

GAMING

Theory and Practice, Past and Future

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Gaming is here to stay. On this twentieth anniversary of the publication of *Simulation & Games*, I am taking the opportunity to indulge in a brief retrospective and prospective without the usual burden of copious footnotes and references.

Gaming has been used for the study of various aspects of society, business, and war. Although board games and other games for entertainment have been around for many thousands of years, gaming probably did not start in any formal sense until the Prussian army adopted formal war gaming exercises. These exercises took place in a simulated environment that originally had to be supplied as written instructions or verbal briefings for a game to be played on a board, map, sand table, or other representation of the actuality.

With the advent of the modern computer and the explosion in the growth of input, output, and display devices, the possibilities for the production of detailed simulations of environments have proliferated. Some years ago, several of us suggested the acronym MSG to distinguish among models, simulations, and games. No taxonomy is sacrosanct, but a few fundamental distinctions are worth nothing. In particular, with the growth of operations research and mathematical methods in the social sciences in general, there has been a proliferation of formal mathematical models. In some disciplines, such as mathematical economics and operations research, mathematical models are constructed and solutions that amount to assumptions about individual intent and behavior are postulated. Mathematical and

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computational methods are then employed to calculate predicted outcomes.

In the military, elaborate representations of conditions prevailing in tactical and strategic combat have been made. These representations are frequently such that even if we were certain concerning our assumptions about the motivation and behavior of individual units, the situation is so complex that no analytical or computational methods are known. Instead, the models are studied by simulating the dynamics of the system.

Much of gaming in the social sciences utilizes a simulated environment with live players. The players' behavior is not assumed to be representable by behavior equations, but is the subject of study for teaching, experimental, or operational purposes.

In the military, there is a split between the use of simulation without human players and the use of large and far more loosely structured games with several hundred experienced and often senior players, such as the Global War Game played at the Naval War College.

My comments in this brief article are directed primarily toward games in which human (or animal) players are involved. Models and simulations are highly related to games, but although we have many theories and conjectures concerning human motivation and behavior, one of the challenges to the social sciences is to develop better insights and to validate our theories of behavior.

Gaming has been used for many different purposes and these different uses will continue. Teaching, training, operational analysis and long-range planning, entertainment, advocacy, experimentation, and theory building all call for their own emphasis and techniques, and all are growing, although at somewhat different rates. Teaching, experimentation, and theory development are my major concerns, but training, entertainment, and operational uses overlap these other purposes and merit some comment.

No matter what aspect of gaming one considers, one must appreciate that the advent of the computer and current communi-

cations have provided the social sciences with instruments that are at least as powerful as, if not more so than, the microscope and telescope were in developing the physical and biological sciences.

Games have an enormous role to play in education, but the sheer mechanics of running a game of any complexity in the classroom even 20 years ago limited its effectiveness. Possibly at least as important as playing a game is constructing one. As anyone who has tried his or her hand at the construction of a playable game to portray social or economic or political interaction soon finds out, the details that one can handwave away in an essay or even in a formal mathematical model come back to haunt the game constructor as soon as an attempt is made actually to run the game. Process is far harder to describe than is usually appreciated. For advanced undergraduates or graduate students, game construction and playing can easily be far more rewarding than just playing the game.

At this time there is hardly a self-respecting business school that does not have one or more business games of its own. There are cycles, and after a period of intense activity usage slacks off, but it comes back in a few years with greater intensity than previously. It is my prediction that in the next 20 years the business game will evolve into a joint teaching, training, and corporate-planning device. We are close to reaching the point at which a company or an industry can afford to have a model of itself. Any major planning group for a large corporation will eventually find that the corporate model is more of a necessity than a luxury. The model will be a focal point for econometric work to validate its description: planning to try out "what-if" scenarios, teaching and training to illustrate both facts in an organized manner and routines in an easy way, and, perhaps even more important, teaching, training, and experimental investigations in organizational structure and behavior in getting tasks done.

We are on the verge of a cultural change. Twenty years ago, and even to some extent today, those who have been brought up in the precomputer era have tended to delegate rather than to

adopt new methods and views. Thus the corporate senior executives might play a business game or two for entertainment and to keep up with the Joneses, but the use of planning models and methods has frequently been delegated to lower levels. But as corporate presidents are replaced by those brought up with computers, games and simulations delegation may be replaced with participation, not out of charity, but out of necessity and self-interest.

For the scholar the change in the social sciences may be even more striking than the changes in business and the military. In economics in the space of 20 years, experimental methods have mushroomed. The marginal utility of rats is being measured along with competitive behavior of many types of humans in different market structures. Bargaining behavior, auctions, negotiations, face-to-face markets, and anonymous markets have all been subject to experimental scrutiny.

Another topic of considerable interest and activity has been the relationship among gaming, game theory, and social psychology. The theory of games has a life independent of gaming. To many it is often considered as presenting an overly rationalistic view of competitive and cooperative behavior, but the simple games devised by game theorists pose many paradoxes that are best considered and investigated experimentally. The Prisoner's Dilemma and the dollar auction (where the high bidder gets the prize and pays his bid, but the second highest bidder gets nothing but must also pay his bid) have given rise to considerable experimentation and have raised basic questions concerning the evolution of trust and cooperation.

There are 78 strategically different 2×2 matrix games,¹ thousands of experiments that have been done, and tens of thousands to be done. Pure game theory poses questions such as how much of bluffing in Poker is psychological and how much is a rational playing of the odds. The answer is neither purely mathematical nor purely psychological, but calls for an interaction of experimentation and game theory.

Simple games to test fair division show that both equity and salience appear to be important. It is clear that the model of a

rational know-it-all calculate-it-all person is a poor approximation to the intelligent, goal-oriented but capacity-constrained human. As yet a game theory has not been developed adequately to take into account capacity-constrained or context-rational behavior. There is little doubt in my mind that the development of an adequate theory of limited or context rationality will be one of the major challenges of the next 50 to 100 years. Psychology, social psychology, game theory, and gaming will all play a prominent role.

In other areas such as economic theory, political science, and sociology, the construction of games is forcing a process view and breaking away from the late nineteenth and early twentieth century emphasis on equilibrium. The act of constructing and playing games is tantamount to devising minimal institutions. Games require rules describing the domain of play, but the rules are in essence the description of the elementary laws and institutions that carry the process. Can we devise games that enable us to operationalize what we mean by money, power, prestige, or status?

There are many levels of feasibility in a society. An idea may be logically infeasible, in which case the wise abandon it and the less wise may turn it into a cult. An idea may be technologically infeasible for many reasons: The strength of materials is not available; the degree of precision is too fine and the costs are overwhelming. The history of precision tools and the computer show that these considerations may be overcome by work and invention in the course of time. Possibly even more important than technological infeasibility is sociological infeasibility. The Tammany Hall of the establishment cannot be overthrown even if the idea is logically sound, technologically feasible, and not necessarily terribly costly. Thus a modern society may face congestion of traffic for many years because imagination and the establishment cannot see beyond the conventional automobile. There are many possibilities for gaming that fall into this category. There is no technological reason why Las Vegas, Atlantic City, and every other gambling establishment in existence could not be computerized and turned into vast, ongoing,

live, experimental establishments. There are many games, lotteries, and prizes that could be invented to study risk behavior where individuals use their own money and set up their own levels of risk. Most of the gaming experiments run in the lab have had the subjects paid a few dollars an hour, or, on occasion, a few hundred, in a world where a lottery ticket may return fifteen million and where fiduciaries using other people's money or deciding upon other people's lives risk billions of dollars and many lives each day.

We have the apparatus but we do not have the organization and the cost effectiveness to view many aspects of everyday risk taking as a potential for data gathering.

Imagination is a precious commodity. I suspect that most of us have more than we imagine. We lose much of it through inhibition, indolence, and essay writing. This is usually done in such a manner that we can fool ourselves and others into believing we have explained how or why things work when our description does not in fact fully describe process. The act of game construction and playing forces us to specify fully scenarios and processes; it challenges imagination and logic. It forces us to pay attention to completeness and consistency, but above all to process and playability.

NOTE

1. That is, games with strong preference orderings. If weak orderings are considered, there are over 700 strategically different games.