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A SEMINAL INVENTORY OF BASIC RESEARCH USING BUSINESS SIMULATION GAMES

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ABSTRACT

The vast bulk of research in simulation gaming focuses on either the design of games or their use in education and training. Considerable basic research, though, makes use of games as a research environment. This paper provides a seminal inventory of the use of games for basic research in business. This inventory is anticipated to evolve into a more exhaustive data base and also to lead to more meaningful categorizations and characterizations of the inventory. Now and in the future this inventory may encourage researchers to make use of the real and numerous advantages of simulation games as a research platform.

INTRODUCTION AND BACKGROUND

The state of business simulation gaming is described from time to time from a variety of perspectives. Most recently, a special issue of *Simulation & Gaming* (Klabbers 2001) was dedicated to the state of the art and science of simulation/gaming generally. Most broadly, Wolfe & Crookall (1998) assessed the state of simulation/gaming as a scientific discipline. As a core reference, Gentry's (1990) *Guide to Business Gaming and Experiential Learning* presents a foundation of business games. The *Simulation and Gaming Yearbook* (Saunders, Percival & Vartiainen, 1996) periodically updates key developments in gaming. More topically, Randel *et al.* (1992) summarized research on the effectiveness of games for educational purposes and, based on an extensive review of the literature, Feinstein & Cannon (2003, 2002, 2001) provided a comprehensive framework for the validation of simulation games. Faria (1998) and others (Biggs, 1979; Burgess, 1991; Chang, 2003; Eldredge & Watson, 1996) have reported the extent of usage of simulation games in academe and business.

Overwhelmingly, the orientation of these "state of" works is either the design of simulation games or the use of games in education and training. Much less widely recognized (and applied) is the use of simulation games as a platform for basic research. Greenblat (1975, p. 320) characterized the shift in focus "...from research on games to games for research..." Less wide recognition notwithstanding, the use of games for basic research has to some extent been conceptualized and applied. The present review summarizes those conceptualizations and applications. In turn, the purposes of this summary are to inventory precedents for use of simulation games for basic research and to inspire researchers to consider possibilities and opportunities for the use of business simulation games as a platform for their basic researches.

DELIMITING SIMULATION GAMING

Simulation gaming, of course, is not limited to the computerized business simulation games of the modern day ilk. Virtually any laboratory experiment may be characterized as a simulation, the laboratory setting not being a natural setting. (For overviews of gaming methodologies in experimental research see Bass [1964], Klimoski [1978], Schlenker & Bonoma [1978], Schwenk [1982], and Shubik [1961].) Setting aside, simulation also subsumes early devices such as information display boards (Bettman, 1975; Jacoby, Speller & Kohn, 1974) and Hughes & Naert's (1970) pioneering computer-controlled experiments, both of which were developed for use in basic research, as well as more mundane devices such as role-playing. Gaming, too, has a substantial modern history of use in basic research, the most prominent early developers being von Neumann & Morgenstern (1944), with Herrmann & Stewart (1957) being among the first to position gaming for basic research in management.

The present review of the use of simulation games in basic research, then, is somewhat arbitrarily limited to (1) competitive (2) longitudinal (3) business games. All of the basic research applications inventoried here are computerized. The aspect of computerization, though, is usually incidental to the participation experience and to the basic research; computerization is but a (perhaps vital) facilitation. Our present delimitation of simulation gaming notwithstanding, there is no reason why

complementary inventories of basic research applications using other types of simulation can not be compiled. Further, we invite advisements of basic research applications not reviewed here so that the inventory may grow to become truly comprehensive.

CATEGORIZING BASIC RESEARCH APPLICATIONS

The basis for organizing/categorizing the basic research applications using simulation games summarized here is the topic of the research. Interestingly, while this may seem to be the most obvious basis, other bases have been proposed. Greenblat (1975) developed a taxonomy comprising eight combinations among (1) the researcher's purpose, (2) the kind of gaming-simulation employed, (3) the researcher's role, (4) the participant's role, and whether the game used was (5) existing, (6) a new game, or (7) a redesigning of a game.

The basic research studies inventoried here are categorized into:

cross sectional organizational behavior,
longitudinal organizational behavior,
management,
decision-making,
forecasting, and
marketing.

The studies and the specific business games used are summarized in Table 1.

A CONCEPTUAL PERSPECTIVE

The most recent work taking a comprehensive look at the potential of simulation games for basic research was published 20 years ago (Gentry *et al.,* 1984). Among the advantages cited by Gentry *et al.* are:

- "...sufficient control so as to ensure internal validity while at the same time being sufficiently realistic so as to have some external validity." (p. 1)
- the capacity to investigate subjects infeasible via questionnaire surveys and field studies due to complexity and time consumption, e.g., decision-making processes, infrequent environmental conditions, e.g., labor negotiations, or sensitivity, e.g., divestment strategies
- high participant involvement
- compression of longitudinal phenomena
- ease of replicability

Among the disadvantages of simulation games for basic research cited by Gentry *et al.* are:

- limited mundane realism, i.e., face validity,
- limited experimental realism, i.e., the propensity of participants to not behave realistically owing to no or nonenduring consequences
- game construction resources required where a suitable game does not already exist
- small sample sizes partly due to administrator and participant time requirements
- confounding effects evolving from the longitudinal dynamism of the game, i.e., while experiment manipulations may remain constant, actual participation conditions vary as a function of differentially evolving conditions, e.g., performance success, as the game progresses.

To the above list of advantages may be added "safely investigate potentially dangerous or costly situations and...provide a situation for players which offers its own rewards for participation" (Dukes, 1973, p. 4), the latter advantage being in contrast to the "no or nonenduring consequences" disadvantage in the above list. Also, in contrast to the "mundane realism" disadvantage listed above, McFarlane (1971, p. 150) cites as an advantage of simulation gaming "a setting more likely to be perceived as 'realistic' by the subjects."

TABLE 1: Games Used for Basic Research

Game	Used for basic research by...
The Carnegie Tech Management Game	Cangelosi & Dill (1965)
Dairy business-management game	Babb, Leslie & Van Slyke (1966)
The Farm Game	Gentry, Tice, Robertson & Gentry (1984)
FINANSIM	Biggs (1975)
KUBSIM	Urban (1977)
The Management Game	Etzion & Segev (1984) Segev (1987)
Market Place	Achrol & Gundlach (1999) Gundlach & Cadotte (1994)
The Marketing Management Experience	Dickinson (2002)

Markstrat	Clark & Montgomery (1999) Clark & Montgomery (1998) Curren, Folkes & Steckel (1992) Glazer, Steckel & Winer (1992) Glazer, Steckel & Winer (1990) Glazer, Steckel & Winer (1989) Glazer, Steckel & Winer (1987) Hogarth & Makridakis (1981) Lant & Montgomery (1987)
The Organization Game	Cameron & Whetten (1981) Smith, Mitchell & Summer (1985)
Purdue Farm Management Game	Babb, Leslie & Van Slyke (1966)
Purdue Farm Supply Center/Business Management Game	Babb & Bohl (1975) Babb, Leslie & Van Slyke (1966)
Purdue Supermarket Management Game	Babb, Leslie & Van Slyke (1966)
QUANTSIM, SIMQ	Cosier & Rechner (1985) Slusher, Sims & Thiel (1978)
Tycoon	Gladstein & Reilly (1985)

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Though not constituting reviews or inventories of such, numerous earlier works have recognized the potential of simulation games for basic research: Cohen & Rhenman (1961), Cohen & Cyert (1965), Babb, Leslie & van Slyke (1966), McFarlane (1971), Inbar & Stoll (1972), Seidner & Dukes (1976), Schlenker & Bonoma (1978), Sewall (1978), Nees (1983). More recently, the *Journal of Business Research* (1987) published a special issue devoted to basic research applications using *Markstrat* (Larr□ch□ & Gatignon 1977) including observations on simulations in business education and research by Larr□ch□ (1987).

CROSS SECTIONAL ORGANIZATIONAL BEHAVIOR

Decision makers, of course, must have information on which to base their decisions. One approach to obtaining information may be to designate, say, two committees: one charged with investigating a certain set of assumptions/conditions and the second charged with investigating a contrary set of assumptions/conditions, i.e., dialectical inquiry. Recommendations from the two different perspectives should prove informative to the decision maker. Alternatively, one committee may be charged with investigating a certain set of assumptions/conditions and a second charged with critiquing the work of the first committee, i.e., a devil's advocate approach. Cosier & Rechner (1985) used Nichols & Schott's SIMQ (1975) as a platform to compare the effectiveness of these two approaches.

Group decision making processes may change as a function of external threats to the company, e.g., high risk of loss, and as a function of time pressure, some anticipated changes being a decrease in the amount of discussion and amount of information used and an increase in decision centrality. The *Tycoon* (Amos Tuck School of Business Administration 1979) management simulation was used by Gladstein & Reilly (1985) to test these types of propositions.

Group decision making performance may also be related to the attitudes of the group members toward their task, the level of effort they exert, and the degree to which the more effective decision makers emerge from the group process. Glazer, Steckel & Winer (1987) found all of these relationships to hold among participants in a *Markstrat* (Larr□ch□ & Gatignon, 1977) competition.

The magnitude and symmetry of interdependence between parties to an exchange was hypothesized by Gundlach & Cadotte

(1994) to influence coerciveness of strategies, feelings of conflict, and business performance evaluation. They used Cadotte's (1990) *Market Place* simulation, featuring exchange between manufacturers and distributors, to test these hypotheses. Extending this stream of research, Achrol & Gundlach (1999) hypothesized that an increase in comparative commitment by one party in an exchange, lower contractual safeguards, and lower levels of mutual interest would result in greater opportunism in an exchange relationship between organizations. They also used Cadotte's (1990) *Market Place* simulation. Achrol & Gundlach (1999) examined the nomological, convergent, and discriminant validity of their measures and characterized these, respectively, as moderate, moderate, and reasonable (pp. 115, 116).

Strategies for labor-management negotiations was the focus of a study by Slusher, Sims & Thiel (1978). Utilizing *QUANTSIM* (Nichols & Schott, 1972), they studied the effects of initial offers, first concession magnitudes, and number of concessions on wage settlements. In this same stream, Urban (1977) examined differences in management-union bargaining behavior of males and females using *KUBSIM* (Klatt & Urban, 1975).

Organizational behaviorists distinguish between strategy (actions taken to match the organization with its environment) and strategy-making (the formulation and implementation process) and various taxonomies for each have been put forth. Segev (1987) hypothesized a relationship between two such taxonomies and that the fit between the two would be associated with high performance. Employing the Graduate School of Business Administration, New York University, *Management Game* (1972), he found support for the association hypothesis and partial support for the high performance hypothesis.

LONGITUDINAL ORGANIZATIONAL BEHAVIOR

Several basic researches have exploited the longitudinal nature of a simulation game to study various evolutions in managers' philosophies and strategies over the course of an organization's "life cycle."

Cangelosi & Dill (1965) examined managers' objectives and practices during different phases of organizational development using *The Carnegie Tech Management Game* (Cohen *et al.,* 1964). They coupled their observations with a synthesis of extant theories of decision-making to formulate a comprehensive theory of organizational learning. Cameron & Whetten (1981) used *The Organization Game* (Miles & Randolph, 1979) to monitor the self-reported effectiveness of different levels of analysis–individual, departmental, divisional, organizational– over the course of the organization "life-cycle" and also the importance of input, internal processes, and output effectiveness at the different levels. Smith, Mitchell & Summer (1985) also used *The Organization Game* to track the change in importance of technical efficiency, political support, and organizational coordination over start-up, mobilization and turnaround, growth, and slow down stages of an organization.

The longitudinal nature of some simulation games, of course, provides relevant "experience" for participants in a variety of forms. Indeed, it may be argued that it is that very experience that is the hallmark of intended learning in longitudinal games. Using *Markstrat* (Larr□ch□ & Gatignon, 1977), Lant & Montgomery (1987) showed that the discrepancy between past aspiration and attainment levels enhances subsequent aspiration level, that past attainment discrepancy and past risk taking significantly explain future risk taking, and that past attainment discrepancy, proportion of unsuccessful R & D projects, and past innovativeness of search all positively affect current innovativeness of search.

MANAGEMENT

Managers whose roles within a company better fit their own interests and managers who have greater general business knowledge may be expected to perform better and to be more favorably evaluated by their peers. Etzion & Segev (1984) found these propositions to generally hold for participants in *The Management Game* (Graduate School of Business Administration, New York University, 1972).

Rowland & Gardner (1973) used the Least-Preferred Coworker questionnaire to classify *Marksim* (Greenlaw & Kniffin, 1964) conglomerate- and firm-level "presidents" as relationship-oriented or task-oriented leaders. Generally, where both conglomerate- and firm-level presidents were relationship-oriented, team members' perceptions of team atmosphere and of their immediate superior were more favorable.

DECISION-MAKING

The notion and application of automating "decision making" has appeared in various management/marketing decision support/information system guises for decades. Hogarth & Makridakis (1981) found simulation gaming, specifically *Markstrat* (Larr□ch□ & Gatignon, 1977), to be a suitable research environment for quantifying the effectiveness of what they termed "arbitrary," e.g., "Set level of advertising at 10% of estimated sales" (p. 97) decision rules *vis-a-vis* decisions made by humans.

The mere accessibility of information may induce managers to focus on that information in their decision making, to some extent regardless of whether that information is most prescriptive for a larger plan; a "locally rational" but possibly ultimately suboptimal approach to decision making. Glazer, Steckel, & Winer (1992) manipulated the types of market research studies made available to participants in a *Markstrat* (Larr□ch□ & Gatignon, 1977) simulation competition to demonstrate this phenomenon.

A relative lack or overload of information on which to formulate decisions may lead to frustration (compared with a moderate amount of information) and lower satisfaction with the task. Biggs (1975) found these relationships to hold in an experiment using *FINANSIM* (Greenlaw & Frey, 1967).

FORECASTING

Simulation games, with their known or knowable and well-defined parameters and variables and their longitudinal natures, provide an ideal research platform for studying forecasting.

Glazer, Steckel & Winer (1990) took advantage of these properties of *Markstrat* (Larr□ch□ & Gatignon, 1977) to compare the rational expectations model of forecasting–essentially the relating of sales to the variables affecting sales–and the adaptive expectations model of forecasting, that "...assumes that changes in forecasts over time are functions of past errors" (p. 152) An earlier study by the same authors (1989) using the same simulation game examined the Rational Expectations Hypothesis specifically. An interesting aspect of this study is the analysis of data at three pooling levels: all firms, firm-type, and firm.

MARKETING

It is widely recognized, though usually only implicitly so, that the basic "percent change in quantity divided by percent change in price" may be too simplistic for use as an estimator of elasticity. Most available "quantity" data are subject to influence by a great variety of influences not recognized in the simple formula. Quantifying the extent of estimation error was virtually impossible, though, until Dickinson (2002) employed *The Marketing Management Experience* (2000) to provide an environment in which true elasticity is known.

When performance is successful, marketing decision makers are more likely to attribute that success to themselves (or their team) and are also more likely to perceive that performance as being more controlled by themselves (or their team) than when performance is less successful. Curren, Folkes & Steckel (1992) used *Markstrat* (Larr□ch□ & Gatignon, 1977) to test these and related hypotheses.

In many competitive business simulation games the "competition" is nominally defined; a company is competing against other similar companies in an industry set by the game administrator and they are competing for a common market of customers. Nonetheless, among the nominal competitors some may be perceived as more formidable than others. Using the *Markstrat2* game (Larr□ch□ & Gatignon, 1990), Clark & Montgomery investigated the accuracy of perceptions that competitors had reacted to a company's past decisions (1996), the credibility of competitors as defenders and, thus, less susceptible as targets (1998), and factors such as size of marketing effort and success that might identify more prominent competitors as well as a possible asymmetry in these identifications (1999).

CONCLUSION

This paper compiles a seminal, and recognizably nonexhaustive, inventory of basic research using simulation games and develops a tentative framework for organizing those researches. It is apparent that simulation games may be employed for investigating a wide variety of management related topics and that games may, indeed, provide not only a ready and useful research platform, but also a platform that may not otherwise be possible. Basic researchers may use this inventory as a consideration in designing their own studies.

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