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CONTEXTUALLY-ANCHORED BUSINESS SIMULATIONS

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ABSTRACT

Business simulation games provide a useful tool for introducing students to the dynamics of a competitive market place. Nevertheless, they are inherently abstract. This paper presents a framework for making them more concrete by anchoring them in the "context" of actual business. It draws on work done in environmental psychology to identify the situational dimensions through which business contexts might be defined and simulated in a gaming environment.

INTRODUCTION

One of the major purposes of business simulations is to introduce students to the competitive dynamics of tile marketplace, enabling them to make decisions and get feedback regarding their impact (Gentry 1990). Typically, these decisions take the form of econometric "Simuworld" simulations (Keys, Fulmer. and Stumpf 1996) and include pricing, production levels, promotional budgets, and so forth. They are input by students in matrix format, as abstract numbers.

One way to address the abstraction of econometric games comes through the dynamics of a simulated business organization, when the game is played in teams. Students can attend meetings, make phone calls, read and write memos, meet deadlines, and the like. They can even be called on the carpet for poor sales forecasting and/or inventory planning. The problem is that conventional games rarely structure the dynamics of these student interactions in any systematic manner. Most often, student teams are left to work out their own organizational issues. In the best of cases, the teams are given guidance regarding principles of specialization and coordination of work activities, communication, and conflict resolution. However, there is rarely any attempt to systematically identify and simulate the most salient elements of an actual business-working environment.

To address this deficiency, trainers have developed a separate type of simulation experience - exercises in which students address the specific events, problems and organizational interactions that take place inside an actual business organization. These include such activities as "in-basket" assignments, role-playing exercises. These are known as "rnicroworlds" (Keys. Fulmer and Stumpf 1996).

Note that the econometric, "simulworld." and 'microworld" approaches are not necessarily mutually exclusive. Indeed the two perspectives can be combined. That is an econometric model of how business decisions affect the market performance of the firm can be combined with a more process-oriented model of how these decisions are made. But to do so, the simulation must incorporate a model of the specific business situations in which the process takes place. Students will then be able to address the activities that are appropriate to each of these situations.

We will refer to the aspects of a simulation that link student activities to actual work-like situations as *contextual elements*. For instance, establishing specialized student roles, such as "general manager,' "production manager, "product manager, and so forth, would be *contextual elements* in a simulation design. Similarly, establishing meetings in which a production, product, and general manager would meet to review results and plan decisions would be a *contextual element* of the simulation environment. Stated formally, a *contextual element of a simulation game is one that links the abstract decision and review processes required by the game to specific roles, events, and/or activities*. These can be incorporated into any type of exercise be it a "Simuworld" or a "microworld" simulation.

Needless to say, the concept of *contextual elements* suggests a dramatic expansion of the complexities facing simulation game designers. In addition to considering how many and what kinds of decisions to make available to players, designers might also address questions of when, where, how, and by whom these decisions will be made. In addition to developing traditional econometric algorithms for relating student decisions to outcomes, *contextual* designers develop what amounts to screen plays to give their simulations added life.

In their simplest form, these plays incorporate *contextual elements* that cast a game in a more concrete organizational setting. In a more complex application, they might make the actual decision inputs, or even the nature of the games econometric model itself, contingent upon the contextual manner in which the decisions were made, using some kind of Boolean algebraic branching algorithm. For instance, a pricing decision might not get implemented unless the product manager writes a memo to sales people promulgating tile policy. Or the policy might be overridden by salespeople in the field unless some kind of control

procedure is established to ensure that this does not happen. A game might incorporate a classical "kinked" demand function to represent monopolistic competition but the game might forego the application of this curve in favor of a more conventional one if players opt for a press release in which they explain the limited objectives of a particular price cut.

We may refer to the process of incorporating *contextual elements* into a simulation game environment as *contextual anchoring.* Virtually all simulation games are *contextually anchored* to one degree or another, but generally not in any systematic or theoretically derived manner. One purpose of this paper is to develop a theoretical framework for developing *contextually anchored simulation games,* with specific reference to otherwise econometric, or "simuworld," simulations.

A CONCEPTUAL FRAMEWORK

Exhibit I presents the structure of a *contextually anchored business simulation game.* It shows how the traditional relationship between student activities and the econometric model are mediated by tile *contextual elements* of the game. That is the decisions students make and the results of the game are embedded in a host of situationally based activities. What is lacking is a theoretically rigorous framework for classifying these situations.

Exhibit 1:
The Structure of a Contextually Anchored Business Simulation Game
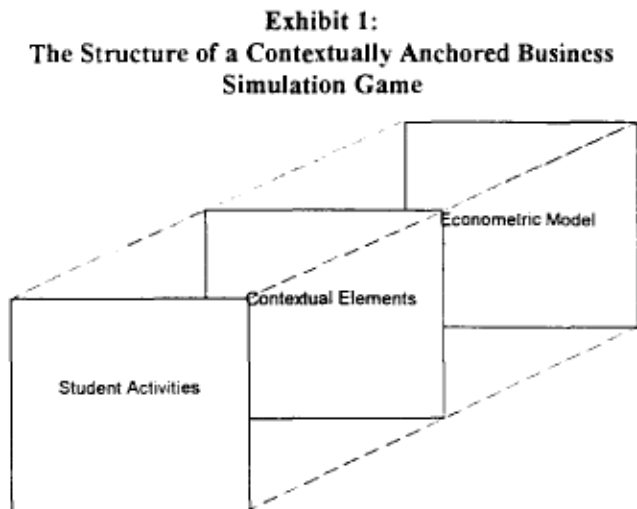
The literature on environmental psychology suggests a number of alternatives. First, it distinguishes between the task of classifying situations and that of classifying the attributes of situations (Frederikscn 1972), While either approach might be a useful in helping simulation designers understand the process of contextual anchoring, none of the situational taxonomies developed by environmental psychologists are specific enough for the task. For instance. Kramer (1995) used techniques of multidimensional

scaling to classify places the might be linked to situations. The result was a taxonomy featuring categories such as "services" (e.g. supermarkets. restaurants, university, hospital, school), "resident" (e.g. one's home, friend's home), "leisure" (e.g. park, beach, swimming pool. hairdresser). While this represents an interesting approach, meaningful business taxonomy would need to address places such as "offices," "conference rooms," "warehouse," etc.

The alternative approach offers much more promise. Actually, Kramer's (1995) study of places was a preliminary to the development of an attribute taxonomy -one consisting of the *function of places, specificity of function,* and *privacy.* But again, this is too general to be a great value to simulation designers. Canter (1977) suggests that places can be identified in terms of their physical attributes, the activities with which they are associated, and with their conception.

Baumeister and Tice (1985) use a card-sorting technique to analyze a large number of different variables, extracted from the literature on social psychology. The result was 5 1 categories of situational attributes. These, in turn, are collapsed into to five general categories: (1) stimulus environment (e.g. physical setting, task); (2) cognitive and affective dynamics (e.g. psychological and emotional predisposition's, goals, information); (3) characteristics of the subject (e.g. personality, affiliations, experience. knowledge); (4) relationship background (e.g. similarity. previous interpersonal behavior, friendliness or hostility, attempts to influence); and (5) matrix of possibilities (e.g. subject's freedom, incentive/importance, task difficulty. role of subjects. competition). Their approach is interesting and useful in a very general sense. But again, it is too general.

Belk (1975) has developed a situational taxonomy that is very similar in concept, but much more useful for characterizing business situations. It classifies situations in terms of five situational dimensions: *physical surroundings, social surroundings, temporal perspective task definition,* and *antecedent states.* These can be easily adapted to address the situational requirements of contextual anchoring. None of them stands alone. But together, they interact to form the unique character of the scene being portrayed in the simulated working environment.

Physical Surroundings

Physical surroundings are perhaps the most obvious source of *contextual elements* in a work situation. These include both *physical stimuli* and *stimulus patterns. Physical stimuli* are the immediate elements of sensory input --

Colors, sounds, light, darkness, and so forth. *Stimulus patterns* are groups of physical stimuli that consumers recognize as having meaning, such as desks. Phones, office equipment, the layout of the office itself.

Physical Stimuli. In the history of simulation gaming, the use of *physical stimuli* has played an increasingly important role in creating user involvement. Bright colors, crisp contrast, and movement can have an enormous effect on the sense of realism and excitement students' experience in a simulation environment.

Stimulus Patterns. *Stimulus patterns* provide a much more direct and concrete tool for crafting *contextual elements.* Desks, phones, office equipment, and the like are easily associated with business decisions and review processes mandated by the econometric model. The office is where most of these activities take place. Thus, incorporating actual images from an office into a simulation gives conventional simulation activities a much greater sense of realism. These can be grouped into several major categories, based on the role they play in developing the simulated situation:

o **Location elements.** These are *contextual elements* that symbolize a work-related location, These would include such things as buildings. corridors/elevators/stairs, offices Conferences rooms. factories/warehouses/stores, planes/cars/buses.

o **Process elements**. These elements, such as telephones, fax machines, computers, books, overhead projectors, or flip charts that symbolize a particular business activity. They would include tools whose use could be simulated in the program, such as email or web-browser programs. They would also include programs such as word processors, spreadsheets, and databases that could actually be used by people playing the game to develop the analyses and documents.

o **Personnel elements.** *Personnel elements* perform three different functions: First, they portray people to represent the various players in the organizational drama. These might be 'talking heads or actual figures that move from one location to another, sit in meetings, sign memos, and the like. Second, they might provide cues to signify the role each player performs in the organizational drama. Such an element might be anything ranging from a name on an organizational chart to a plaque on a door. Third, they provide cues that represent the way people feel about what they doing. These elements would typically be the most difficult to formulate and incorporate into the simulation. They would consist of such things as facial expressions or key words inserted into a dialog.

o **Product elements.** These include the output of any work process. For instance, they might include products, advertisements, shelf displays, memos, or budgets. Typically, the objects in the developer's library would consist of a prototype or template, which students would then modify in the course of playing the game.

o **Temporal elements.** These include any elements that orient students toward the passage of time. Most notable would be clocks and calendars, although they might include more subtle cues, such as movement of scenery or movement of products through a production line.

Social Surroundings

In contrast to the broad range of alternatives available to the simulation developer with respect to *physical surroundings,* the *social surroundings* are determined much more directly by the requirements of the simulation. Here the metaphor of the screenplay is especially useful. Each scene within the drama of the simulation is characterized by both the *type of social situation* it portrays and the *role expectations* inherent in the interactions among the actors.

Type of Social Situation. There may be virtually an infinite variety of different types of business situations. However, from the game developer's perspective, the most significant of these can be characterized by one of three major *types.*

• **Individual work sessions.** These might include everything from sorting mail at a desk to work on a computer to research in a library. However, in every case, the situation will involve a single individual - the player of the game - performing some kind of task. Again, note that the *social setting* will be characterized by a unique configuration of *physical stimuli.* The key determinant of the setting, however, is the nature of the *task definition.* For instance, the task of writing a memo will typically imply sitting in an office in front of a computer. Sorting mail will generally involve sitting at a desk in ones office, but not working on a computer.

o **Meetings.** Meetings differ from individual work sessions in that they involve other people in addition to the player of the game, all interacting with each other. As with *individual work settings,* the meeting will generally be driven by a *specific task definition.* However, from a game developers perspective, they are complicated by the necessity of modeling realistic interactions among various players in the organizational drama. This is where *role expectations* become important. They provide general guidelines for structuring the kinds of interactions that characterize meetings.

o **Presentations.** Presentations are like meetings in that they involve communications, structured around both *specific task definitions* as *role expectations.* However, they are like *individual work settings* in that they do not require two-way communications. However, they are unique in that they involve the use of specific formats and/or tools to organize and present the necessary communication. This may be a formal written document, such as a memo or position paper, or financial report. It may also be verbal, such as a set of verbal instructions, or a speech. Of course, as simulation technology becomes more powerful, the range of options will increase dramatically. For instance, game players may be expected to put together audio/visual electronic slide presentations.

Role Expectations. *Role expectations* define the general way people interact with each other in an organization. The most obvious roles correspond with organizational positions. Since a contextually anchored game typically models a real, or at least realistic, organization, the relevant positions in the organization provide a natural set of roles for the game. However, to provide additional guidance in the modeling of personal interactions, the developer might use taxonomy of roles to suggest ways people in different organizational positions interact in a decision-making environment. These might include:

o **Beneficiaries.** The people whose activities and responsibilities are directly affected by the outcome of a decision. For instance, a salesperson would be the beneficiary of a pricing decision, since it will affect her ability to sell the product.

o **Deciders.** The people who have the actual responsibility for making a decision. In a game environment, as in a real organization, this may be more complicated that it first appears. For instance, the game player may have decision responsibility, but be required to submit the decision to a higher authority for final approval.

o **Implementers.** The people who are responsible for caring out a decision. For instance, a production decision must ultimately be translated into production orders at a factory, orders for raw materials and perhaps machinery, labor, and so forth. In a game environment, the player may or ma not be tasked with implementation.

o **Influencers.** The people whose opinions are taken into account when making a decision, even though they do not have any formal decision-making responsibility. For instance, technical support staff would typically play this kind of role.

o **Gatekeepers.** The people who control the flow of information that is relevant to a decision. For instance, secretaries and researchers often play this type of role.

Temporal Perspective

Temporal perspective is the time frame represented by an ad. It can include anything from the time of day to the season of the year. It can also be relative time - the time since last purchase or other decision, time since or until a particular organizational event, such as an appointment or meeting. A game might use events to communicate the temporal dimension, such as would be the case when a player is notified that a particular decision is due. Conversely, the game might use time to trigger an event. For instance, a set of operating procedures might specify that the marketing plan is due on the first day of the month preceding a new fiscal year. A simulated calendar would then provide the cue to trigger the event. These concepts can be formalized in terms of the following dimensions:

o **Temporal significance.** The role time plays in the organizational drama. For instance, the drama might involve key deadlines, planned events, or regular sequences of activities and decisions. For instance, a simulation might be modeling a bidding situation, where the timing of one's proposal is crucial to the bids acceptance. In some kinds of simulations - those involving professional services, for instance - time is the unit of production. That is billings skill be tied to time, and value delivered to the client will, in part, be determined by the amount of work produced during each unit of time.

o **Temporal orientation.** As noted earlier, there are any number of different ways to view time. For instance, time might be *relative* to some other events or decisions, such as the action of a key competitor or the completion of a prior step in a production sequence. Time can also be *absolute,* as represented by the date on a calendar or the time of day. For instance, when modeling a work process, a specific date or time might be crucial in the ability to meet an established deadline. This suggests yet another temporal orientation - *elapsed* time. If a player is required to estimate the time required to complete a sequence of tasks prior a deadline, she must be able to estimate the elapsed time required for each task in order to determine when to begin in order to meet the deadline.

o **Temporal cues.** One of the problems faced by the game designer is to represent time in an actual simulated business environment. From a very practical perspective, these require temporal cues such as calendars, clocks, memos or other communications

Task Definition

Task definition is the situational variable that is most central to the simulated business environmcnt. Within the role structure established in the simulation, the game developer must craft her screenplay around specific simulated activities. These, in turn, will be driven primarily by the objectives of the simulation. For instance, a general management simulation might be built around tasks such as planning, organizing, leading and control. A marketing simulation would superimpose these on more specific tasks such as market analysis developing product strategy and tactics and so forth.

Antecedent States

Antecedent states are the conditions that define the state of a game at a given point in time. In general, this is addressed by the underlying game algorithm, and therefore requires no special consideration in a contextually anchored game. However, in advanced games, it is possible to develop on-going scenarios, where the value of player responses will change based on simulated dialogs or other conditions not addressed by the regular game algorithm. For instance, a simulation might offer the player an option of including or not including salespeople in thc development of pricing decisions. Including them might increase costs and slow down the decision process but not including them might decrcasc the chance of proper implementation.

Typically, antecedent states are captured in the parameters of the econometric models that drive the game. Other aspects of antecedent states can be captured through the use of "flags." or categorical variables that determine the nature of the model being used the choice of parameters, or the kinds of responses simulated characters will provide to the player of the game.

**DEFINING SIMULATED WORK SITUATIONS**

The situational factors discussed above interact with each other, as suggested by Exhibit 2. It suggests that specific work situations, or "scenes." can be defined in terms of the various situational components. The actual development of the game can be broken down into eight critical tasks:

Task 1: Develop the underlying econometric game

Recall that the underlying representation of the business process is generally captured in the structure of the econometric model that underlies the game generally through some kind of hierarchical structure. The model, in turn, drives the decisions that students are required to make. The first step then, is to develop tile model as with a conventional business simulation game. The nature of this

model will van dramatically with the nature of the experience being created by the contextually anchored game, but it will generally be built around some form of the profit equation as an objective function. The function calls for a pricing decision. Other variables, such as costs and quantity sold are determined by separate functions at lower levels in the hierarchy. For instance, quantity demanded might be determined by the interactive effects of product, price, distribution, and promotion response functions. Which, in turn, mediate the effect of product, price, distribution and promotion decisions.

Exhibit 2:
How Situational Factors Interact to Define the Simulated Work Situation
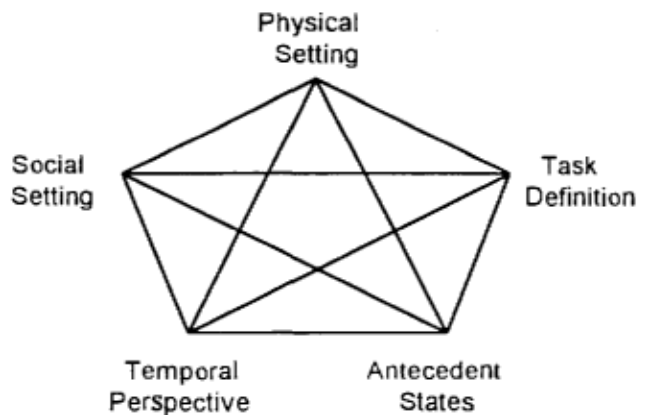
Task 2: Develop a Sequence of Game Events

The decisions required by the econometric model can be used to structure the sequence of game events. This can bc done using the concept of the planning hierarchy to structure sequences of decisions. Each decision involves an event, the nature of which is defined by the interaction of the various situational variables, as depicted in Exhibit 2. For instance, an advertising budget decision might define an event - a meeting - in which the game player makes the actual budget decision. The results of this decision would condition the media plan, since the plan would seek to allocate the budget across advertising media. And so forth,

Task 3: Model Decision Interactions

On of the unique features of the contextually anchored game is the potential presence of interactions between the progress of the game and the decisions made by a player at a point in time. Of course, this is true of conventional business simulation games as well, If the player in a conventional simulation chooses to engage in a low-price low quality strategy, the game algorithm may well resist a later change to a high-quality strategy. Similarly, a low-

quality product decision and an advertising campaign that emphasizes quality might actually hurt long-term sales. However, in the contextually anchored game, specific events can be structured to confront the player with the strategic discrepancy. For instance, if the player pursues a low-quality strategy and then recommends a quality-oriented advertising campaign. a manager might call her and say, "What's going on here? I thought we were pursuing a cost-leader strategy!"

Herein lies the most difficult task of contextual gaming - anticipating the major types of decision patterns players might use especially mistaken ones. Each one must be identified and addressed through some kind of response routine, whether through a simulated phone call, a memo requesting a revision of plans, or whatever. Obviously, the alternatives can quickly become almost infinite. Neither the game itself, nor the resources of the game designer can accommodate large numbers of alternative scenarios.

In practice, there is no need to program any interactions into the game. At worst, the contextual game simply provides a context for the decisions a player would normally make in a conventional simulation game. The ability to program specific interaction effects provides an added advantage, enabling the designer to address the most common errors players are likely to make in a particular environment. This is particularly useful when developing specific training tools that model a particular organizational environment. For instance, General Motors might want to sensitize its trainees to the importance maintaining message consistency through its various communications programs for each product line, as part of its integrated marketing communications program. A player who violates this norm could be called to account in the game for her negligence.

Task 4: Develop the Office Interface

Developing the office interface is analogous to adding staging instructions to a screenplay. A meeting is a meeting, but to make it real, it must be staged over the phone, in a conference room, across a desk, or whatever, If we return to our budget planning situation, the staging might specify that the initial budget meeting takes place in the account executive's office, followed up by typing a memo to be e-mailed to upper management.

Task 5: Develop Decision linkages with the Underlying Econometric Model.

Note that the econometric model requires the kind of decisions that are actually made in organizations. The linkage requires us to identify the specific place in the organizational drama where they are made. For example, it

could take place in the course of a conversation - perhaps a conference call with a sales manager. If the player forgets to schedule the call, the decision might be made by default (simulating a decision made by the sales manager, rather than the game player, as her superior). Similarly, a decision could be a specific statement written into a marketing plan generated using a standard piece of marketing plan development software. In the case of our budget recommendation, the decision might be taken from the memo to upper management, or it may be taken from a formal memo to the client, following the approval of upper agency management.

Task 6: Develop Performance Output Protocols

Output protocols consist of the usual battery of income statements, inventory reports, personnel interviews, and so forth used in real organizations. They are the instruments used to evaluate performance. While they are generally standard in nature, they still need to be designed specifically to fit the needs of a particular game. The accounting system must contain a manual of accounts that is appropriate to the industry the personnel evaluations must address the appropriate types of performance criteria for the player's job description; and so forth.

Task 7: Develop Output Analysis protocols

Output analysis protocols provide the means through which the performance outputs can be objectively evaluated. For instance, a certain percentage increase in sales might qualify a manager for a bonus, or a low-level residual inventory might qualify for some kind of performance recognition.

The key to output analysis is a *variance analysis* of various measures of performance. The game developer has access to the underlying econometric model, and so it is easy to identify the variables that caused any particular variance in performance. For instance, following the logic used by Teach (1990), a player's performance might be evaluated by her ability to anticipate the consequences of her decisions, rather than actual profit, or some other absolute measure of performance. If the marketing plan included a sales forecast of $10 million, the greater the error, the poorer the performance. Furthermore, these dollar sales can be decomposed to component parts. Sales of $8 million dollars might result either from a shortfall in unit sales, or a lower selling price. The output analysis protocols would be structured to determine the source of the shortfall, and provide it as feedback to the player of the game.

Task 8: Develop Help Features.

The help menu might address three major issues: First it

might help explain how to play the game. For instance, it might tell students where in the drama various decisions are actually made, and how to make them.

Second, it can provide reference materials to help students perform various marketing functions. For example, Richard D. Irwin Publishing Company markets a business library on a single CD-ROM. The library consists of nine textbooks along with a number of supporting study aids. Such a disk could be accessed through the help function, thus delivering "just-in-time" learning to students at the moment they are making a particular decision, or engaging in a particular marketing activity.

Third, the game might provide students with helpful hints regarding the consequences of various alternative courses of action. This could be presented as advice from a "consultant." or any other of several formats. But it would draw on a type of expert system, whereby the computer would be able to analyze the player's behavior and provide useful critiques and advice.

SUMMARY AND CONCLUSIONS

The purpose of this paper has been to describe the design features of contextually anchored games, a simulation tool for introducing students to the dynamics of a competitive market place. Contextual anchoring results in a more concrctc organizational setting for the simulation game. Which, in turn, helps students to better conceptualize what a business is really like.

Contextually anchored games are by 110 means a panacea. Just as synthetic foods or fibers lack the random rich mixture of trace elements that make natural products what they are, so synthetic experience will inevitably fall short of the real thing. But it can come very close. And given the ability to tailor the games to simulate experiences that, in addition to facilitating the attainment of educational goals, address specific training requirements. their advantages make a compelling argument for their development and use.

If this argument is valid, the next logical step is to begin conceptualizing different types of experience and thc kinds of learning we hope to get from each type. This, in turn will provide a set of guidelines for game dcvclopment. It will stimulate academics and practitioners alike to become much more rigorous in their conceptualization of what constitutes business practice and expertise. In this sense the notion of contextually anchored games should not only be as a educational or training tool, but as a stimulus for the development of new levels of practical business theory.

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