Experiential Learning Enters the Eighties, Volume 7, 1980

INDEXING SIMULATION MODEL RESPONSE FOR GAMING FLEXIBILITY

Richard F. Barton, Texas Tech University

ABSTRACT

A method for incorporating into computer simulation game models judgments about player behavior and performance external to the model is described. Input to the model is by means of indexes that affect simulation model responses to player decisions. Each index may be programmed for specific effects. Applications of the method are reported.

CAPTURING THE NUANCES OF PLAYER BEHAVIOR

Both interactive and solitaire man-computer gaming can quickly approach the level of a numbers game. Pure numbers-game player behavior may not be reached due to participants' well-known emotional involvement and to any reality details they may imagine to exist in the model during gaming sessions. This paper describes a gaming method and computer program technique that takes advantage of these player tendencies to expand a complex man-computer management game well beyond a numbers exercise level. The gaming method organizes reality details imputed by participants into the model and the computer technique incorporates these and other observed player behavior into during-play feedback. The method also allows for adaptive model changes during play without altering the computer program or directly manipulating the game data base.

Compared to the subtleties and nuances of human behavior, computer simulation models are extremely gross. During play, gaming administrators usually observe finer aspects of player participation than the model can accept. Administrators can also formulate judgments about the behavior they observe. Standard gaming procedure suggests that administrators use such observations and judgments to structure their debriefings and critiques at the ends of gaming sessions.

If the numbers-game aspects of educational simulation may be called quantitative, then observations and judgments by administrators may be considered "qualitative." Of course, players themselves cannot be divided into their quantitative aspects and their qualitative aspects. It is their interaction with the model or the way they are observed that is either quantitative or qualitative.

Historically, the development of man-computer simulations has organized quantitative variables to the exclusion of qualitative aspects. The term verisimilitude in simulation literature represents a particular characteristic of gaming models, not of game participants. Verisimilitude is the ability of the model to give the appearance of reality while obviously being something quite different. Verisimilitude, it has been said, is sufficient reflection of reality for effective educational gaming. The method reported here is intended to supplement verisimilitude in designing and administering educational simulations by organizing and capturing nuances of player behavior and incorporating evaluations of them into during-play feedback from the model.

QUALITATIVE JUDGMENTS AS INDEXES FOR COMPUTER SIMULATION MODELS

Qualitative judgments by game administrators (or by other judges) during a gaming session may take many forms. What is observed and judged may range all the way from general playing behavior to numerous small, special assignments. When placed on a scale, these qualitative judgments are indexes. Indexes may be scaled against an arbitrary standard for noninteracting simulation designs or they may represent relative performance among competing players or teams for interacting designs. The indexing scheme should not distort the verisimilitude of the model. To achieve educational objectives, the behavior indexed should, if possible, also be observed by all participants and the indexes for that behavior publicly posted.

Flexibility

Incorporating qualitative judgments as indexes in a man-computer simulation model designed for discrete decision cycles can be independent of the source language used to program the model. Without this indexing method, the administrator may manipulate the data base from decision to decision. However, in this case, the administrator needs to know the operations of the model well enough the achieve the effect desired. The indexing method requires additional variables--the indexes--as input to the simulation model. The index variables are then programmed as multipliers of one or more input or generated variables to produce the desired alteration of output as a consequence of the value assigned to the index.

This method applies regardless of what the model simulates or the specific purposes of gaming sessions. The participant behavior that is observed and indexed is external to the operation of the model and can be designed and manipulated by the administrator as he wishes without reconstructing the model. However, once a convention is made for a particular model for which the computer reads indexes, this convention restricts the "qualitative" assignments that can be made because indexes will have specific effects.

Administrative Procedures

Man-computer gaming is usually run in discrete decision cycles. Players make decisions that are read by the computer to produce printouts. The printouts are returned to the players, who again make decisions, and so on. If qualitative indexes are to be incorporated at a specific cycle, the behavior to be judged must be concluded soon enough for completion of the judgment process before the next computer run. The administrator may announce indexes before player decisions are finalized, in which case players may adapt their decisions, or he may announce indexes later so players must make decisions without knowing the influence of the indexes. In either case, players should know the consequences of good and bad indexes when the assignment is made.

Index Revisions

Indexes for a specific decision cycle may apply only to that cycle or, once given, may hold constant for

the remainder of play. Another alternative is to allow opportunities for assignment revision and hence improved indexes. This opportunity encourages participants to interact competitively in the behavior that is indexed as well as through the numbers written on their decision sheets. If revisions are permitted, administrators should insist that players or teams live with the initially earned index and its consequences for at least one decision cycle before a change is made. For interactive simulation designs, all indexes may be revised if one or more players or teams submits an assignment revision.

Conceptually, unlimited revisions of indexed assignments would permit the quality of these assignments to converge to a point where all indexes were equal. The effect of indexes would then cancel out. This never happens because players usually have too much to do during gaming sessions to try more than a few revisions.

Preventing Distortions Due to Indexing

The effects of indexes should be well understood by administrators so that extreme indexes will not distort the legitimacy of the gaming sessions or the verisimilitude of the model. Preventing distortion by setting upper and lower bounds for indexes depends on the effects built into the computer model.
Acceptable ranges may differ from assignment to assignment.

For interactive simulations, all low indexes may depress the representation of the object system simulated, e.g., an industry in management gaming. On the other hand, all high indexes may accelerate representation of the object system beyond reasonable player expectations. To prevent this, indexes should average out over interactive players or teams to a neutral quantity. One technique for doing this is to program the model to always expect indexes, then have the indexes be uniform and neutral at the first simulation session. The author begins his simulation sessions with the computer reading indexes of one. Indexes are then given among competing teams so they always average one. However, allowing indexes to average other than one allows additional flexibility. For example, if indexes in the author's particular application were to average less than one, depressing effects would occur for the entire simulated industry; indexes that average more than one would bring on unheralded prosperity and assured labor
peace.

Types of Assignments to be Indexed

Three general types of assignments have been used to organize player behavior into "qualitative" units sufficient for indexing. These are:

1. Display a display of poster-size newsprint sheets or flip-chart pages containing subject matter written or illustrated with colored marker pens. Display assignments speak for themselves without a typed manuscript or oral presentation. Displays are to be left up in a common meeting room or display area.
2. Presentation a formal team oral presentation, which may also include all the devices of a display assignment. Speaking duties should include each player on a team at least once. Any display material used is to be left up in a common meeting room or display area.
3. Report a formal written report suitable for distribution to an imagined constituency or board of directors. After indexes are assigned, reports are displayed for observation by all players in a common area.

Administrators may allow displays or reports to be temporarily removed from the display area for development of revisions. Revisions are then displayed after new indexes are given. Indexes may be posted directly on displays or on reports. A comparative table of indexes may be posted separately or shown from an overhead projector on a large screen.

AN APPLICATION FOR A COMPANY DEVELOPMENT PROGRAN

Qualitative aspects of game participation were incorporated into player feedback in an interactive educational man-computer simulation designed for a large international corporation. The gaming sessions lasted only three days and were structured around two practice decisions and up to twelve official decisions. Display and presentation "qualitative" assignments and revision opportunities were scheduled throughout the three days. Time was too short for report assignments. Assignments, index effects, initial indexes (in the first column), and index revisions (in rater columns) are shown below for two separate company development programs (called plays of the game). Since four teams participated in each play, indexes were given so that they always summed to four in order to average one. More revisions were received in Play 1 due to working lunches.

1. Research and Development a display assignment with indexes that would affect the output of the simulation model. Indexes higher than one increase competitive advantage, and vice versa. An index of 1.10 would make a dollar of cumulative R & D investment interact competitively as $1.10; an index of .90 as $.90. High indexes also increased a team's overall product quality; lower indexes reduced product quality. Indexes given were:

Team	Play 1			Play 2	
1	.90	.90	1.03	.80	.80
2	1.10	1.07	.99	1.00	.90
3	1.10	1.08	.99	.90	1.10
4	.90	.95	.99	1.30	1.20
	4.00	4.00	4.00	4.00	4.00

2. Marketing a stand-up oral presentation assignment with indexes higher than one increasing the competitive effectiveness of team expenditures for its sales force and advertising, and vice versa. An index of 1.20 would make each dollar expended for sales force and for advertising interact competitively as $1.20. (Of course, only actual dollars appear on the printout income statements.) An index of .85 would make sales force and advertising dollars interact competitively as $.85. Indexes given were:

Team	Play 1			Play 2		
1	.85	1.10	.96	1.15	.85	.90
2	.90	1.05	1.01	.80	1.10	1.00
3	1.05	.80	1.02	.80	1.10	1.00
4	1.20	1.05	1.01	1.25	.95	1.10
	4.00	4.00	4.00	4.00	4.00	4.00

3. Efficiency a display assignment with indexes operating to tower overhead, labor, and distribution costs. An index of 1.20 reduced these costs by twenty percent, i.e., to eighty percent of what the costs would have been with an index of 1.00; an index of .80 increased costs by twenty percent or to 120 percent of what costs would otherwise have been. Indexes given were:

Team			Play 1			Play 2	
1	1.20	1.10	1.01	.90	1.00	1.04	1.04
2	1.00	.80	.98	1.10	1.05	.97	.97
3	1.00	.80	1.00	.90	.90	.97	.96
4	.80	1.30	1.01	1.10	1.05	1.02	1.03
	4.00	4.00	4.00	4.00	4.00	4.00	4.00

4. Store and Warehouse Location a stand-up presentation assignment with higher indexes enhancing the competitive influence of physical distribution facilities on market demand. The amount of the influence was a straight multiple of the index received when considered in competitive interaction.
Indexes given were:

Team	Play 1			Play 2	
1	1.15	.98	1.00	1.10	1.02
2	1.25	1.00	.99	.95	.98
3	.80	1.02	1.02	1.25	1.10
4	.80	1.00	.99	.70	.90

5. Employee Program -- a display assignment covering wages, salaries, and benefits. The higher the index received by a team, the lower would be its probability of a strike. The probability reduction was approximately point for point with the index. At equilibrium, all firms had a strike probability of .05. An index of 1.03 would reduce this probability to .02; an index of .92 would increase it to .13. Indexes given were:

Team				Play 1			Play 2	
1	.95	1.05	1.03	1.01	.95	1.00	1.05	1.01
2	.95	.95	1.02	.99	1.03	1.01	.97	.99
3	.95	.95	.92	.99	.97	.97	1.03	1.01
4	1.15	1.05	1.03	1.01	1.05	1.02	.95	.99
	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

During the three days devoted to each of these two plays, teams prepared three display assignments and two stand-up oral presentations, plus revisions, that were indexed. This organized "qualitative part of player participation was in addition to the practice and official "quantitative" decisions. Initial and revised indexes were immediately incorporated into feedback from the computer simulation model, with the proviso a team could not additionally revise an assignment until at least one feedback cycle had occurred. A revision submission by a single team, which then changed the entire column of indexes, usually brought forth subsequent revisions by competing teams, especially from those whose indexes had been lowered. Convergence due to revisions can be seen in the index histories above.

AN APPLICATION FOR THE COLLEGE CLASSROOM

In a college classroom setting, incorporation of qualitative aspects of player participation differs from company development programs in that simulation sessions are spread out. In the college environment, team decisions are made usually once a week during a quarter or semester rather than two to five times a day. Also, collegiate participants do not have strong company backgrounds to draw on for imagined imputations to the simulation model. Student imaginings come largely from courses they have taken. For this reason, the place in a curriculum for gaming sessions using this method is usually near the end.

The author has used this method and technique in the college classroom for twelve years, but only with formal report assignments and experimental variations thereof. Revision motivation appears about the same as in the industrial setting, but revisions are largely guided by the nature of the critique of the reports. This indexing method has worked well in collegiate applications regardless of industry simulated by the computer model, or the disparate backgrounds of students. Responses to end-of-game questionnaires take two general forms. One is that students did not like the written reports because they were too much work. The other is that the written reports forced students to be specific about their policies and strategies in playing the game; these students felt the reports were highly rewarding.

A potential application of this method and technique not yet attempted is incorporation of the game including indexed assignments as a common assignment in parallel courses. The assignments would then be made as part of each course judged by the teachers of those courses, and the resulting indexes entered into the computer simulation model to affect during-play feedback. The computer printout feedback would be common to the cooperating parallel courses, but the reports would be specific to the course in which they were assigned.