AN INTRODUCTION TO ANALYTIC GAMING

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I would like to thank William Jones and Milton Weiner, both now-retired RAND colleagues who got me interested in gaming and taught me most of what I know about it.

I'd also like to acknowledge my daughter, Marie, who, as a young girl, taught me two lessons I've tried to profit from in writing this paper. The first lesson came when, after listening to my very carefully worded answer to her inquiry as to what a prostitute is, she responded, "oh, you mean like a hooker?" The lesson being not to belabor explaining what people may already understand. The second lesson came one evening when I told the family that we were eating out because I had just gotten a pay raise, and without a moment's hesitation Marie looked up at me and said, "but you don't *do* anything!" The lesson being that, try as I might, I'm never going to succeed in convincing people that gaming is really work.

AN INTRODUCTION TO ANALYTIC GAMING[1]

William Schwabe

Clark Abt (1970) defines a *game* as "an *activity* among two or more independent *decision-makers* seeking to achieve their *objectives* in some *limiting context*." *Gaming* involves the activity itself, whereas *game theory* uses mathematics to seek the best strategies, the sets of decisions that decisionmaking players might make.

Games are played for entertainment, sport, teaching, training, and research. As a research method, gaming is used by psychologists, educators, and sociologists interested in how people learn and play games and by operations researchers, other analysts, and decision makers interested in developing, exploring, and testing policies, strategies, hypotheses, and other ideas. This paper deals with gaming as a research method for analysts and as a vehicle for helping players understand complex policy issues.

As such, gaming is controversial, often practiced more as an art than a science. Few methods have been so inadequately named, prompting ridicule from skeptics and attempts by adherents to call it something more serious sounding or descriptive, such as "operational gaming," "simulation gaming," "free-form gaming," and, in defense analysis, "war gaming" and "political-military gaming." Although gaming has not been made as scientifically rigorous nor as universally accepted as adherents hoped for decades ago, it has helped importantly in developing strategy, in pretesting policies before actual implementation, and in communicating understanding of operational complexities.

Research games are often played as part of the planning process in developing important policies and strategies for organizations in competitive situations. Accordingly, the results--and sometimes the existence of gaming--is not publicized. For example, several Iraq-Kuwait scenarios were gamed in 1990 before Iraq actually attacked, but they are not fully documented in the open (unclassified) literature.

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[1]This entry was prepared for inclusion in Saul I. Gass and Carl M. Harris (eds.), *Encyclopedia of Operations Research & Management Science*, Kluwer Academic Publishers, Norwell, Massachusetts.

Sources of information on research gaming include special interest sections at ORSA, TIMS, and MORS conferences, reports and bibliographies published by organizations with a tradition of gaming (such as the Naval War College, RAND, and others), the journal *Simulation & Games*, and various books and articles. Shubik (1975) is one of the most comprehensive discussions of gaming, including a game theory background for gaming, analytical and behavioral models, and examples of games used for a variety of purposes.

Learning from Gaming: People can learn from gaming by designing the game, by playing it, or by analyzing the play or results (Perla and Barrett 1970).

Cathy Stein Greenblat (1988) discusses game design as a five-stage process: (1) setting objectives of and constraints on the game, (2) conceptual model development, (3) decisions about representation, (4) construction and refinement, and (5) documentation. Because a game is meant to model one or more important aspects of something that is operationally complex, game design is usually an intense intellectual exercise in analysis. Analysts commonly learn a great deal from the process of designing a game, as is true with other types of model design.

Most games have two or more *teams*, each representing a decisionmaking entity, such as a country, a military command, or a business firm, with from one to hundreds of players on a team. Players may be assigned specific roles--a leader of a country, a CEO in a regulated industry, a local warlord--in which they can criticize or embrace the policies of their own or competing governments or organizations. *Formal games* have rigid rules for play, while *seminar or free-form games*, have few rules. Play of a game is usually divided into *moves*, each being a period of real time during which *game time* (often posited to be in the future) is assumed to be frozen. Moves usually begin with teams being presented with information that players are asked to accept as true for the purposes of the game and use as a basis for their deliberations and decisions; this information is often in the form of a *scenario*. The set of decisions made by a player or team during a move period is sometimes called its move. Game administrators, who

usually include researchers who designed the game and will analyze its results, are commonly called *controllers* or *referees*. Games have usually been played with all participants at one site; however, *distributed games* can be played with remotely located players communicating via electronic mail or other means.

Despite the "make believe" aspects of gaming, players often become intellectually (and sometimes emotionally) caught up in the game, engaging in intense, goal-focused thought and discussion. In the process they learn about the issues, about their teammates, and about themselves. Controllers often learn what can go wrong operationally and how "signals" and other forms of communications between teams can be misunderstood.

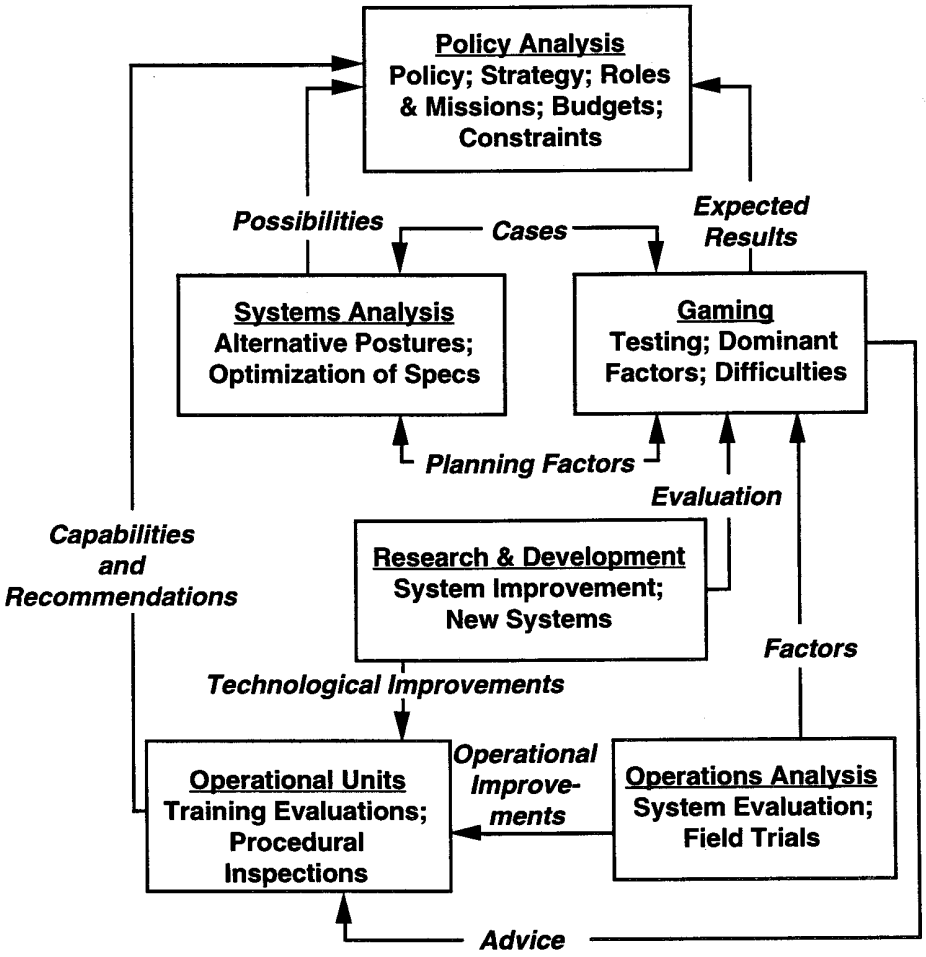
Analysis usually begins with a critique at the end of the last game move, attended by players, controllers, and observers. The game director may ask each team leader to present his or her analysis of what the team saw as the major issues, how they analyzed their options, what they decided, and what results they expected. Whether analysis is more formal than this depends in part on whether the game was designed as an experiment, to yield data or other observations suitable for analysis. If a series of games is played, then there is opportunity for comparative analysis.

Why Game? Unlike many other techniques of analysis, gaming is not a solution method. The output of a game is not a forecast or prediction, solution, or rigorous validation. The output of a good game is increased understanding.

Gaming can do several things: reveal errors or omissions in concept; explore assumptions and uncover the implicit ones; draw out divided opinion; examine the feasibility of an operational concept; identify areas that are particularly sensitive or in which information is lacking (Quade 1975); pool the knowledge of several experts; suggest questions or hypotheses for further study; identify the values or measures of effectiveness (MOE) that people care about; breadboard approval-winning or implementation of policies; or test strategies for long-term consequences. Gaming can do something an individual person cannot do, no matter how vigorous his or her analysis, to list the

things that would never occur to him. It can help identify all the ways that a carefully composed statement can be misinterpreted. It can "generate the phenomena of understanding and misunderstanding, perception and misperception, bargaining, demonstrations, dares and challenger's accommodation, coercion and intimidation, conveyance of intent, and uncertainty about what each other has already done or decided on. There are some things that just cannot be done by a single person or by a team that works together." (Schelling in Levine, Schelling, and Jones 1991).

Gaming in Context: Gaming has often not been as well integrated into studies using other methodologies as might be warranted. Gaming is but one form of analysis to inform policy, managerial, or operational decisions. The following figure, adapted from Paxson (1963), shows how



gaming may be related to other analysis. This is clearly a "systems analysis" view of the world and may be dated.

Prospects for Gaming: Gaming has had its ups and downs; it is presently enjoying some popularity. Videoconferencing and electronic mail networks open possibilities for less expensive games with broader participation, including international play. Advances in computers and software make it easier to develop models to support games, to use them on the fly during games to update scenarios, to query data files in response to player questions during games, and to prepare presentation graphics during the games and for post-game critiques. Videotaping has been used to present scenario updates to players in "newscast" format and to present pre-taped briefings by experts to players. Expert systems are used to support some games, but the use of artificial intelligence, rule-based "agents" in gaming is not as active as it was in the 1980s.

Regardless of whether gaming ever achieves the rigor early proponents sought, it appears to have continuing value. Gaming can often respond to changing operational or strategic contexts more rapidly than other methods. Challenges remain in making games less demanding of player time (especially important in enlisting senior officials as players), in reducing costs of games (including travel costs), and in using game results responsibly and effectively in analyses to inform decisions.

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