailed. The ability of their organizations to enter into trustful relationships with other organizations may likewise be curtailed." (1966, p. 405).

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COMMUNICATION AND EXPERIENTIAL LEARNING: A TRANSACTIONAL VIEW

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Over the years much has been said about the operational development of "parametered" simulations. Recently, however, the development of "parameter-free" simulations is being talked about as a powerful technic for the design of learning environments (11,13). The differences between these two types of simulations represent not only operational distinctions but major shifts in conceptual thinking.

Most designers of "parametered" simulations make assumptions about the necessary relationship between the parts and the whole of our socio-ideological environment. The term philosophers give this level of organization and presentation of inquiry is "Interaction." On the other hand, designers of "parameter-free" simulations assume that there is no necessary relationship between the parts and the whole. "Transaction" is the level of inquiry which includes this assumption.

I will attempt to explain the shift in conceptual thinking by suggesting what form a transactional approach to communication and experiential learning might take.

TRANSACTION

The term "transaction" has been given some unusual implications: first, that all things in a situation – people, objects, etc., enter the situation as active participants; second, that people and objects owe their very existence in the situation to their active participation, and do not appear as already existing entities that merely interact with each other without affecting their own identity (3,7,9). Transaction was first used by Dewey and Bentley in their book, Knowing and the Known. They suggest, "Observation of this general (transactional) type sees man-in-action not as something radically set over against an environing world nor yet as merely action 'in' a world but is action of and by the world in which the man belongs as an integral constituent." It follows, then, that all of man's behavior "including his most advanced knowings" are treated as "activities not of himself alone nor even as primarily his but as processes of the full situation of organism-environment" (5:271).

To further elaborate, Bentley states: "We do not, however, take the organism and environment as if we could know about them separately in advance of our special inquiry but we take their interaction itself as subject matter of study. We name this transaction to differentiate it from interaction. We inspect the thing-seen not as the operation of an organism upon an environment nor of the environment on an organism but as itself an event" (1:285).

Each event a person takes into account is not independent of past transactions and future expectancies. An event represents an arbitrary point along a continuum of life's experiences. For the purpose of being able to reflect on them, the experiences are pulled out of the process and given a beginning and an end. Each event represents a unique reflection.

As Whitehead states, "An event has contemporaries. . . This means that an event mirrors within itself the modes of its contemporaries as a display of immediate achievement.

An event has a past. This means that an event mirrors within itself the modes of its predecessors as memories which are fused into its own content. An event has a future. This means that an event mirrors within itself such aspects as the future throws back on to the present; or, in other words, as the present has determined concerning the future. . .These conclusions are essential for any form of realism for there is in the world for our cognizance memory of the past, immediacy of realization and indication of things to come" (17:166).

Several implications are involved in the suggestion that an event does not have its own existence and can only be observed through a person's active participation in it. If this is the case, then each person must enter into the transaction from a slightly different perspective since each person is a unique configuration of experiences, assumptions, and purposes. One, then, observes and acts from a unique point of view. Participation is always an activity by a unique participant from his unique position providing him with his unique world of experience.

EXPERIENCE

Experiential learning is the arrangement of a person's environment so that he comes into direct contact with the phenomena to be understood. Thus, one aspect of a person's world of experiences is how he experiences his participation in a transaction. A person has the ability to communicate with himself or, in other words, he reflects on his purposes, assumptions, and actions, and the consequences of actions. In addition, the ability to abstract certain aspects of experiences gives a person the opportunity to provide inputs into experiences of other people. This ability allows man to participate in communication with others, yet the transaction is not limited by either space or time. However, Whitehead has characterized one major difficulty with our ability to deal with abstractions which he has called the "fallacy of misplaced concreteness" (10:576). That is, the aspects of our experience which are abstracted tend to be thought of as more "real" than the aspects of our experience which are not symbolized. For many people, then, "reality" is limited to only those aspects of experience which are verbalized and/or written down.

Abstractions lead people to assume a communality of experience rather than assuming that each person's experience is unique. Yet, we know that no two people have exactly the same point of view because of the simple fact that they cannot occupy the same space at the same time. Since perfect correspondence in meaning is impossible, we are left with the notion that communication, one of the most basic life processes, operates on a whole set of very complex assumptions about ourselves, others, and the world in which we live.

As Birdwhistell says, "An individual does not communicate; he engages in or becomes part of communication. He may move, or make noises. . .but he does not communicate. In a parallel fashion, he may see, he may hear, smell, taste, or feel – but he does not originate communication; he participates in it. Communication as a system, then, is not to be understood on a simple model of action and reaction, however completely stated. As a system it is to be comprehended on the transactional level" (2:104). Communication, then, is that aspect of the total life process by which each one of us creates a unique world of experiences and through which each of us strives to attain our purposes.

EXTERNALIZATION

One of the more fundamental assumptions a person makes is that what he takes into account exists outside of himself and has characteristics beyond those he gives them. For the most part, we treat people and objects as existing in their own right having traits, attributes, and characteristics quite independent of our transactions with them. One essential aspect of communication, then, is the assumed externality of certain aspects of experience. The world as one experiences it is both the product of communication and the cause of it.

The question arises, however, as to what aspects of our experiences can usefully be externalized. One of the major problems in therapy sessions is for the patient to learn which aspects of his experiences he has been externalizing and which aspects he has been repressing. It is usually crucial that a patient recognize as his own certain aspects of his experience which he formerly attributed to external events. Most contemporary psychoanalytic writers stress the importance of the communication process in shaping the content of an individual's experiences (4,12,16).

Most simulations are based on the notion that objects or people exist in their own right as one takes them into account and all one has to do is derive the appropriate strategies from the already-existing knowledge. Whitehead addressed himself to this assumption when he said, "We must not slip into the fallacy of assuming that we are comparing a given world with given perceptions of it. The physical world is in some general sense of the term a deduced concept. Our problem is, in fact, to fit the world to our perceptions and not our perceptions to the world" (10:89).

In the simulation designer's attempt to relate his thinking and observation on some phenomenon to others, he must make statements about what others will experience if they follow certain procedures. This is so because what a designer experiences are the variables of his own creation and they do not exist independently of how he has named the problem under investigation. So for other people, especially participants, to understand his work he must externalize the procedures used, and only in this way can he convey the constructs of his work. When the designer makes operational statements he is abstracting from his own experience certain aspects which he believes are or can be shared with others.

Thayer states, "What is unavoidable, if we are to take what we know about communication seriously, is that a) Problems exist only in people; b) Problems exist only in the form they are conceived of; c) The problem dealt with is the one named or identified (not the 'objective' conditions of concern); and d) Given that one can 'get into contact' with his environment only via his own take-into-account-abilities, the solutions (or potential solutions) one has for problems generally determine the problems he 'sees' or identifies" (14:18).

The way the designer or the participant poses his problem determines what answers he will seek; determines what aspects of the present state of knowledge will have a bearing on the problem; determines which procedures he will follow or try to devise. Without some indication of a person's purposes, one cannot evaluate the correspondence between his actions and his problem-naming capabilities. For the significances a person encounters in the course of acting can be evaluated only in terms of what he intended to do. It should be clear by now why we have great difficulty in predicting other's behavior. For simulation participants, like simulation designers, have purposes and it is no easy task to acquire a correspondence between the purposes participants may actually be pursuing and the purposes designers attribute to them.

The process of communication provides each person with the only world he knows. A person's predictions of what will probably happen if he acts in a particular way transpire in and through communication. His actions will be effective only insofar as the predictions derived from his past correspond to what he actually experiences when he acts. The central problem of communication is understanding the degree of correspondence between the significant aspects of past experiences which one externalizes in one's problem-naming and those significant aspects which one externalizes in one's present encounters.

ASSUMPTIONS

A person's experience comprises a total complex of significances. In both past and present situations, certain significances have been found by a person to have a high probability of satisfying his purposes. Other aspects of a person's experience have proven not to work, leading to the frustration of his purposes. This evaluating is accomplished through a largely unconscious process and results in a set of assumptions which are brought to the present situation.

Assumptions, as we have seen provide predictions of the probable significances a person will encounter in the external world. And, only through participation can a person come to grips with the problem of externality. By experiencing the consequences of participation one is able to give meaning or ascribe significance to external situations. Communication, then, provides both the framework on which action is based and the channel through which the consequences of action are experienced.

We know, however, that the constancy of a person's assumptions vary from transaction to transaction and that his assumptions are hardly ever in complete harmony with each other. Those assumptions from a person's past experience that have worked probably become key guidelines for thinking and acting in present situations. There will also be assumptions which are tied very closely with particular experiences, especially those experiences which have had great significance for him. Thus, an assumption enters into the process with a weight determined on a probability basis adjusted in terms of its previous importance and its relationship to one's immediate transaction. The relevancy of an assumption in any situation is always gauged in light of one's particular purposes.

CHANGE

The prediction on which a person's participation is based is tested by him experiencing the consequences of his action. As a result assumptions are either bolstered, modified, or completely rejected. The probability is changed in proportion to the unconscious weighting given to that particular experience, resulting in modified assumptions, modified predictions, and modified externalized significances. Toch and MacLean suggest that "Man, the scientist, or just plain man is in a continuing process something like the following:

1. He senses inadequacies in certain of his assumptions. They don't seem to hold as well as they did in the past. This is problem awareness.

2. He tries to locate those aspects of phenomena <u>except for</u> which the functional activities in question would not exist.

3. He chooses those aspects he feels are most crucial.

4. He works out some methods for changing those aspects and experimenting with the changes.

5. He modifies his assumptions on the basis of empirical evidence" (15:75).

Change and uncertainty, then, become the guiding rules of nature. Yet, part of a person's sense of surety stems from situations in which his assumptions resulted in an adequate fulfillment of his purposes. In this case, actions merely reinforce what he believes to be true. Any transaction one takes part in has some degree of unpredictability for which past experience is a totally unreliable predictor.

What happens, however, when the significance of an experience is not as expected? Inadequate assumption can result in a hitch or problem. As Ittelson states, "Every hitch is either the result of a failure to achieve a particular goal, that is, of inadequate 'how-to-do' predictions, or else the result of a failure to experience a hoped-for satisfaction resulting from an incorrect 'what-for' prediction" (6:36). This lack of correspondence between externalized and encountered significances accounts for most of the change in man.

The primary function of communication, then, is neither revelation of the present nor remembrance of the past; it is prediction of the future. As Kelley put it, "The most important thing in anyone's externality is other people. . .Since we build and are ourselves built by other people, we can see how great is our stake in them. The psychological function is developed with people, and the quality of the psychological self depends upon the quality of the people out of which it is built" (8:251).

The future and all that it holds for us and those yet to come will be determined by the assumptions we hold. Possibly, through the use of "parameter-free" simulations we can produce situations and experiences which will lead people to test their assumptions and modify them when necessary.

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SIMULATING ESTABLISHED GROUP COMMUNICATION BEHAVIOR

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Simulation and gaming, at least considered as relatively unrestricted terms, have been a pedagogical component, and a problem of speech education for as long as the speech communication field has had an academic identity. For example, intercollegiate debate is organized and functions within the field as a recognized game.[1] However, the speech discipline has only recently begun to recognize the complementarity of its interests with the interests of others as exemplified by the National Gaming Council. Tucker's 1968 assessment of the place of simulation and gaming in the speech curriculum represents one of the first intra-disciplinary statements of that mutual interest.[2]

Group communication behavior, frequently referred to as discussion or group problem-solving, is one area of speech communication in which the reciprocal interests in simulation are becoming most evident. The purpose of this paper is to examine the current use and the potential of man-simulation methodologies for study and research of group communication, particularly as the communication behavior of established groups.

The term established group has been chosen to specify groups according to social roles and positional relationships. This definition contrasts with the more common procedure in small group study of classifying groups as naive (the members of the group have no history of prior interaction with each other) or as experienced. Thus, a college's freshman basketball team, as well as its varsity team, would be an established group. In either case, the individuals have knowledge, either experientially or vicariously based, about how their interactions should proceed: that is, they presumably know a great deal about group membership in that group, even though they do not know the specific group members.

Small Group Research Problems and Simulation

Marvin Shaw, one of the most active researchers in the small group

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[1] Millar, Dan P. Debate as Communication. In Otto Bauer (ed.) Introduction to Speech Communication, Dubuque, Iowa: Kendall-Hunt, 1968, pp. 81-91.

[2] Tucker, Raymond K. Computer Simulations and Simulation Games: Their Place in the Speech Curriculum. The Speech Teacher, XVII March, 1968, 128-133.

field has recently listed seven criticisms of group dynamics research. Among the seven critical characteristics he listed: (1) an overemphasis on laboratory research and a corresponding lack of emphasis on research in natural settings; (2) an overemphasis on ad hoc groups, with a corresponding lack of concern for traditioned groups; (3) a restriction of research to intragroup processes; and (4) an overdependence on arbitrary statistical standards.[3]

Inasmuch as simulation is, by definition, a laboratory event, it does not provide a definitive means of correcting the shortcomings of small group research but it is an alternative procedure that can contribute to the correction. In fact, if one accepts Abraham Kaplan's open-minded perspective of behavioral science[4] as an answering alternative to Shaw's criticism of overdependence on arbitrary statistical standards, the reports of game developments and game refinements become a feasible type of data for deriving inferences about "real-world" inter-group processes.[5]

In a time of diminishing research funding opportunities it is unlikely that laboratory research will be abandoned for more costly field studies. Man simulations provide a partial means of bridging the difference between the typical ad hoc group of the laboratory (i. e., students assigned to highly restricted problems) and the traditioned or established group of the field. Prior research, such as Strodtbeck's simulated jury sessions[6] and Gamson's coalition study,[7] provide evidence for the feasibility of the method.

Two other developments in the small group field concomitant with the increasing recognition that rigorous but trivial laboratory studies have limited utility, appear to be bringing man-simulations into a more central position in small group research. One of these is the increasing refinement and clarification of relationships between systems theory and group processes. Another development is the increasing use of multivariate statistical models for analyses

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[3]Shaw, Marvin E. Group Dynamics: The Psychology of Small Group Behavior. New York: McGraw-Hill, 1971, p. 357.

[4]Kaplan, Abraham. The Conduct of Inquiry: Methodology for Behavioral Science, San Francisco: Chandler, 1964

[5]Inbar, Michael, and Stoll, Clarice S. Simulation and Gaming in Social Science. New York: The Free Press, 1972

[6]Strodtbeck, F.L., and Hook, L.H. The Social Dimensions of a Twelve Man Jury Table. Sociometry, 1961. 24, pp. 397-415.

[7]Gamson, W.A. An Experimental Test of a Theory of Coalition Formation. American Sociological Review, 1961, 26, pp. 565-573.

of small group data. That is, small group systems theory, man-simulations, and multivariate analysis are moving toward a promising coalition that is likely to alter the current conception of what constitutes a "proper" laboratory study.

For example, DiSalvo's dissertation research was based on experimental conditions of subjects' role-playing groups of industrial shop foremen under varied conditions of simulated organizational climate and with varied amounts of problem-relevant information.[8] Although DiSalvo's operational procedures were still simple enough to criticize the research as another "artificial" laboratory study, it nonetheless represented a move toward more system complexity than most limited-variable, ad hoc group studies of the past.

Instructional Problems and Simulation Methods

A series of small group studies which has had a visible interactional relationship with teaching/learning practices in small group communication is Bales' research development and use of Interaction Process Analysis.[9] His methodology of providing a case study or topic problem which is discussed until there is a group-recommended solution continues to be the most used method for providing laboratory learning experiences for students. The Bales' studies and the instructional applications are clear examples that the research problems, cited above, and the problems of group communication education arise from similar sources.

Two conditions in the small group instructional field may be sufficient to suggest the problem. One is that group discussion courses, despite the fact that such courses have consistently used student participatory involvement as a procedure, have been the recipients of their share of student criticisms of irrelevance. A second condition is that the principal instructional stance has been limited to a single-alternative, prescriptive model of "effective" small group communication behavior. On the other hand, small group research indicates rather clearly that group effectiveness is a multi-alternative outcome, i. e., that one group's "tea" is another groups' "poison".[10]

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[8] DiSalvo, V.S. A Multivariate Analysis of Variance Investigation of the Effects of Information Processing Ability, Amount of Task Relevant Information, and Group Climate on Group Behavior. Unpublished Doctoral Dissertation, Bowling Green State University, 1971.

[9] Bales, R. F. Interaction Process Analysis: A Method for the Study of Small Groups. Cambridge, Mass: Addison-Wesley, 1950.

[10] Hackman, J. R. Toward Understanding the Role of Tasks in Behavioral Research. Acta Psychologica, 1969, 39, pp. 97-128.

It seems obvious that at least part of the problem is centered on the methodology: the instructor's (or the experimenter's) discontinuation of the group communication process at the point in time that the group agrees upon a decision. In most instances no attempt has been made to allow the group process to continue through phases of activating the solution-plan and receiving feedback from ensuing environmental processes. It is these later processes, of course, that provide information about the adequacies or inadequacies of pre-decision task-oriented group communication behavior in "real-world" established groups.

Parenthetically, a speculative consideration regarding the past use of the "problem-solving discussion" methodology is that it may have provided some of the impetus for sensitivity and encounter group approaches which have appeared around the country in speech communication courses. Bales himself, for example has publicized his "self-analytic" group approach in which only the "problem" is intra-group membership and the group interaction.[11] Such approaches seem to suggest that the only solution to irrelevancy is to throw away task-related problems.

However, man simulations, in which there are task problems, are being used as an alternative solution. Instead of isolating the learning group from contingencies of a social environment, simulations provide an environmental context (namely, other groups) which requires intra-group communication processes to be extended beyond the solution-agreement phase. Group decisions necessarily become related to experienced actions and experienced consequences. Under these conditions "effective" intra-group communication behavior gains a reference check beyond group "togetherness" and/or beyond conformity to a singular, prescriptive model for problem-solving behavior.

Jandt has devised a simulation which is intended to emphasize relationships between communication and conflict.[12] The simulation is an attempt to structure a problem situation in which intense social conflict is likely to occur. Based upon a real-life situation described in the January 30, 1970 issue of Life the simulation requires participants to interact as members of a major chemical company planning the construction of a new plant, highly skilled and professional people who share a common vacation area, activist students attending a state college, and elected government officials and Chamber of Commerce members. The participants must deal with the chemical company's

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[11]Bales, Robert F. Personality and Interpersonal Behavior. New York: Harper, 1970.

[12]Jandt, Fred E. Conflict Resolution Through Communication, New York: Harper, in press.

plans to construct a chemical plant on Resort Island. According to Jandt, the simulation has been used by a number of small group communication instructors and he has reported evaluational results based on attitude and comprehension measures. The simulation appears to be a viable method for studying problem-solving and ensuing feedback phases of established group communication processes. Gamson's Simsoc[13] has also been used with apparent satisfaction by speech communication instructors at a number of institutions. Other learning activities of a more restricted nature, such as the "Community Leader Exercise" used by many in the communication field, are analogs of communication processes operating unrestrictedly in real group environments.

In speech communication, as in other fields, involvement in simulation methodologies is promoting re-examination of purpose and of theoretical perspective. For example, earlier perspectives implicitly or explicitly defined interpersonal conflict as prescriptively undesirable. Work with simulation has helped to re-orient perspectives to a recognition that conflict is a condition of interpersonal relationships in problem-solving. From this perspective conflict is considered as a phase of interpersonal and/or group communication processes. As a process term conflict defines the phase, or phases, in which alternatives of problem definition (goals) and solution proposals (methods) occurs. Some behavioral responses to conflict relationships (violence, apathetic acquiesence, etc.) are personally or socially costly, but conflict processes may lead to positive behavioral outcomes. Simulations help to provide coping or observational experiences that validate this viewpoint.[14]

As models, or dynamic representations of established group communication, man simulations have as much potential for transforming laboratory learning and laboratory research from triviality to significance as any methodology emerging from the flux of today's behavioral sciences. They offer the speech communication field a needed alternative for meeting its objectives.

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"THE USES OF SIMULATED PROFILES AND THE PROF TECHNIQUE IN CAPTUR'NG THE POLICIES OF 'RATERS'"

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INTRODUCTION

Since the first conceptualizations of a general purpose stored program computer during the mid nineteen-forties, the computer field has grown tremendously. Today the availability of high-speed computers has made it feasible to utilize statistical computational and simulation techniques previously considered impractical. This tremendous expansion of research capabilities has encouraged researchers in education, industry, business and the government to consider studies involving broad problems never before regarded as being possible.

The field of communications has also reflected this expansion over the years regarding research rigor and computer utilization. Essentially, the communication field has moved beyond the usual rule of "keeping all the variables constant but one" and has begun investigating the communication process by recognizing that communication is based upon a complex model of human behavior involving systems and subsystems of variables, all of which can affect the "communication process." The communication field has gone to computerized content analysis, computer simulations of small group behavior, audience analysis computer simulations, multiple regression analysis, discriminant function analysis, multivariate analysis of variance, etc. to help understand the complexities of the "communication process." The purpose of this paper is to present a general technique (called PROF) which will offer communication researchers another potential methodology utilizing computer simulations and computer data analysis which hopefully will yield the answers necessary to help us understand the "communication process" we so often talk about.

The PROF Technique

Although "man-the-communicator" can be viewed in many different lights, his day-to-day activities are intimately related to the perspective that man is an information processing system. This notion is, of course, not a new one to the field of communication theory. Miller[1] talked about information processing in terms of Information I and Information II and that man's decisions are the result of the interaction of Information I and Information II. If we stop for a moment and return to "man-the-communicator," we can see that a normal activity is one of weighing alternatives in a situation before deciding on a specific course of action: to buy this car rather than that car, to accept this speaker as being more credible than another speaker, to solve a problem one way rather than another way. In each of the situations mentioned above, we could probably list the information for and against each of the alternatives. But what is man actually doing in each situation? Before he decides on a course of action, he attempts to deal with the information he has and attempts to formulate a subjective construct of that information, so that he ultimately can make a decision. In essence then our model of "man-the-communicator" attempts to structure the pieces of information he has available so that he might make some sort of a comparative assessement of the situation before committing himself to a specific course of action. Miller[2] indicates that research at this level of information processing is essential for communication theory if we are to develop an understanding of how people interpret information differently. The PROF technique, we believe, will aid the communications researcher in this area.

Research in the area of information processing and decision making has for the most part been centered in industrial psychology and military evaluation; as well as psychiatric and medical diagnosis. Researchers, for the most part, have been interested in studying the information processing strategies of individuals given different types of decision making demands. Naylor and Wherry[3] help to crystalize the area for us when they state that whenever you ask someone to give judgments, you are essentially asking for an expression of their "policy" or "strategy." An individual's information processing policy reflects, in a very real sense, the way in which that individual views the world that he has been assigned to evaluate. For example, if one individual responds or makes evaluations of one kind to a set of stimuli (pieces of information) while a second individual responds or makes judgments of a different kind to the same stimuli (identical pieces of information), these two individuals possess different information processing policies. As we mentioned earlier, Miller considers this task an important mission of communication research.

A little over ten years ago, a new approach to the policy capture problem was proposed by Bottenberg and Christal.[4] They labeled their method the JAN technique which stood for Judgment Analysis. Basically the method grouped information processing individuals in terms of the homogeneity of their prediction equations which is a modification of a more general clustering model developed by Ward.[5] Naylor and Wherry[6] offered a modification to the JAN technique which required that researchers using the technique possess a large number of stimuli sets or profiles to meet certain assumptions. Since this can be a problem when working with "real" stimuli sets, Wherry, Naylor, Wherry and Fallis[7] developed a program to create simulated stimuli sets or profiles. Later Wherry and Naylor[8] in reviewing the JAN technique, suggested that the technique is based upon defining the capturing of an individual's policy as the extent to which one can predict the information processing actions of an individual from the human characteristics of the data being required to evaluate. They go on to suggest that the JAN technique falls short of actually capturing policies, rather the technique identifies those policies that are similar and dissimilar. Given this limitation, the PROF method was advanced by Wherry and Naylor. The PROF (Profile of Factors) technique not only identifies the similarities and dissimilarities of information processing policies but also defines the captured policy by identifying the relative importance assigned to each factor array in a given information processing policy. For instance, if we presented 100 individuals 200 stimuli sets or profiles with each profile having the same seven stimuli but different value combinations and followed the procedures and computations required in the PROF technique, we would be able to identify which individuals had similar and dissimilar policies as well as identifying the specific stimuli from the seven the individuals were using in making their evaluations.

The PROF Procedure

The following is a step-by-step listing of the procedure used in the PROF procedure:

(1) The first step is the development of the simulated profiles to be used in the research project. In generating the necessary profiles it is essential that the stimuli (the individual information items to be processed) scores (represented on a one to nine scale) on each profile appear to be meaningfully related so that they reflect a "real world" relationship that will make sense to the individual who is processing the information. To accomplish this a theoretical or hypothetical factor analysis structure (consisting of theoretical factors, factor loadings, communalities and uniqueness scores) is created by the research team based on their review of the literature and pilot testing. This theoretical program which will then establish, for each profile, those traits (information items) that go together as well as the strength of their relationship. Figure 1 below shows an abbreviated sample profile.

Figure 1
Abbreviated Simulated Speaker Profile

	Poor			Average			Excellent		
Trait	1	2	3	4	5	6	7	8	9
Intelligence	.	.	.	.	.	x	.	.	.
Honesty	.	.	.	.	.	.	.	x	.
Trust	.	.	.	.	.	.	.	.	x
Expert	.	.	.	.	x	.	.	.	.
Qualifications	.	.	.	.	.	x	.	.	.
Concern for others	.	.	.	.	.	.	.	x	.
Reliable	.	.	.	.	.	.	.	x	.
My overall Evaluation is	1	2	3	4	5	6	7	8	9

(2) Step two deals with the profile rating procedure. Subjects being tested are usually presented with a packet containing the profiles (anywhere from 100 to 250) with the instructions to follow a basic sort-resort procedure so that the profiles are sorted into a forced stanine scale distribution.

(3) Step three of the PROF procedure deals with the data analysis aspects of the profiles and can be broken down into the following steps.

3.1 First, validity coefficients or correlations must be calculated for each individual engaged in the project using each profile trait score as a predictor and the global rating as criterion. In the above figure we had seven traits or information items so we would have seven validity coefficients for each individual in the project.

3.2 Once the validity coefficients (the correlations) have been calculated for each individual, an inverse data analysis is performed on the data followed by a Q type (correlating persons) factor analysis[9] in which the raters are factor analyzed. This step allows the research team to begin identifying those raters who rated the profiles in a similar and dissimilar manner. Factor arrays can be identified from the Q factor analysis by isolating raters with relatively pure loadings on a single factor and then going back into the validity coefficients on the trait or information items to determine which information items were important in the individual's information processing and then using those items to identify the factor that the individuals are correlated with.

3.3 A rater's information processing policy can then be "captured" by identifying those factors which the individual used in making his global rating on all of the profiles used in the project. The guidelines established by Wherry and Naylor are as follows: (1) if a factor controlled 25% or more (factor loading of .50 or higher) of an individual's rating behavior it was considered a major factor and represented with a capital letter which represents a specific factor; (2) if a factor controlled from 9% to 25% of the variance (factor loadings from .30 to .49) it was considered a minor factor and represented with a small letter; (3) a factor controlling less than 9% of the variance was considered as not playing a significant role and was identified with a dot.

We will now briefly work through an illustration to help demonstrate the procedure and the type of data the research team will be dealing with when using the PROF technique. Returning to the profile mentioned earlier let us say that we had 200 profiles possessing the same seven traits, although each profile varied in terms of how the information (trait score combinations) was arranged. We give these two hundred profiles to one hundred individuals (fifty individuals are fourteen years old and fifty are seventy-two years old) who then sort the profiles into three piles (poor, average, good) and then, taking one of the piles at a time, resorting the pile into three more piles so that in the end we have nine piles which follow a stanine distribution. From this, the validity coefficients are determined and then we inverse the data and perform the Q type factor analysis. For illustration purposes, let us say that our factor analysis provided us with three factors and after returning to the validity coefficients for individuals who had relatively pure loadings on a single factor, we label the first factor array "speaker competence," and the second factor array "speaker character," and the third factor array "speaker intention." To "capture" the information processing policies of the one hundred individuals involved in the project we now need to code the factor arrays. We will designate them as follows: "speaker competence" will be A, "speaker character" will be B, and "speaker intention" will be C. Given our two populations within the one hundred fifty teenagers and fifty aged people, we arrive at the following hypothetical array:

Strategy Pattern	The Teenagers	The Aged	Total
A . .	10	0	10
. B .	0	50	50
A B c	10	0	10
. B c	10	0	10
A B .	10	0	10
. . C	10	0	10
	(5)50	(1)50	(6)100

Remember that an "A" indicates that "speaker competence" controlled 25% or more of an individual's behavior, while "a" indicates that the competence factor was a minor dimension in the rating. From the table we can see that there were six different information processing policies captured with the PROF technique. The table indicates that seventy individuals used just one factor in their evaluation of the information while twenty used two factors and ten used three factors in their decision making. Also, the first group utilized five different strategies while the other group used one. We can also see from this table that the first group had little agreement regarding the information and their decision making, while group two had a great deal of agreement. The fifty individual aged who were 72 all were using "speaker character" to rate their profiles. No one used all three factors equally in arriving at their decisions. Ten of the teenagers used all three factors, but with A playing a dominating role and B and C playing secondary roles in their decision making.

Conclusion

This paper was designed to present to the communication field a methodology that would offer interested researchers a potential procedure for investigating "man-the-communicator's" information processing policies. The use of simulated profiles and the PROF technique appears to offer an exciting and successful dimension to this type of research. On the basis of the research conducted in other fields and our own research we are led to believe that further implementation of the PROF technique in communication research can make a significant contribution to our understanding the "hows" and "whys" of human information processing.

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[9]Assuming principle axis followed by an orthogonal varimax rotation.

THE DIRECT SIMULATION OF EFFECTIVE LEARNING ENVIRONMENTS: ENHANCING COMMUNICATION AMONG DIVERSE PEOPLE

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Simulation games can be divided into two general classes: Those in which the players are supposed to be the learners and those in which the observers are the learners. This paper is with reference to the former of these two classes, simulation games in which the players are supposed to learn from playing the game. My frame of reference is largely that of classroom simulations in schools.

As I have elaborated at some length in a previous paper,* I do not think we know much about the effectiveness of simulation games as learning devices when the players are supposed to do the learning. Most of the claims for the learning value of playing simulation games are extravagant, and for many such games there is no logical mechanism that would enable players to learn what the designers claim they would learn. The quality of the research investigations of these claims for the learning value of simulation games has been poor. The variables have been measured by different instruments in every study. The simulation devices have been used usually with a single play of the game, and usually there has not been careful attention to the actual behavior of the person in the game. Classroom research in particular still remains single-shot studies with different measures of different sets of variables that have very little comparability or mutual consistency. There is still no guarantee that findings on one game are at all generalizable to others.

I proposed in that previous paper an approach to doing research on simulation games which would be programmatic, and which would provide the

* See: "The Effectiveness of Simulation Games as Learning Environments," Simulation & Games, Vol. II, #4, December, 1971.

possibility of data accumulation over a series of discrete studies to provide answers to some of the major questions about simulation games. Over the past year I believe there was the beginning of movement in the direction of such programmatic research on games, particularly among the Johns Hopkins group, but just at that point the USOE cut off this funding on the grounds that they hadn't been doing it earlier!

It is a shame to report this. Simulations or simulation games provide one of the best opportunities we have to use controlled variations of complex social situations as part of a program of research to explore important variables in those social situations. This is true because simulation games provide by their very nature a closed system. Many of the variables in the social situation of a simulation game are controlled by the rules or the resources or the other parameters of the game. These allow controlled variations. They insure that the same game will look pretty much the same in each place where the rules are the same, and when one rule or parameter is varied, that the differences in that situation will be due to the changes in that rule or parameter.

This makes possible research into games as learning environments. There is no more critical question in education than to find out what kind of environment leads most effectively to learning by what kinds of people. Research into learning conditions--in classrooms in particular but also elsewhere--has been handicapped in the past by our inability to control enough of the variables in the situation to attribute any changes in learning outcomes to changes in the treatment. Games could be that much needed intermediate situation--more complex than laboratory experiments, yet controllable--that would provide a way to investigate learning environments.

I still remain convinced that somewhere money will be found for careful controlled variations studies into the critical variables that are simulated in a select set of simulation games. But this has not happened, and consequently, there has been little advance in our knowledge of effective applications of simulation gaming techniques beyond the enthusiastic testimonials of every new set of people who try one.

Given my interest in games as learning environments, and in the absence of money to pursue systematic research into them, I have recently become intrigued by designing simulation games to simulate ideal learning environments directly, rather than simulating some other social or institutional situation and hoping that in the process of playing the game the person will also learn. This interest arose out of the problem of trying to design ways to run conferences so that more communication takes place, more satisfaction is apparent, and fewer of the dreary, boring panels, lectures, and "reading of papers"--such as this--take place at conferences. I would like to explore in this paper, therefore, not a review of what we know about effective application of simulation and gaming techniques, but to suggest a new way of looking at what to simulate, as a way of designing simulation games in which the players do learn more.

Most of the simulation games that presently exist have been designed to simulate some complex social process which is asserted to operate in the real world. The notion has been that putting people in the simulated circumstances would enable them to gain insights into the nature of the more complex real world--to learn about the real situation. I would like to suggest another approach. I suggest that we model directly learning situations we have found valuable in our own lives. That is, start some situation that each of us in our own experience has found to be extremely educational and simulate it as a way of recapturing and applying that educational experience to other problems.

For example, one of the most valuable learning experiences that I have participated in in the past three or four years has come from structured interactions of diverse people around the problem of responding to an RFP (a request for proposals) from the government. In such cases the RFP spells out the nature of the problem to be addressed and some of the criteria which an acceptable solution must meet. The task is to write the most creative proposal to solve that problem within those criteria, and to make a convincing case that the proposal could be carried out. In most cases this involves getting together a small group of carefully selected people who, by their collective experience, cover the range of inputs necessary to respond to the RFP. Then, under the pressure of a deadline, brainstorming must be done, ideas exchanged, concepts clarified, paragraphs written, edited and rewritten, and a coherent proposal developed. Inevitably the most powerful effects of writing such proposals are the residual effects _on my own thinking_, caused by the intense interaction with people of different backgrounds. I often pick up new ways of thinking, new concepts and new approaches to solving problems, and I am often forced to explain my own thinking in a new way which adds to its power for me. There is this payoff, regardless of whether the proposal is funded.

If the RFP structures an interaction much more powerful than its ostensible purpose, why not simulate the RFP model? A problem could be carefully defined, including a set of reasonable parameters under which that problem had to be solved, and then carefully selected teams of individuals (possibly self-selected) representing a range of competencies would be brought together (or get together) for two or three days of intensive interaction, with whatever support was necessary, to write a proposal in response to that simulated RFP. Even if the proposals generated were not significant breakthroughs in dealing with the problem, the impact intellectually on the members of the working team would certainly be far greater than an equivalent amount of time spent in any other form of interaction presently in use in classrooms, or at conferences.

A second valuable learning experience in the real world is to be a member of a proposal reading team which attempts to evaluate and rank proposals that are submitted in response to an RFP. Again, the review panel is small and usually made up of people who represent the range of competencies which need to be represented to make a careful evaluation. This team starts by reading the RFP, discussing among itself the criteria which must be met by proposals and discussing ways to rate proposals on each of those criteria. They, then, each independently read each of the proposals and attempt to rank them on the criteria they have established. Finally, they meet to share their ratings and rankings, to argue over them and to develop some mechanism for consolidating their independent ratings to finally rank the submitted proposals.

I would suggest that this model could also be simulated. Commissioned papers, or written assignments in classrooms, could serve as the grist, and the participants would act as if they were responses to an RFP, collectively evaluating and ranking them. Again, even if the topic of the papers were trivial, the interaction among diverse people would be more valuable than what we presently do in classrooms, or at conferences.

A third special learning circumstance is that of designing games. It has long been recognized that designing a simulation of a problem is perhaps the most insightful learning experience one can have about the problem. However, the task of designing a simulation or game is very difficult and takes a great deal of time, even by those with a lot of experience in game design. Commercial companies have usually taken on the order of two years to produce a playable simulation game. Designing games from scratch is beyond high school students. I once took a group of twelve of the brightest students in a suburban high school and taught a nine-week course on the design of simulation games. We were totally unsuccessful, both in achieving completed designs and in having a valuable learning experience. Semester long graduate courses are the only place I know where games have been designed from scratch and the process was reportedly an exciting educational experience.

How, then, might we broaden the range of people who could be involved in a design experience which was educationally valuable? I would suggest that we could try to produce simulation games that were about ninety percent complete and/or which were designed so that making major modifications was a relatively easy task.

I think it would be possible to design simulation games and imbed them in a context where people first read about various hypotheses or theories relevant to the subject matter simulated in the game, and then made manipulations in the simulation game to test the hypotheses about which they had read. By running the specially set up simulation games several times and watching the outcomes, they could test the hypotheses. By the accompanying deliberations among themselves in the process of deciding how to set the last unset parameter, or how to manipulate the existing parameters to make the simulation a true test of the theory, they would have a game design experience that was a valuable learning experience.

In conclusion, these, then, are three approaches I would take to develop more effective use of simulation games techniques. I would simulate learning circumstances that people have found in their personal experience to have been educationally valuable. The three I sketched out here--the response to a proposal, the judging of a proposal, and the completion of the design of a basic game--are three I have found particularly valuable. Mine are those rare instances where I have managed to break through to communicating with someone very different from myself.

As we all know, with the explosion in the amount of information available in the world and the increasing specialization which must accompany this, a critical need in the modern world is to increase communication between specialists who previously have not communicated because they do not know each other's field. Since no one can master all of every area that he might need to know, we need to improve our techniques for going to another specialist and getting his head into our problems far enough that he can relate, adapt and extend his special knowledge to our problems; and even blend it with our own, which he may not fully understand, in order to solve some problem.

It is undoubtedly difficult to structure such interactions between specialists so that they are able to communicate, and past experience would indicate that we have not been often successful. Alienation is a fact of modern life. I suggest that simulation games of the type described above would help greatly in increasing communication between people who previously were unable to communicate, because they structure the environment in a special way to enhance communication. The time people spend together would be much more valuably spent than what we now do in conferences or in classrooms even if the problems on which they worked were in themselves trivial. How much more exciting if the problems were in fact, significant.

GAME DEMONSTRATIONS

In Charge	Title	Topic
Layman Allen University of Michigan	QUERIES 'N THEORIES	Game dealing with generative grammars and scientific method
Felton Armstrong The Institute for the Study of Health and Society	HEALTH GAME ONE	Self planning and delivery exercise
Alexander Bassin Florida State University	CRIMINAL JUSTICE GAME	Simulates the problems involved with criminal justice work
Hank Becker University of Utrecht	CLASSROOM CONFLICT	Goal conflicts in a Junior High classroom
Ervin Bell University of Colorado	U-DIG (Urban Development Investment Game)	Simulation game to test existing and innovative urban plans
Cora Coleman Temple University	GENETICO	Board game using Genetics concepts
Linda and Craig Decker The Johns Hopkins University	TECHNOCRACY	Interaction between science and politics in designing the future
Keith Edwards The Johns Hopkins University	URBAN SIMULATION AND EDUCATIONAL TELEVISION	Video taped documentary of the use of the urban simulation model, TRI-CITY
Gail Fennessey Academic Games Associates	SURVEY OF GAMES	Upon request, demonstrations of CLASSROOM, DEMOCRACY, DRUG DEBATE, GENERATION GAP, GHETTO, TAKE, TRADE AND DEVELOP, and others
Daria Bolton Fisk University of Texas	HOMEGROWN	Evolutionary housing game
Thomas Fletcher The American University	PRESIDENTIAL POLITICS	Simulation game in presidential politics
Fred Gage University of Pittsburg	FANCY HILL	Deals with the quality of life in a company owned coal town
Timothy Gamelin Eckerd College	POLITICS IN A MODERNIZING SOCIETY	Members of an elite compete for a governmental office through which status, wealth, coersive potential are redistributed
Caroline Gillin U.S.O.E. Teacher Corp	QUESTIONEZE	Individual or group game involvement for developing questioning skills

IN CHARGE	TITLE	TOPIC
Nancy Glandon University of Redlands	CATCH 16 A LEARNING GAME	Interaction simulation of survival in educational institutions.
John Jakubs Ohio State University	SUCCEED	Abstract simulation of urban public service
Jean Johnson Stanford University	NUERLAND	Game which simulates changes in a developing society
Armand Lauffer University of Michigan	COMPACTS	Community planning and action simulation
Patricia Martin The Florida State University	THE MIXED-MOTIVE DATING GAME	Simulation of "fair" social exchange of interpersonal relationships
Judson Morris, Jr. Kingsview Community Mennonite Health Center California State University	TEACH-IN	Shared decision making by students and teacher of the solutions to problematic behaviors in the classroom
Mary Ann Parks Robert Morris College	SITUATIONS	Simulation game for students of drama
A. J. Pennington J. A. Orlando Decisions Sciences Corporation	BUILD	Community development simulation game
Jack Rabin Auburn University	POLLUTION POLITICS	Problem of locating a new airport for a metropolitan area
Thomas Rundquist Wayne County Health Narcotics Rehabilitation	HORSE IS BOSS	Drug education game
Constance Seidner Boston University	HIGH SCHOOL GAME	Illustrates effects of certain social-structural variables upon behavior of high school students
Hazel Taylor Spitze University of Illinois	THE NUTRITION GAME THE CALORIE GAME	Principles of nutrition with applications in everyday eating behavior

In Charge	Title	Topic
Sivasailam Thiagarajan Center for Innovations in Teaching the Handicapped Indiana University	NAKED MONSTERS	Series of card games using a special deck on the analysis teaching and testing of concepts
Zdzislawa Anna Walaszek The Johns Hopkins University	THE ESTABLISHMENT	Collective decision-making game in which the Establishment tries to satisfy personal and societal interests
Mark Weiss Columbia University-South Carolina	PSYCHODRAMA	Psychodrama as a realizing agent in simulation games
Marshall Whithed Temple University	TeleCLUG	Time shared computer-assisted urban land use simulation game
Benjamin Zablocki California Institute of Technology	DICTATOR'S DILEMMA	Game of collective decisions focusing on problem of collectivity vs. self orientation

Note. There was a meeting held Thursday evening, October 5, 1971, on Information Dissemination in Simulations & Games with Jim Mulder, Utah State University in charge.

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