

ON THE SCOPE OF GAMING*†

MARTIN SHUBIK‡

Yale University

Gaming and simulation mean different things to different people. Currently there exist separate schools of individuals working on interrelated but basically different areas. Each has its own special goals and terminology. Yet there is a sufficient overlap among them that it is important to clarify the common and different interests and terminology.

The general topic of gaming is ripe for an examination to see to what extent there exists a basic methodology and theory of gaming. This paper addresses itself, in part, to this problem. Different types of games and different purposes are discussed. It is stressed that there is not one validation problem but many validation and specification problems which must be addressed if professional standards are to be attained.

1. Introduction

There are many forms of gaming, stretching from complex mathematical models to free-form verbal interchanges. Individuals whose world view and professional backgrounds are utterly different may all regard themselves as being involved in "gaming."

The subjects are different, their purposes are different and the criteria of validation differ, but the name is the same. In this paper, an attempt is made to sort out these major differences.

In a companion paper, definitions of the words gaming, game theory and simulation are given to provide a context both for the discussion here and there.

The prime purposes of this classification are:

(1) to call attention to the important prevalidation problems of *specification*, i.e., stating purpose and devising criteria by which to judge the attainment of one's goals;

(2) to indicate the possibility that *in spite* of the diversity there may be a common core of knowledge and professional skills of importance to all gamers; and

(3) to suggest that all specialists stand to benefit from an understanding of the diversity of gaming because frequently different types of gaming overlap and errors or important phenomena that may be completely ignored by one specialist may be obvious to another who sees the same game from a somewhat different viewpoint.

2. The Many Goals of Gaming: Teaching

Figure 1 shows the six main divisions of the goals of gaming, together with a finer breakdown of the categories of teaching and training. The breakdowns of the other categories are given subsequently.

In teaching and training, the audience for different games is extremely varied with respect to age, occupation, and reasons for using a game. A useful breakdown which correlates well (but not perfectly) with age is the type of educational operation:

Preschool,
Elementary School,
High School,

* Received April 1971.

† An early version of this paper appeared as a RAND Corporation publication, P-4608, March 1971. This is a heavily revised version with the additional research undertaken by the Cowles Foundation for Research in Economics under Contract with the Office of Naval Research.

‡ The author wishes to acknowledge the assistance of James Mayberry and Clayton Thomas.

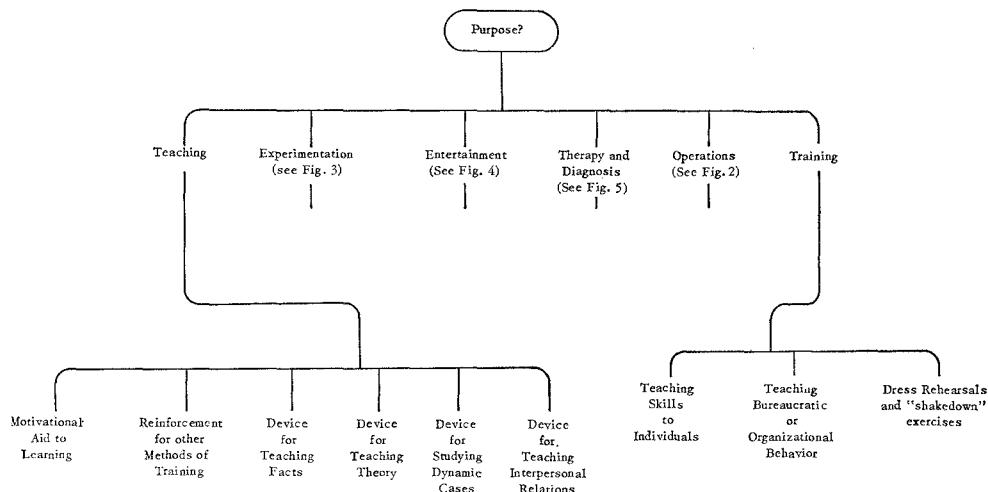


FIGURE 1

Undergraduate college,
Graduate, and
Adult educational programs.

An individual's occupation and his reasons for using a game are highly correlated. Without going into great detail, four reasons are suggested which broadly describe why most players are involved with teaching or training games:

- They volunteer to play,
- They are advised to play and follow the advice,
- They are ordered to play by a superior, or
- Bureaucratic or organizational rules require that they play.

Most games in most educational institutions are parts of courses or programs. There may be electives prior to registering for the program; however, once a student is in a program the organizational rules will require that he participate. In many colleges and universities in the United States there is a considerable amount of voluntary gaming.

Where the participants are members of large bureaucratic organizations such as the military, other parts of government service, or private corporations, they have, for the most part, been advised or ordered to participate. On occasion they may be volunteers. When this is the case, the type of volunteering is usually of the type where a department head is told to supply three out of his twenty men for a game. He may call for volunteers. It is not uncommon that the volunteers may be the three least busy or most junior men in the department.

Concerned citizens groups, curious students and "buffs" form the hard core of volunteer gamers. A crude estimate indicates that in 1970 there were between 15,000 to 25,000 war-gaming amateurs in the United States.¹ Currently there is a trend towards games stressing social interaction and the problems of society. This is manifested in the growth of a number of board games in the penumbra between education and entertainment; thus we have had a progression from MONOPOLY to SMOG. Even with war games there appears to have been an upswing in the last ten years of games calling for diplomacy, negotiations and grand strategy, such as DIPLOMACY and

¹ Based on the number of subscribers to the Avalon Hill publication, *The General*.

SUMMIT as contrasted with straight war games. From a technical game theoretic point of view there has been a shift from two-person zero-sum games or noncooperative individualistic enterprise games to nonconstant sum games where coalitions are of importance.

The overall trend in voluntary gaming in the last thirty years has been from an almost exclusive emphasis on military games to military-diplomatic games and to business games and now more recently to games concerning society.

2.1 Different Roles in Gaming for Teaching

Before questions concerning validation can be asked with respect to a single game, it is desirable to consider goals and criteria of success from several different points of view.

In particular any game should be considered in the context of its impact on individuals engaging in four activities related to it. They are:

- the players,
- the builders,
- the controllers or directors, and
- the sponsors.

Frequently an individual may play more than one role. Furthermore, the roles are often more finely differentiated than the breakdown noted above. For instance, the game direction may consist of a team which contains not only umpires or teachers who direct the game, but also experts who are called upon to judge the feasibility of certain acts while otherwise having no control role.

At the university level, especially with graduate students, more may be learned by the students in constructing games than in playing them. The locus of the learning experience is by no means centered with the players.

In gaming for teaching purposes, especially at the high school level or younger, the worth of a game is frequently no more than that of the teacher. An inspired teacher can direct a mediocre game with good results, and the best of teaching games can be of little use if it calls for considerable direction from an inadequate teacher.

The breakdown of roles noted above applies to gaming used for purposes other than teaching. It is referred to again later.

2.2 Motivational Aid to Learning

One of the major attractions of gaming has been as a motivational device. It appears to attract the attention of and involve the players deeply where other methods have far less impact. There is reasonable consensus on this point among those who have used games and a small amount of experimental evidence as shown by the work of Wing [29] and others [5]. Creators of educational games such as Layman Allen [21] stress the positive motivational features of educational games. However it is easy to slip from conjecture to unsubstantiated advocacy as is exemplified by the writings of Clark Abt [1]. Coleman has stressed the value of games in teaching disadvantaged children [9].

2.3 Reinforcement for Other Methods of Teaching

In the universities and schools, games are frequently used as part of a program along with more traditional methods of teaching. This is also true of the business schools and military academies. Gaming proponents claim that the mix of methods is most effective.

2.4 A Device for Teaching Facts

In virtually every type of gaming including the diplomatic-military games of the Studies, Analysis and Gaming Agency,² and business games such as the Carnegie Tech Game or INTOP, [28] gaming practitioners and players have claimed that gaming is an extremely useful way to learn and organize facts. A game usually provides a handy scheme for supplying associative links between facts, and as such it may aid both learning and remembering; although to date there is little hard evidence substantiating these claims.

2.5 A Device for Teaching Theory

At the advanced undergraduate and graduate level the building of games appears to be extremely useful in encouraging students to think in terms of models and abstractions. This improves their ability to theorize. In the social sciences especially, the importance of improving the ability of an individual to enable him to construct abstract representations of complex systems cannot be overemphasized. The discipline in constructing a playable game provides a deep appreciation of logical consistency and completeness, as well as stressing the connection between the model and its subject matter.

On the other hand, it is important to stress that before a game can be used with any success to teach theory it is rather desirable that the theory exists to be taught. In the exploitation of business games over the last decade this has not always been the case. A flagrant example of potential misuse has been in the modeling of advertising in business games. Even a brief glance at the literature on how advertising affects sales is sufficient to indicate that there is little substantiated theory in advertising, yet in many of the business games played both at universities and in business training programs advertising has been thrown in as an *ad hoc* modification on demand with teaching results which could be damaging were it not for the basic skepticism of most of the players. It is critically important that players be warned against learning false or unsubstantiated principles.

2.6 A Device for Studying Dynamic Cases

Several business schools, especially the Harvard Business School, favor the use of the case method. A specific historical case may be taken up, a "scenario" written describing it, and the class is required to consider the problems it poses and the ways in which they were handled or might have been handled.

A game lends itself with great ease to providing a dynamic context to a case. Furthermore like the Czech experimental theater at Expo '67, it provides a natural means whereby alternative histories can develop.

A formal game, especially a large and complex one, has both the advantages and disadvantages of an institution. It may take on the inertia of an institution itself, as is exemplified by the Carnegie Tech game [7]. However, this may be an advantage as it is extremely difficult to explain or reproduce in the classroom the ambience of decision-making within a bureaucracy.

2.7 A Device for Teaching Interpersonal Relations

Many of the basic games for younger children and disadvantaged groups, as well as community action games to study urban redevelopment or other social problems, stress

² This agency is the successor to the Joint War Gaming Agency.

interpersonal relations both from the viewpoint of the individuals and their roles. In many of the uses of gaming "seeing the other individual's point of view" by role playing his position appears to be of value. Thus, for example, a slum child may begin to appreciate that a policeman's lot is not a happy one. Furthermore it might even be possible for a United States official to appreciate that to a North Vietnamese he does not necessarily appear as the epitome of sweetness, light, reason and democracy.

At the more direct level an appreciation of the need for bargaining, communication and compromise can be obtained from many of these games. A good example of such a game is DEMOCRACY [8]. Some of the insights gained here do not pertain only to personality factors but to a basic game theoretic phenomenon that in an n -person non-constant sum game there is no neat unique way of defining socially rational behavior. There are many different criteria for social rationality, and (as evinced by the lack of a core) [22] it is frequently not possible to satisfy the demands of all groups even if each group can show that its demand is within the scope of its own power if it fails to co-operate with the remainder of society.

3. The Many Goals of Gaming: Training

Teaching blends into training, training into operational uses and so forth. Nevertheless it is useful to make the distinctions among different goals for gaming although they may blend together at the boundaries between them. In particular the major distinction between teaching and training concerns the emphasis placed on the *why* of the process. There are several quite effective small games which can be of use in improving an individual's performance in production and inventory scheduling without ever going into the depths of why certain methods work. An operator does not have to get a course in dynamic or in integer programming to become a better manager of production and inventory scheduling.

Many individuals can be taught to drive safely by means of analogue device trainers without having to learn much about Newtonian mechanics or how an automobile works. Training games for simple manual skills especially those requiring a fair amount of coordination are not particularly exciting, but they can be of tremendous use and can provide valuable simulated experience that would be costly in the extreme to obtain from the field.

In general when games are used for training, the only role occupied by the individual being trained is that of player. This contrasts with gaming for teaching where because the *why* is so important it is highly desirable in some instances to have students build or supervise as well as play games.

3.1 Bureaucratic and Organizational Behavior

In a complex society, licenses must be obtained, permits granted, rules checked, expectations examined, accounts audited, telephone calls made and routines for processing torrents of communication must be established. Training games offer the possibility not only of training individuals to acquire individual skills but also to learn bureaucratic routines.

3.2 Dress Rehearsals and Shakedown Exercises

Rehearsals in the theater, field maneuvers and battle exercises are all examples of operations devoted to seeing that individuals know "their lines" and are able to co-operate in team action. They differ from the previous category only inasmuch as they are usually aimed at preparing for coordination in a temporary context such as a specific

play or a projected offensive. The phrase "shakedown" appears to come from the naval usage "shakedown cruise" which is the original cruise of a ship devoted to getting the crew to coordinate and to check to see if the equipment works.

4. The Many Goals of Gaming: Operational Gaming

The different goals of operational gaming are indicated on Figure 2. In contrast with gaming for teaching, operational gaming is used almost exclusively by adults in military, governmental or corporate organizations.

There is an overlap between operational and training games in the domain of field exercises. It is difficult to say where the dress rehearsal and coordination aspects of an exercise cease and where planning, strategy testing, and exploration begin. In Figure 2 the category "shakedown" has been included under operational gaming as well as in Figure 1 under training.

By far the largest use of operational games to this day is military or diplomatic-military. Relative to these uses corporate operational gaming is insignificant and the use of operational gamings for social planning is in its infancy.

Because of the nature of the bureaucratic structure of decisionmaking a clear understanding of the roles and goals of the players, builders, controllers, and sponsors of operational gaming exercises is far more important to the professional who wants to know "what is going on" than is such detailed understanding of the use of gaming for teaching.

Operational gaming is "where the money is" currently and the goals of a consulting firm wanting to build a large game, a general wishing to advocate a weapons system and a colonel assigned to play in or operate the game can be sufficiently diverse that the mismatch makes an objective evaluation of such a game harder than reading the Rosetta stone.

4.1 Cross-Checking and Extra Validation for Other Methods

A game may be used as a back-up procedure to provide an extra insight into a process that has been investigated by other means. For example, a recommendation may be presented in report form. The basis for the recommendation may be expert opinion and/or empirical evidence. A gaming study of the same problem may turn up insights or raise questions overlooked by the approach. As operational games in general tend to be somewhat expensive in both time and money, the problem has to be of sufficient importance to merit the extra effort.

There is also the danger that a game may be employed to give a pseudoscientific window dressing to a recommendation.

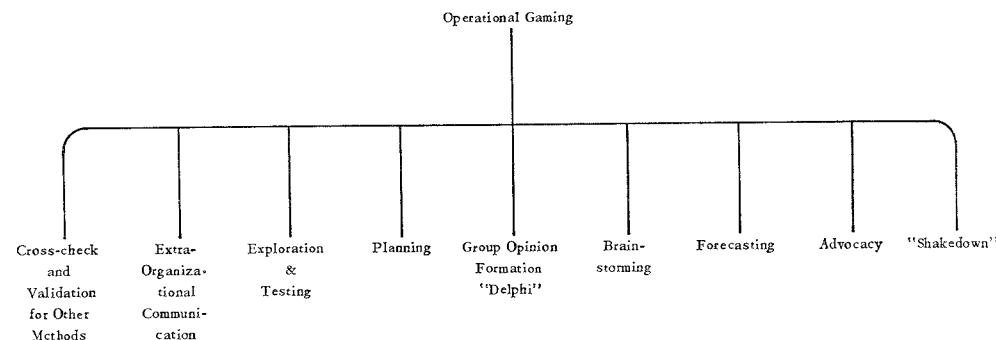


FIGURE 2

4.2 Extraorganizational Communication

There may be a game outside of the game being played. With operational games it is critical to understand both the stated and the unstated purposes of gaming by the individuals involved in the exercise. In particular gaming, along with short courses and seminars, is used to establish informal means of communication. In some instances the main objective may be to arrange to get two or three ranking individuals trapped together for two or three days on neutral ground.

Participants in diplomatic-military war games frequently comment on the value of being able to watch the decisionmaking styles of different high-ranked individuals.

The use of a game as a means for establishing informal communication will vary heavily with the style of play. If the game is held in an isolated locale over an intense period of play for three or four days or more, the effect may be quite striking. If, on the other hand, it is played in an intermittent manner over several weeks or months, then it is easy for most of the participants to minimize the disturbance to their set patterns.

4.3 Exploration, Testing, and Planning

The strict meaning of a strategy in the sense of game theory, while precise and worthy of note to a gamer, is not particularly useful to a planner. Planning involves the selection and aggregation of information. Even with the aid of high-speed digital computers the number of alternatives which can be explored is minuscule. Games such as those played by the SAGA³ operation or the SIERRA series⁴ of The Rand Corporation and many others have been used for planning, exploration and the testing out of a limited number of alternatives.

An intense amount of preparation goes into a game of this type. The preparation is in general far more extensive than the play. Two or three moves on each side may be taken, and in a debriefing session after the game there will be an attempt to summarize and note the consequences, alternatives or facts that had been overlooked prior to the commencement of play.

A planning game to be of use must utilize individuals sufficiently involved in the process that they can be privy to the actual problem and the major considerations. In military and governmental games these may range from colonels to five-star generals and cabinet officers.

There is some evidence that some high-ranking officials enjoy participating in gaming exercises; but there appears to be little evidence beyond the occasional testimonial as to what was accomplished. This last comment applies to gaming regarded as a "brain-storming" exercise as well.

4.4 Group Opinion Formation and "Delphi"

In the behavioral sciences and in the study of organizations, in evaluating many aspects of the present, and in forecasting the future, we have very little "hard" knowledge in the sense of the sciences in which experiments are performed and *replicated* frequently. In most professions much use is made of expert opinion. Up until recently little systematic thought was given to the study of how expert opinion is used and what the techniques are for optimizing the use of this scarce resource. Furthermore, little was known of the relative worth of using the opinion of more than one expert. When do diminishing returns set in? What sort of controls should there be over the interaction, and so forth?

³ The type of game used here was originally suggested by Goldhamer and Speier [15].

⁴ See, for example, Northrop [24].

An operational game may be regarded as a formal structure to elicit group planning—a process which involves both evaluation and prediction of the likelihood of contingencies.

Helmer [17] and Dalkey [10] have advocated the use of Delphi techniques, which consist of having a group of experts who are anonymous to each other respond to questionnaires, after which the results of their responses are processed and returned to them so that they can adjust their estimates in the light of the new information. Dalkey currently is engaged in large-scale experimentation [11] on the properties of the Delphi method.

One important feature that differentiates a formal operational game from Delphi is that there has been less emphasis on the aspects of motivation in relation to performance with the former than with the latter. To date there has been little effort to blend these two approaches. However the potential appears to be worthwhile.

4.5 *Forecasting*

In general a game is *not* a forecasting device. A good operational game may make use of good forecasting procedures but it is not in itself aimed at providing forecasts. This should not be confused with its use in discovering new alternatives and in helping to evaluate future possibilities. *Forecasting* and *contingency planning* are related but extremely different activities. In particular, a good forecaster may not be in the slightest interested in the importance or worth of his forecast. Accuracy may be a goal for the forecaster in and of itself, not because of its relevancy to the planning process.

A game may be a useful device for stressing the need for coordination of forecasting activities with planning and decisionmaking processes. In this sense the involvement of forecasters in the design and play of operational games may be of considerable use.

4.6 *Advocacy*

Last, but not least, we must note the use of operational games for advocacy. A competent game designer can build biases of almost any size into a game. Advocates for specific policies or weapons systems can load the dice so that the game has a great probability of producing the results they want to see. Games are fun. They are great propaganda devices. The exploitation of the AMA business game provides one such example [3]. Action groups of nonprofessionals can easily be hornswoggled by a latter-day snakeoil salesman peddling a game to cure all ills.

Smog, fog, the crime rate, central city decay, impotency, war, lack of understanding among nations, the evils of unemployment and the drug culture, the curse of the automobile and the lack of a good 5¢ cigar will all be cured if we only have a big enough data bank tied into a game room with large fancy maps.

Recently there has been a move for the building of a "World Game" by several extremely well-meaning individuals [13]. As a mild advocate of gaming this author believes that there are many good reasons to proceed with the use and building of large games for operational purposes, especially in areas dealing with social policy. However one must not confuse conversational feasibility with operational feasibility.

In some instances a game can be used as a euphemistic way for informing others of a change in policy by asking them to participate in an exercise whose outcome is a foregone conclusion. The Japanese war gaming prior to Pearl Harbor could be interpreted in this manner.⁵

⁵ See Wohlstetter [30].

5. Experimental Gaming

Human beings fortunately are more difficult to experiment with than rats or guinea pigs. Even so, there is now a fast growing literature on experimental gaming in which human decisionmaking behavior is studied by observing the performance of individuals in formally structured games. In order to pursue this type of work fruitfully it is important that the experimenters have at least a basic elementary understanding of game theory and social psychology. In a companion article a background of game theory relevant to gaming has been presented [25].

Much experimentation has been done with simple 2×2 matrix games under relatively restricted conditions.

The experimental subjects have been, for the most part, undergraduates at various universities; some army personnel have been used, as have been some inmates of local jails and some middle- and upper-level corporate personnel.

These experiments are psychological-light-years distant from preschool educational games or from military-diplomatic free-form war games. The criteria for validation belong to more or less accepted statistical methods familiar to physical scientists, econometricians, and experimental psychologists.

Some experimentation has been performed with business games of middling or of considerable complexity [19] and with political, diplomatic, and war games [18]. In general, owing to the greater complexity and smaller degree of control on these games they have been harder to control, and hypotheses have been difficult to test. In some instances (Hoggatt [19], Shubik, Wolf and Lockhart [27]) players have been faced with artificial players as competitors.

5.1 Validation of Hypotheses

In general although the goals of the game designers are usually clear in experimental gaming, the goals of the players are by no means clear. There exists an enormous, and frequently poorly handled, problem in specifying, controlling, and measuring the goals and motivations of players in simple as well as in complex experimental games.

A separate article is needed to do justice to the literature on experiments with 2×2 matrix games, and another article is needed to discuss experimental work on the analysis of human factors in complex competitive systems. Nevertheless, without going into detail several disturbing features of work in gaming can be seen. Specifically much of the work with operational games presupposes that a considerable number of problems that belong to the domain of experimental gaming, i.e., basic research, have been solved; whereas, in fact, the expenditures and activities in experimental gaming are minuscule as compared with operational gaming.

Furthermore, although the word "validation" is popular and takes on a particularly

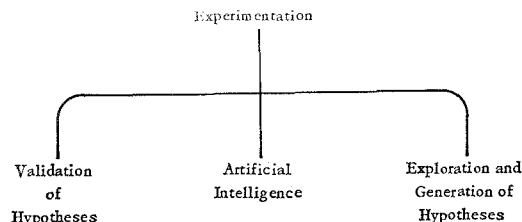


FIGURE 3

scientific flavor when applied to experimental games, if you do not know what you are trying to validate then all of the statistical apparatus you have may not help you (unless you are consciously searching your data to generate hypotheses). *Control* and *specification* are prevalidation procedures which even at this time are not yet carried out adequately on many of the experiments. The major contributing factors to the failure of control and specification are lack of cooperation among specialists (i.e., social psychologists who know no game theory, misunderstanding the competitive structure, or game theorists knowing no social-psychology, failing to allow for simple explanations of behavior) and lack of sufficiently automated laboratory facilities to enable the careful experimenters to obtain detailed observations and to run standard analyses at a reasonable cost.

5.2 Artificial Intelligence

Figure 3 has three branches. The first covers the type of experimentation that is more or less familiar in other disciplines. In the past decade there has been a considerable upsurge in the study of *artificial intelligence*, or in the study and the construction of computer programs which perform tasks that are usually regarded as requiring intelligence. No distinction has been made, in general, between the sort of intelligence required to solve difficult problems, such as playing chess, and to resolve interpersonal problems, such as those which arise in nonconstant sum games—bargaining, for instance.

Frequently the gamer is more interested in *social intelligence* than in individual intelligence. The problems in the construction of a good problem-solver or a socially intelligent player differ inasmuch as the criteria for the performance of the former are relatively easy to construct, whereas there are no such easy criteria that can be constructed to judge group or social rationality.

In particular, it appears that a good problem-solver, a program which can play chess well, for instance, requires efficient searching and calculating abilities and other features usually associated with intelligence and intellect. By the very nature of the game it need not have any “personality.” A good chess-playing program has to be a “smart” or intelligent program, not a pleasant or nice one. This is not the case when we turn to nonconstant sum games. It is possible to build an artificial player for a business game [19] which plays in a manner comparable to human players. The rules or “heuristics” needed to construct such a player call more for an emphasis on his interpersonal relationships than on his ability to compute. A “nice,” moderately cooperative and not particularly aggressive artificial player in a business game may elicit cooperation from his competitor and will do quite well.

The literature on artificial intelligence has very little on the subject of social intelligence. There has been and there is currently an extreme division of opinion on the nature of problem-solving, leaving aside the extension to social interaction. Simon, Minsky and Pappert [23], and many others are the proponents, whereas considerable criticism of the basis of artificial intelligence work has been offered by Bar Hillel and H. Dreyfus [12].

To enter into the debate on the pros and cons of artificial intelligence would take us too far astray from the work relevant to gaming; hence we confine our remarks only to those aspects of the subject relevant to those interested in gaming.

Along with the growth of interest in artificial intelligence has come a considerable growth in the design of protocols and ways to describe decisionmaking processes. Much work has been addressed to analogies between how one teaches a machine and how one

teaches a child [23]. In particular those interested in experimentation with computer-aided instruction⁶ need to be aware of the developments in artificial intelligence.

The experimental gamer is usually more interested in games which are more than problem-solving exercises. Many war games and games such as chess can be modeled as two-person zero-sum games, hence the main analytical problems they pose are in the domain of information processing and problem solving. Diplomatic-military, business, social development, and most other games do not fall under the zero-sum rubric. Social, political, or economic behavior all call for attention to interpersonal interaction. The construction of robots or artificial players in these games both provides opportunities to attempt to model socio-psychological processes in the building of the players and gives the experimenter greater control over his experiments, especially when he is able to replace a set of two-person experiments with a set of experiments consisting of a group of individual human players playing with the same artificial competitor.

5.3 *Exploration and Generation of Hypotheses*

Frequently, experimental games are used to explore decisionmaking processes and to generate hypotheses rather than to test specific hypotheses. Sometimes this is not the way things were planned, but this is how it works out. Prior to the experiment, several hypotheses may be suggested. After the experiment it appears that hypotheses can neither be accepted nor rejected, owing to insufficient definition or complications in the control of the experiment. Nevertheless, the running of the experiment clarifies the definition of the hypotheses, locates others, and locates the control difficulties.

The above reasoning is often used as an excuse or self-justification after an ill-conceived experiment has been run. However this is not always the case and pilot experiments play an extremely useful role when the topic being studied is both complex and ill defined.

6. Games for Entertainment

6.1 *The Theater*

It is important to remember the deep interconnection between gaming and theater. For example, many war exercises, fleet maneuvers, and "dry-runs" are identical in purpose with dress rehearsals. Huizinga [20], Callois [6], and many others have discussed the relationship between plays and games. It is not the purpose of this paper to explore the historical, anthropological and religious aspects of this interconnection. They form a fascinating subject in themselves. However, those who wish to use games for more mundane purposes should at least be aware of the interrelationship among the games, plays, theater in general, mass spectacles and ceremonial parades. The military parade itself is an extremely complex phenomenon being part entertainment, part training, partly a signaling process in a diplomatic dialogue and a device for influencing morale.

An important but open question is what are the basic features that differentiate good theater from good operational gaming? For example, how does the "realism" of the scenery affect both of these activities? The audiences are different, the role playing is different, and the stated purposes are different. Nevertheless, an analytical categorization of these differences is not an easy task.

6.2 *Gambling*

Three categories of individuals involved in gambling must be distinguished. There are those businessmen who run gambling ventures, professional gamblers who make a living from playing, and those who play for other reasons.

⁶ See for example [2].

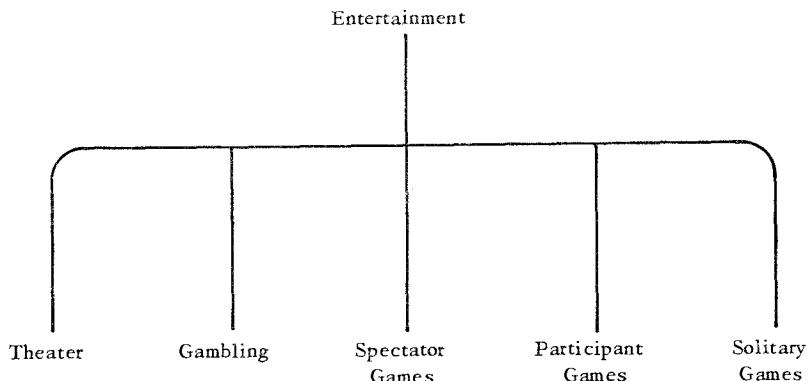


FIGURE 4

The individuals who run gambling establishments are in many senses not particularly distinguished from other businessmen except that possibly gambling as a business tends to be an enterprise with not very large components of risk as compared with a high innovation technology enterprise. The professional gambler such as the poker player (see for example H. O. Yardley [31], *The Education of a Poker Player*) does not seem to be far different from the professional arbitrageur. They both take risks but they are in the true sense of the word calculated risks and the individuals who devote professional attention to these occupations are usually skillful enough that they are able to earn a good (but in general not spectacular) living from their professional skills.

Although there is a large element of chance in a game such as poker in contrast with a game such as roulette it is primarily a game of skill and not of chance. The calculation of probabilities is one of the key aspects of good poker playing. There are obviously enormously important psychological factors in one's ability to judge the competence and style of the other players. Betting on horse races stands somewhere between a roulette game and a poker game in its skill component. The element of chance is extremely large. However, there are some useful calculations to be made concerning the odds being offered and the probable performance of the horses. The main factor, however, does come in the judgment of the horses and their performance on a specific track under the appropriate weather conditions.

In general, especially in large organizations, when someone states "we have taken a calculated risk," that frequently means that individuals have made a decision without doing the calculations necessary. In the case of the professional gambler, the very reverse is true. In general they have no bureaucratic structure around them and they are in a position where fast and explicit calculation of the odds is a central aspect of their very living.

In contrast with the fighter pilot, the poker player thinks in terms of odds explicitly. It is unlikely that the pilot calculates a probability of 0.15 of success by one avenue or 0.3 of success by another approach. There is undoubtedly an important difference in calculating explicit probabilities involving death and explicit probabilities involving money. Furthermore, the very nature of many gambling games of skill makes the calculation of probabilities a natural and explicit way of evaluating one's position. It is unlikely, however, that these features are in themselves sufficient to explain the fundamental difference in approach to thinking in terms of explicit probabilities evinced by professional gamblers as compared with, say, middle management or army colonels or, even more so, the citizen on the street. The literature on the social and personality aspects of the professional gambler appears to me to be surprisingly slight. This also

holds true for the handful of special professions in which the risk-of-life component is sufficiently important to make the gambling aspect explicit, for example, test pilots and steeplejacks.

The interests of the individuals not professionally involved in gambling run the gamut from mild entertainment to deep addiction. Many individuals who lose \$20, \$30 or \$100 at the tables in Las Vegas or Monte Carlo are paying an entertainment fee. For the most part they know that they are paying this fee and have decided that the entertainment is worth it. It is worth noting that the mere location and decor of main major gambling towns and main casinos lay stress on the theatrical aspects and the role-playing features of gambling. Las Vegas is designed so that the perfectly ordinary middle-class dweller of suburbia can lose his \$100 or so in a socially acceptable manner in surroundings ranging from pseudo-luxury to pseudo-wickedness.

What are the risk-taking features of the ordinary individual who is not addicted to gambling, who plays small-stake roulette at a casino, or who buys the occasional ticket for the races? There exists a certain amount of literature in economics and psychology concerning gambling and the buying of insurance where the odds are in general extremely small for an event to occur. However, there is virtually no analytical literature on ordinary gambling behavior. Erving Goffman has several highly stimulating articles on con-games where the otherwise prudent and nonaddicted individual is taken for a sucker [14].

There are many individuals for whom gambling is an addiction. Dostoevski was a good example of one of these. There is a small psychopathological literature on gambling as is evinced by the somewhat unsatisfactory book of Dr. E. Bergler [4]. One of the difficulties in studying a subject such as pathological gambling is that it requires a multi-disciplinary approach. Psychiatrists will tend to see only the psychiatric aspects whereas, for example, those trained in a theory of games will undoubtedly lay heavy emphasis on the structural differences among various games.

From the viewpoint of those interested in operational games, especially games of a military or social variety, the study of addiction and extreme risk-taking would appear to be critical. The distance between the gambling addict and the drug addict may not be great. There also appears to be an important psychopathological risk-taking component in assassinations, in some forms of exploratory behavior, and in the actions of some extremist groups.

In summary, it appears to me that gambling behavior of virtually all types is a critical phenomenon in the understanding of many important features of risk-taking. Those who argue for operational games as a means for studying extremely original or surprising alternatives should also consider the need to explore the genesis of both "reasonable and pathological risk behavior."

6.3 *Spectator Games*

Many sports, such as football, baseball, hockey, basketball, cricket, etc. are primarily spectator sports. The vast majority of the participants are in the audience and derive vicarious pleasure from the play. There the analogy between the game and theater is possibly at its closest. There are the actors, and the great majority are spectators. The sports event is far more of a free-form play than is a theatrical performance. In the former, although the rules are given, the actual path of the play is not completely known in advance. In the latter, the complete path of the play has been specified except for the acting that has not been controlled by the direction. Spectator games may have a small advocacy and teaching component to them, inasmuch as they may inculcate

an appreciation of teamwork and an ability to judge and understand the qualities of effective performance. However, for the most part they are pure entertainment. For a discussion of the vicarious pleasure and role identification aspects of spectator entertainment see Callois [6].

6.4 *Participant Games*

Bridge, poker, tennis, chess, football, charades, monopoly, and many board games, many of which can be played as spectator games, are most frequently played only by the active participants for their own amusement.

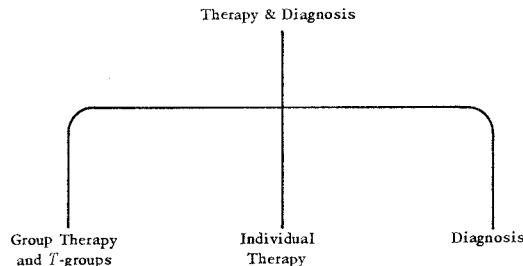
The distinction between participation in a poker game for amusement and for gambling purposes may easily vary as the size of the stakes. The importance of the payoffs to the players as an influence on the nature of the game cannot be overstressed. When an individual participates in a game whose stated purpose is operational or educational, but which nevertheless is formulated in such a way that the payoffs to him are not particularly clear, it becomes absolutely crucial to investigate the possibility that he has turned the exercise into a game for his entertainment.

It is a safe rule to apply when using games for teaching, experimentation, operations, or therapy to have as a null hypothesis that in fact the game was primarily theater or participant entertainment.

6.5 *Solitary Games*

Possibly one of the greatest sinks for the use of man-hours in gaming is the solitary game. Crossword puzzles, jigsaw puzzles, and solitaire are major examples of games "played to while away the time," although it can be argued that they may have an educational component. The origins of both the crossword puzzle and the jigsaw puzzle are relatively recent (within the last hundred years). Precisely what makes them so popular? Will they be supplanted by other solitary games? Could solitary games be designed that would be fun and more explicitly educational or experimental?

7. Therapy and Diagnosis



Games may well have both diagnostic and therapeutic value. Although these areas lie well beyond my own training and competence, it would be a glaring omission not to call them to the attention of the reader.

7.1 *Group Therapy and T-Groups*

In some ways group therapy sessions and *T-groups* might be regarded as "anti-games"; as such, the comparison between them and a formal operational game such as, say, a diplomatic-military game becomes of considerable interest. In the case of the latter, the individuals are encouraged to concentrate on certain aspects of role playing.

Very frequently an individual is required to simulate the decisionmaking process of someone else. In contrast with this activity, in group therapy individuals are encouraged to find out who they are. The stress appears to be in the other direction. Individuals will hopefully be able to examine where they have been role playing in a manner not consistent with their comprehension of self.

It appears to me that the paradigm of the game offers an extremely fruitful basis for joint work by psychiatrists, social-psychologists, and those interested in organizational decisionmaking.

7.2 *Diagnosis*

It is not difficult to design games that focus on relatively narrow band-widths of decisionmaking and of interactive behavior. Informal experimentation with several games such as "So-Long Sucker" [16] and "The Dollar Auction" [26] indicates that it is possible to obtain extremely strong participant reactions to relatively simple games. Experimentation with two-by-two matrix games of certain design has also indicated this. The use of small games for diagnosis might be relatively cheap and effective.

7.3 *Individual Therapy*

The use of games for therapeutic and corrective purposes is clearly closely related to, but somewhat different from, the use of games in teaching. Little appears to be known about the potentialities of this use.

8. Concluding Remarks

The scope of gaming is considerable. Many uses are utterly different from each other both in concept and purpose. Yet at the same time amid all of the diversity a certain common thread is present. The game is a paradigm for competitive and/or cooperative behavior within a structure of rules. The rules vary in formality in free-form gaming or in rigid rule gaming. They vary in portrayal of war situations, economics, social contract formation and so forth. But *all* games call for an explicit consideration of the role of the rules. A serious user of games is well advised to be broadly aware of the alternative uses and meanings of games as well as deeply specialized in his own type of gaming.

A key word concerning gaming that he hears frequently and from different sources is "validation." How can games be validated? Prior to asking this question it is imperative that we ask: "For what purpose and for whom?" A common vocabulary employed by different groups to mean different things is guaranteed to breed confusion. Around thirty considerably different purposes for gaming have been suggested. The criteria of validation for the success of a gaming endeavor are extremely different as we consider the different uses.

The size of the box office receipts is a good criterion for evaluating the success of a spectator sport from the viewpoint of the promoter. The number of people doing crossword puzzles is a good criterion for the owner of a newspaper. The criteria applied by a general, a zero-sum game theorist and a military hardware expert to force posture and allocation games are planets apart from the criteria that might be used to judge the success of a political-military exercise run by a mixed group of political scientists and top government officials. This in turn would be different from the judgments applied to evaluate the worth of a teaching game designed to give high school students an appreciation of international relations.

In light of the many different types of gaming, the different goals of the various interested parties and the problems of control, rather than talk about validation we are probably better off concentrating on four stages in the evaluation of gaming. They are:

- (1) intention,
- (2) specification,
- (3) control, and
- (4) validation.

The first refers to finding out generally what the goals of the concerned parties are. The second involves translating these goals into well-defined measures and in establishing that the measures can in fact be obtained from the game. The third refers to the actual control of the game necessary to guarantee that extraneous elements do not confound the obtaining of the measurements called for by the specification. The process of validation calls for interpreting the significance of the measurements in terms of the specification.

A methodology and a theory of gaming are only beginning to emerge. It is certainly premature to believe that there is such a thing as "the method for evaluating or validating all games." The "prevalidation" steps are still not always done adequately. The surprising feature of the growth in gaming is not that there is no single method of validation, but that so little attention has been paid to sorting out the different uses of gaming and to developing criteria and methods that apply to the special uses.

The promise from many of the different types of gaming appears to be considerable. The proof of the promise is by no means empty for some of the categories of gaming. There are some reasonable criteria available for judging the success of a social psychology experiment, the teaching value of some elementary games, and of some business games; the worth of some formal game theoretic and simulation models for weapons evaluation; the profitability of sports; the entertainment value of the theater and entertainment games and several other uses of gaming.

Our hard knowledge is extremely limited concerning how successful (and what are the criteria for success?) operational games are. What is really learned from political-diplomatic and military exercises? Who learns what from teaching games? The words *ad hoc* are frequently used in the pejorative sense. I would like to use them in a non-pejorative manner. It is my belief that the potentialities of gaming are considerable in many different fields of application. The *ad hoc* construction of specification, control and validation procedures with extreme attention paid to special purpose at hand could yield valuable insights and results from which the broader generalizations called for by a general theory of gaming might be constructed.

References

1. ABT, C. C., *Serious Games*, The Viking Press, New York, 1970.
2. ATKINSON, R. C., "Role of the Computer in Teaching Initial Reading," *Childhood Education* (1968).
3. BELLMAN, R., CLARK, C. E., MALCOLM, D. G., CRAFT, C. J. AND RICCIARDI, F. M., "On the Construction of a Multistage, Multiperson Business Game," *JORSA*, Vol. 5, No. 4 (August 1957).
4. BERGLER, E., *The Psychology of Gambling*, Hill and Wang, New York, 1957.
5. BOOCOCK, S. S. AND SCHILD, E. O., *Simulation Games in Learning*, Sage Publications, Beverly Hills, 1968.
6. CALLOIS, R., *Man Play and Games*, Thomas & Hudson, London, 1962.
7. COHEN, K. J., DILL, W. R., KUEHN, A. A. AND WINTERS, P. R., *The Carnegie Tech Management Game*, Richard D. Irwin, Homewood, Illinois, 1964.
8. COLEMAN, J., *Democracy*, The Johns Hopkins University Dept. of Social Relations and Academic Games Associates.

9. ——, "Social Processes and Social Simulation Games," in Boocock, S. S. and Schild, E. O., *Simulation Games in Learning*.
10. DALKEY, N. C., *The Delphi Method: An Experimental Study of Group Opinion*, The Rand Corporation, RM-5888-PR (June 1969).
11. —— AND ROARKE, D. L., *Experimental Assessment of Delphi Procedures with Group Value Judgments*, R-612-ARPA, The Rand Corporation (to appear).
12. DREYFUS, H., *Critique of Artificial Reason*, 1971 (to appear).
13. FULLER, B., *Presentations to Congress: The World Game*, Southern Illinois University, Carbondale, 1970.
14. GOFFMAN, E., "On Face Work," *Journal for the Study of Interpersonal Processes*, Vol. 18, No. 3 (August 1955), pp. 213-231.
15. GOLDHAMER, H. AND SPEIER, H., "Some Observations on Political Gaming," *World Politics*, Vol. 12 (1959), pp. 71-83.
16. HAUSNER, M., NASH, J. F., SHAPLEY, L. S. AND SHUBIK, M., "So Long Sucker," a four-person game in *Game Theory and Related Approaches to Social Behavior*, M. Shubik (ed.), John Wiley & Sons, New York, 1964.
17. HELMER, O., *A Use of Simulation for the Study of Future Values*, The Rand Corporation, P-3443 (1966).
18. HERMANN, C. F., "Validation Problems in Games and Simulations with Special Reference to Models of International Politics," *Behavioral Science*, Vol. 12 (May 1967), pp. 216-231.
19. HOGGATT, A. C., "Measuring the Cooperativeness of Behavior in Quantity Variation Duopoly Games," *Behavioral Science*, Vol. 12, No. 2 (March 1967).
20. HUIZINGA, J., *Homo Ludens*, Beacon Press, Boston, 1955 (translation).
21. LAYMAN ALLEN, *WFF'N PROOF*, New Haven.
22. LUCE, R. D. AND RAFFA, H., *Games and Decisions: Introduction and Critical Survey*, John Wiley, New York, 1957.
23. MINSKY, M. AND PAPERT, S., "Artificial Intelligence Memo No. 200, Progress Report 1968-69," Massachusetts Institute of Technology (1970).
24. NORTHRUP, G. M., *Use of Multiple On-Line, Time-Shared Computer Consoles in Simulation and Gaming*, The Rand Corporation P-3606 (1967).
25. SHUBIK, M., "On Gaming and Game Theory," *Management Science* (January 1972).
26. ——, "The Dollar Auction Game: A Paradox in Non-cooperative Behavior and Escalation," Yale University, Dept. of Administrative Sciences, Report No. 30 (1970).
27. ——, WOLF, J. AND LOCKHART, S., "An Artificial Player for a Business Market Game," *Simulation and Games* (1971) (to appear).
28. THORELLI, H. B. AND GRAVES, R. L., *International Operations Simulation*, The Free Press, Glencoe, 1964.
29. WING, R. L., *The Production and Evaluation of Three Computer-Based Economics Games for the Sixth Grade*, Board of Cooperative Educational Services, Westchester County, 1967.
30. WOHLSTETTER, R., *Pearl Harbor: Warning and Decision*, Stanford University Press, 1962.
31. YARDLEY, H. O., *The Education of a Poker Player*, Simon and Schuster, New Jersey, 1957.