A First Life With Computerized Business Simulations
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Simulation Gaming published online 10 August 2010
DOI: 10.1177/1046878110378529

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A First Life
With Computerized
Business Simulations

Precha Thavikulwat

Abstract
The author discusses the theoretical lens, origins, and environment of his work on computerized business simulations. Key ideas that inform his work include the two dimensions (control and interaction) of computerized simulation, the two ways of representing a natural process (phenotypical and genotypical) in a simulation, which he defines as a replicable representation of a natural process. The author touches on his professional activities, summarizes his journal articles, accounts for his education, and considers two problems that remain to be resolved: the free rider problem when participants are assigned to work in teams and the measurement reliability problem when a business simulation is used for program assessment. He reflects on the possibility of using business simulation to expand business education in developing countries.

Keywords
business games, business simulations, CEO, computer-assisted simulation, computerized simulation, education, free rider, genotype, GEO, MANAGEMENT 500, measurement reliability, phenotype, replicable representation, Thailand

I remember a statement by a lady who was known for her apple pies. “You have to be careful what you are good at,” she said, “for you may spend the rest of your life doing it.” So, I happened to have an interest in computers, became good at writing computer programs to support business simulations, and have since been spending my life doing it. It just happened that way.

I am interested in the design of simulations. I concur with Klabbers (2006) that design is a science, but not one to be confounded with the more familiar analytical science, for whereas the key question of analytical science is “Is this a valid theory?” the key...

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question of design science is “Does it work?” (p. 168). I concur also with Goosen, Jensen, and Wells (2001) that simulation design is not simply the application of theory. The challenge for the designer is to apply the right theory, which sometimes necessitates extending an existing theory or developing a new one.

I am interested in simulations that involve both people and computers as part of the exercise. I view them through the lens of Crookall, Martin, Saunders, and Coote’s (1986) four-type classification system (Table 1). I am especially interested in computer-assisted simulations (CASs), for I concur with Crookall et al. that CASs “have greater scope and potential than other types when social and socially-mediated processes and skills are seen as important learning outcomes” (p. 370).

**Simulations**

I began working with computerized simulations at the University of North Dakota, where I accepted an appointment as assistant professor after receiving my doctorate from the University of Minnesota in 1978. I named my first computer-assisted simulation BLOCKS & CHIPS. The simulation required participants to make products by cutting and pasting small pieces of paper. They sold their products to each other, paying for their purchases by writing checks. I wrote a computer program to clear the checks, which was the extent of its computer assistance. I named my next computer-assisted simulation BOSS. This simulation required participants to employ each other. The computer assisted by enforcing superior-subordinate roles, thereby enabling subordinates to make operating decisions for which they were hired and requiring superiors to depend on them to make those decisions. I described these two simulations in conference proceedings (Thavikulwat, 1982, 1983) but did not commercialize them.

Since then, McGraw-Hill has published two of my simulations, MANAGEMENT 500 (Thavikulwat, 1989a) and CEO (Thavikulwat, 1991a). MANAGEMENT 500 is a CBS for operations management; CEO extends MANAGEMENT 500 to cover strategic management. My current effort is directed toward GEO (2010), a global simulation that integrates the money-managing features of BLOCKS & CHIPS, the people-managing features of BOSS, and the top-management perspective of CEO.

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**Table 1. Types of Computerized Simulations**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Types</th>
</tr>
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<tbody>
<tr>
<td>Control</td>
<td>Computer Participant</td>
</tr>
<tr>
<td>Interaction</td>
<td>Computer Participant</td>
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</tbody>
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GEO is computer-assisted, and distinctive in four ways. First, it is Internet based rather than web based (Pillutla, 2003), so it accesses its data through the Internet without a browser. Second, it requires companies to sell their virtual products to the participants themselves. Third, it motivates participants to buy those products through a distinctive scoring system, whereby participants buy products to extend their virtual lives, their goal being to extend their lives as long as possible. Fourth, it is designed especially to assess the abilities of participants, so every participant logs in individually and each receives an individualized score.
Professional Activities

I found the most receptive audience for my work in the membership of the Association for Business Simulation and Experiential Learning (ABSEL), an academic organization notable for what its members call the ABSEL style (Cannon, 2004; Gentry & Wolfe, 1981; Hoover, 2008; Patz, 1994; Schreier, 1984) or the ABSEL way (Butler, 1999, 2000a, 200b). Key elements of this style are the member’s informality, collegiality, and inclusiveness. Informality is evident in dress and discourse. Regular attendees at ABSEL conferences dress informally, and bantering permeates even the most formal of occasions. Collegiality is evident in the way conference sessions are scheduled and chaired. First-time presenters are assigned to prime slots, board meetings are scheduled at times that do not conflict with board members attending presentations, and sessions are chaired by seasoned members charged with assuring constructive discussion. Inclusiveness is evident in the broad spectrum of approaches that are accepted, which spans all fields of business, and in the international scope of its membership.

I presented my first ABSEL paper (Thavikulwat, 1982) at its ninth annual conference in Phoenix, Arizona. Subsequently, I became a regular presenter at ABSEL conferences, volunteered for various duties, and was elected a director-at-large in 1990. Later, I was appointed track chair for simulations, and elected junior proceedings editor and went on from there to be senior proceedings editor, program chairperson, president-elect, president, and past president. I was designated a fellow of ABSEL in 1999. Without ABSEL to give credence to the value of my work, my career would almost certainly have taken a different path.

Research Philosophy

My view of simulation design permeates my publications. As I explained in a retrospective essay (Thavikulwat, 1999), a simulation is a replicable representation of a natural process. An extensive simulation includes many processes, each of which may be represented phenotypically, as a mathematical model, or genotypically, as an operating procedure. For example, the process of employment is represented phenotypically when a participant enters a decision to hire a fictitious person whose behavior is computationally determined. The same employment process is represented genotypically when a participant agrees to hire another participant, whose behavior is a consequence of the psychology of the circumstance. Thus, the phenotypical representation is a reflection that may be verisimilar to the natural process; whereas the genotypical representation is a subset that is an instance of the natural process itself. I view phenotypical representation as expedient for processes incidental to an exercise; genotypical representation as essential for processes that define the exercise.

My treatment of simulations is wider than that of Weirich (in press), who limits his consideration to simulations “that attempt to explain a natural phenomenon” (p. 2), that is, to phenotypical simulations. A genotypical simulation is a natural phenomenon, recreated in a laboratory setting. When the natural phenomenon of interest is the behavior...
of people, the process recreated may be referred to as empirical role-playing, which should not be confounded with hypothetical role-playing (Spencer, 1978), for empirical role-playing requires action whereas hypothetical role-playing requires imagination.

Extending Weirich’s (in press) table (p. 3), Table 2 uses his abstract and repeatable attributes to distinguish between natural systems, models, phenotypical simulations, and genotypical simulations. Thus, because phenotypical simulations are abstract and repeatable, they are the opposite of natural systems, which are neither abstract nor repeatable. Likewise, because genotypical simulations are concrete (not abstract) and repeatable, they are the opposite of models. So, if natural systems are truths, then phenotypical simulations, their opposites, are plausible untruths (Simpson, in press), which is not to say that phenotypical simulations are worthless. Phenotypical simulations are often developed for policy discussion, where, as Duke (in press) notes, they are not designed to be predictive but to improve communication among competing stakeholders, an application where veridical results are not critical. Likewise, if models are ideas, then genotypical simulations, their opposites, are actions. Mastery of ideas requires the ability to learn; mastery of actions requires the ability to reason. Learning, involving the integration of contiguous experiences, depends on the order in which ideas are presented; reasoning, involving the integration of isolated experiences, depends on the goal of actions that are contemplated (Maier, 1931). Learning may help or hinder reasoning, but it is reasoning that motivates achievement in a changing world. Clarity with respect to simulation type leads to clarity with respect to the ability that applies. I see more potential in using simulation to enhance reasoning than in using simulation to enhance learning. I see the most potential in using simulation to assess the joint application of both reasoning and learning.

### Journal Articles

I became interested in submitting manuscripts to *Simulation & Gaming* when it became ABSEL’s official journal. My first submission was unsuccessful, but the second, on configurable simulations (Thavikulwat, 1988), was accepted. Since then, the journal has published a series of articles I have written on mathematical models and operating procedures, two of three articles that I coauthored with Sharma Pillutla, and a review article that I wrote on simulation architecture.

My first article on mathematical models (Thavikulwat, 1989b) presented a comprehensive model of product demand for a computer-based simulation. The model contributed

| Table 2. Attributes of Natural Systems, Models, Phenotypical Simulations, and Genotypical Simulations |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Attribute                      | Natural System  | Model           | Genotypical Simulation | Phenotypical Simulation |
| Abstract                       | No              | Yes             | No               | Yes             |
| Repeatable                     | No              | No              | Yes              | Yes             |

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to an area of research that was pioneered by Goosen (1981), which has blossomed into
a very active area of study, as attested to by Gold and Pray's (2001) review. My later
articles were about modeling human resources (Thavikulwat, 1991b, 1991c), product
quality (Thavikulwat, 1992), and currency exchange rates (Thavikulwat, 2002). Except
for Wolfe's (1991) comments on my human resource model and Mergen and Pray's
(1992) presentation of total quality management issues, Gold and Pray (2001) found no
other article on mathematical models for these latter issues in the simulation and gaming
literature, so they are issues available for further exploration.

Unlike mathematical models, operating procedures are easy to describe but frequently
difficult to implement, because simulation participant often do not behave as one might
expect, as Bots, Wagenaar, and Willemse (2010) found when they directed some par-
ticipants to follow a rational-design procedure and other participants to follow a political
negotiation procedure for resolving a policy problem. Therefore, when I write about a
procedure I go beyond describing the procedure to show that I have succeeded in making
it a viable part of a simulation. Thus, in my first two articles on procedures for enabling
the genotypical representation of markets, I show that a simulation where all market
processes (resources, products, finance, and employment) are represented genotypically
is viable (Thavikulwat, 1995, 1997). Time is a critical component of markets that are
represented genotypically, so I developed an activity-based timing procedure and
explained how it related to other procedures for managing time in a simulation
(Thavikulwat, 1996). More recently, I developed a continuous voting procedure for the
genotypical representation of democratic government processes and showed its viability
in a simulation that also included genotypical representations of best bidder (typically
wholesale) and first bidder (typically retail) product markets (Thavikulwat, 2009). I find
that participants are very good at detecting flaws in procedures but agree with Wolfe
and Jackson (1989) that they often do not notice errors in mathematical models.

I collaborated with Sharma Pillutla on three articles. The first is about arranging a
simulation exercise such as to constitute a tournament of several exercises (Thavikulwat
& Pillutla, 2004); the second, about trading strategies in the auction market of a simula-
tion (Thavikulwat & Pillutla, 2008); and the third, about a constructivist approach to
simulation design (Thavikulwat & Pillutla, 2010). The studies discussed in these three
articles were based on CEO and GEO. They took advantage of data arising from using
the simulation and insights gained from developing them.

At the urging of Joseph Wolfe, I collected everything I knew about the architecture
of computerized business simulations into a review article (Thavikulwat, 2004). Wolfe
(1994) had concluded that because simulations commonly in use had not changed much
from those created in the late 1950s, the basic discovery phase of the field had ended,
leaving for its future only “peripheral modifications in the basic technology” and “the
dissemination of its practices to other countries and cultures” (p. 277). Disagreeing
with his conclusion, I took the position that the basic discovery phase has only begun
(Thavikulwat, 1999), so the review was my opportunity to show that much has been
achieved since the late 1950s and that many more issues remain to be resolved.
Education

I trace my interest in simulation design to an experience I had in graduate school at the University of Minnesota, when I was recruited to take part in an adulthood simulation designed for high school students. The simulation placed participants in adult roles, as job seekers, employers, husbands, wives, and parents. I remember thinking that such a simulation, properly adapted, would be useful in business education also.

Even so, my most significant graduate school experience came with a course titled “Psychology in Management” that was taught by Allen R. Solem, who became my mentor. Solem was himself a student of Norman R. F. Maier. Both Solem and Maier considered themselves to be Gestalt psychologists. Like Maier and other Gestalt psychologists, Solem was interested in qualitative differences. “If you need statistics to prove your point,” he would say, “you don’t have a point worth proving.” Solem viewed statistical proofs as having a decorative function, useful in making a paper look respectable but substantively unnecessary for points worth proving, because the results would be strikingly clear in any case.

Solem taught with a mixture of lectures, twice a week, and laboratory sessions, once a week. He had about 100 students in each class. As one of his teaching assistants, my job was to lead one laboratory session of 25 students every week. I took advantage of this job for my doctoral thesis, for which I assessed the effectiveness of the course by having the students conduct a role-played appraisal interview at the beginning of the course in one term and at the end of the course in two other terms. I found that the interviews conducted at the end of the course were clearly done better but that a focused exercise intended to improve performance even further had little effect. I realized then the limitation of training that would inform my later work—that it takes a good deal of training to make a small improvement in performance.

Since then, I have avoided studies that attempt to show that students learn from any single experiential activity. They do learn, of course, for as Dewey (1938) observed, “Every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after” (p. 27). Nonetheless, each experience is only one among many other experiences that have a collective effect on the student, so the attempt to distill the contribution of any single experience is likely to be unsuccessful. What is possible is to assess the contribution of a program of many experiences.

Going further back, I grew up in Bangkok, Thailand, the youngest of six siblings. We went to what Americans might best understand as a missionary school, run by Seventh-Day Adventists. As typical of Christian schools in Thailand, the school was much more successful in its educational mission than its religious one, which is not to say that it did not put a great deal of emphasis on religious instruction. The first hour of every school day was dedicated to Bible study, an all-school assembly for religious admonitions was a weekly affair, and attendance at church on Saturday was a requirement, although it was not strictly enforced. The school’s religious mission was hindered
by the setting, for Thais generally see themselves as a contented people, grateful to their country, king, and religion. In Thailand, they say, “There is rice in the field and fish in the water.” So, the school’s secular teachings were welcome, its religious teachings were seen as no threat, and its offer of salvation won few converts.

English was the school’s medium of instruction, and English was the lingua franca of its students within the school compound and often outside the compound as well. The teachers were predominately expatriates who knew little Thai, so we had to converse with them in English. Sometimes, the teachers would penalize us for using Thai; sometimes we would penalize each other, in a game we devised for our own benefit. So, when I finished high school and enrolled as an undergraduate at the University of Minnesota, I was already fluent in English.

My father’s income was not at the level that enabled him to send his children to a foreign university. That, however, was my mother’s plan. She had managed to get her eldest son through college in the United States. He enrolled in Warren Wilson College, where students worked on its farm to pay for their room, board, and education. From him, the rest of us understood then that it was possible to work your way through college in the United States. So, when it came to my turn, I enrolled as a student of mechanical engineering at the University of Minnesota and worked my way through college also, with a little help from my family and a small scholarship and loan from the University itself. On graduation, I stayed on at the university to pursue an MS degree in management, which I parlayed into a doctorate in management after the first year. By then, I had become active in student activities, with stints as presidents of the Minnesota International Student Association and the Thai Association of Minnesota and chair of the board of the International Study and Travel Association. It was through these extracurricular activities that I received an invitation to participate in the adulthood simulation for high school students.

Conclusion

For what remains of my working life, my intent is to continue to extend the frontier of business simulations. Is it possible to resolve the free rider problem, so that participants might be properly credited for their participation in teamwork? Is it possible to involve thousands of participants in a simulation so that each participant’s score would be a reliable measure of that participant’s ability? The former question is an issue that I might resolve in a few years; the latter is an issue that may not be resolved in my lifetime, because it requires marketing, which is not my forte.

Some 30 years earlier, I had thought that business simulations would be a great way to bring inexpensive business education to developing countries. The logic of business is the same everywhere; only the language changes from place to place. So, why not take a business simulation developed in one country and administer it in all other countries, with only changes in language to adapt it from place to place? Why not have people everywhere learn about business through informal experiences with business simulations in the same way people in many developing countries learn to drive cars, informally,
with advice from family and friends? I have come to understand that the problem of expanding business education in developing countries is not an easy one, for people see a connection between learning to drive and living better, but they do not see a connection between participating in a business simulation and having a better life. If people do not see the connection between simulation participation and a better life, they will be less motivated to participate in business simulations even if it is readily available to them. So, participation in simulations must be incentivized; how to do so is a challenge. Yet perhaps the time has come when what I envisioned 30 years earlier may become reality. An academic society for simulation and gaming, ThaiSim, has been organized in Thailand, of which I am a founding member. It has already organized two conferences. I understand that a similar society has been organized in India also.

I close with a word of tribute. I am grateful to the state where I worked my way through college for many things, among which is that it was where I met Tipaporn, who became my wife. I am grateful for her tolerance and her support over the many years that we have been together. We have two daughters, Alisa and Amalie. They know nothing of business simulations, but that is just as well, for they have their own thoughts, their own lives, and their own dreams.
Acknowledgments

I am grateful to Kenneth R. Goosen and Sharma Pillutla for thoughtful comments that improved this article.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The author(s) received no financial support for the research and/or authorship of this article.

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