

A Simulation of Strategic Decision Making in Situational Stereotype Conditions for Entrepreneurial Companies

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Entrepreneurship is concerned with pattern recognition of situations and information by entrepreneurs. Simulation methods represent an attractive venue for exploring pattern recognition and information interpretation issues. A computerized decision-making simulation was developed and run to test hypotheses concerning interpretation of stereotypical situational cues to which new ventures are subject. Partial support is found for the existence of classes of situations to which entrepreneurs and managers respond. Stereotypical views of situations may develop quickly and be acted on easily in critical decision making. Future simulation research on cognition issues in entrepreneurship may enable entrepreneurs to better learn how to learn.

KEYWORDS: *cognition; entrepreneurship; learning; life cycle; simulation; stereotype.*

To what extent do entrepreneurs and corporate managers of new business correctly perceive the current stage of their businesses' development and make effective decisions based on those perceptions? Successful new business start-ups ordinarily arise out of more or less "correct" views of environmental situations. Commensurate opportunities are associated with these situations by entrepreneurs, leading to decisions to proceed with start-ups. This is often referred to as entrepreneurial vision. Once a business has started up, effective entrepreneurial decision making presumably then continues to arise out of correct views of the situations that their firms face.

Theory and evidence suggest that entrepreneurs become less effective in correctly appraising their current situations once their companies have started

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up. Misperception of the situation often results in diminished performance and possibly results in failure.

This article proposes that the (mis)perceptions of present situations by entrepreneurs have a profound impact on the effectiveness of strategic decisions about the future. The article provides evidence, via a simulated decision-making exercise, that the entrepreneur's interpretation of the current situation is one that may propagate inertial pressures for the continuity of strategic status quo and that may impede effective decision making under uncertain environmental conditions.

In this article, organizational life-cycle concepts are invoked to characterize situations that entrepreneurs encounter in their developing companies. Theoretical and empirical evidence suggests that life-cycle concepts may be managerial beliefs about situations. These are combined with perspectives on stereotypes from the field of social psychology and result in hypotheses concerning interpretation of stereotypical situational cues by managers in entrepreneurial companies. A computer-simulated decision-making exercise was developed and run to test the hypotheses.

Simulation in Entrepreneurship Research

Simulation methods and models are believed to enhance management education by virtue of their ability to enhance learning through experience (Graham, Morecroft, Senge, & Sterman, 1992; Keys & Wolfe, 1990; Senge, 1990). These methods enable researchers to focus on singular dimensions while controlling for confounding factors and, by so doing, to better determine causal relations. In addition, they may generate rich data in accelerated time frames of participant action (Keys & Wolfe, 1990; MacMillan & Katz, 1992). Rapid feedback on their performance in simulations informs participants, leading to participant learning. Such learning is particularly important in simulations that allow managers to practice for infrequently experienced organizational events (DeGeus, 1988; Senge, 1990). Learning how to make successful transitions between life-cycle stages may be a critical factor in success for entrepreneurial companies.

Some researchers have called for a greater emphasis on quantitative methods in entrepreneurship through experimental research and the study of causal inference (Low & MacMillan, 1988; Vesper, 1988). Because simulation methods are particularly well suited for research issues involving strategic management, group decision making, leadership, and information processing (Keys & Wolfe, 1990), they are especially relevant to entrepreneurship.

A particularly important issue in entrepreneurial companies lends itself directly to simulation research. This is the issue of entrepreneurial decision making based on pattern recognition (Hofer & Bygrave, 1992). "The essence of entrepreneurship is the seizing of opportunities through the recognition of emerging . . . patterns in chaotic day-to-day real world data" (p. 98). As described in the introductory remarks, new business start-ups and subsequent effectiveness both arise out of accurate perception of environmental situations by entrepreneurs. Simulation environments are being used to discover tendencies toward misperception, cognitive distortion, and the use of heuristics in decision making (Isaacs & Senge, 1992). Such approaches enable research participants to form perceptions and perception-based decisions and to evaluate them against actual results during or after role-play (Graham et al., 1992). Consequently, entrepreneurs who participate in such simulations may be able to gain a better understanding of the ways in which they interpret patterns of information, biases they employ in so doing, and how such interpretation and biases may affect their decisions.

The present study applies this perspective directly, overcoming the drawbacks of field research on perceptual issues. Field research, such as that which investigates situational assessments by entrepreneurs, usually suffers from various threats to internal validity (Bracht & Glass, 1968). For example, a study of several firms in the growth stage might include firms in different industry segments exhibiting varying levels and types of growth stage evidence, making it difficult to accurately determine the real degree of growth occurring as well as the consistency of managerial interpretation and response. In this research, simulation provides a means to control for threats to internal validity and to discover the extent to which entrepreneurs misperceive circumstances based on cognitive models held of previous events.

Life-Cycle Stages as Perceptions

Empirical evidence suggests that entrepreneurs consider their business situations in terms of stages of development (Quinn & Cameron, 1983). Recent work capturing the logic of various life-cycle models that have been proposed supports a four-stage model, which includes the stages of conception, commercialization, growth, and stability (Kazanjian, 1988; Kazanjian & Drazin, 1989).

Organizational life-cycle stages are defined in terms of specific firm issues. Miller and Friesen (1984) and Kazanjian (1988) find that there are significant differences between the dominance of certain problems at different life-cycle stages in new ventures. Therefore, "the particular problems it faces at a given time define a venture's position in a particular stage of

growth," and "problems may influence stage characteristics . . . according to their relative importance" (Kazanjian, 1988, pp. 274-275).

Support has been found for the sequential progression of firms through development stages (Kazanjian & Drazin, 1989; Miller & Friesen, 1984). Life-cycle research has thus moved to the point of supporting the predictability of the firm moving sequentially from one stage of development to another as well as the predictability of encountering specific sets of problems in each stage it enters. These patterns of development are observable across firms and across industries (Miles & Snow, 1978).

The finding that growth stage problems are predictable in nature, and that they occur in a predictable sequential fashion, suggests that they may be better defined as problems of management cognitive development and complexity (West, 1992). The dominant problems encountered at each stage are different in content and complexity from those encountered during earlier stages and consequently require organizational learning for adaptation to be effective (Kazanjian, 1988). Thus growth stage problems may not be the result of a changing interface between the organization and its environment, as is commonly posited in the literature. Instead, these problems may reflect top management's inability to perceive a changed interface until the need for change is compellingly on the organization, and on managerial and perceptual shortcomings in addressing the change.

Such problems of management cognitive development and complexity may be more critical in entrepreneurial firms than they are in more bureaucratic firms. Bureaucratic firms have more managers involved in decision making and formalized procedures for scanning the environment and assembling information within these firms. A greater number of managers would potentially lead to a greater number of perspectives about the firms and their environment; organizational processes may serve to facilitate the sharing of diverse information and interpretations of individuals. In entrepreneurial firms, on the other hand, there are fewer decision makers and formalized processes. In fact, the top management of these firms may consist of only the founders or chief executive officers (CEOs). In these firms, the inability to perceive changing conditions becomes even more critical because the opportunity for corrective interpretation is not afforded through multiple perspectives or organizational processes.

The labeling of stages may exacerbate interpretation problems. Managers rely on labels to organize issues into categories, and then rely on such labels in directing organizational action and making strategic decisions. Labels reduce the complexity of organizational stimuli into meaningful categories (Dutton & Jackson, 1987). Labels also serve to focus attention on particular aspects of strategic issues (Dutton & Ottensmeyer, 1987) and on characteristics

implied by labels. These issues and characteristics then become the drivers for organizational routines and types of organizational response behavior.

In attempting to understand current situations, top management's biases, heuristics, and schemas narrow their vision (Daft & Weick, 1984) and limit their consideration and scanning of possibilities to situations and perspectives consistent with their experience. Kiesler and Sproull (1982) propose that managers operate on mental representations that are likely to be of historical environments instead of current ones. Miller (1991) suggests that "ingrained scanning habits of tenured CEOs make them especially good at detecting and interpreting events that are in line with historical trends, traditions and expectations, but poor at perceiving, understanding, and reacting to significant changes" (p. 49). The biased perceptions of that history may interfere with making effective decisions on current events.

In sum, perceived problems and issues tend to define the stages of development of entrepreneurial organizations. The labels applied to particular stages then become a kind of shorthand for a set of schematic representations and beliefs about appropriate issues and activity spheres requiring strategic management and decisions. As long as the current situation reflects the past, entrepreneurs may be justified in basing decisions on the shorthand labels and the associated mental representations of historical environments. But where current contexts are different from those of the past, such a basis may yield less effective decisions.

Situational Stereotypes and Decision Making

The interest in stereotypes lies in the behavioral response toward social groups based on stereotypes held of these groups. The present research extends the concept of stereotypes beyond social group characteristics to characteristics of situations and circumstances. Such extension has implications for decision making by management of organizations when confronted with stereotypical situational cues.

Stereotypes are typically defined and considered in terms of social groups (Weber & Crocker, 1983). A stereotype is an organized, abstract knowledge structure about a set of individuals that comprises a group. Certain common traits or characteristics of individuals distinguish them as belonging to the group. Thus any single individual who exhibits such a trait may also be categorized as a member of the stereotypical group, and behavior toward that individual reflects the stereotypical view.

Similarly, a situational stereotype may be considered as a mental representation or belief structure regarding a set of instances or events. These sets of instances would be perceived as having common underlying characteristics,

causes, or effects or as exhibiting some common pattern of information. A single event or instance that exhibits such a commonality may then be categorized as belonging to the situational stereotype. Just as social group stereotypes can be learned through borrowing (Fiske & Taylor, 1991) and spontaneously activated (DeVine, 1989), even with limited experience, situational stereotypes may be easily learned or borrowed, easily recognized, and quickly acted on.

Whereas stereotypes are typically viewed in the context of relationships between individuals and groups, the literature of multiple disciplines supports the existence of classes of situations characterized by sets of features. Tversky (1977) describes similarity as a feature-matching process and suggests that similarity may appear "between occurrences" (p. 327), which he has previously characterized broadly as including instances, situations, and scenarios (Tversky & Kahneman, 1974). In a review of previous research on classifying situations, McCrae (1984) identifies meaningful dimensions characterizing loss, threat, and challenge; he finds that specific coping behavior is determined to a great extent by the way people classify critical life events. In organizational research, threat and opportunity have been found to characterize a range of circumstances and types of events (Jackson & Dutton, 1988; Staw, Sandelands, & Dutton, 1981). As discussed previously, organizations are often perceived as being within distinctive life-cycle stages, which in turn precipitate certain types of organizational responses (Kazanjian, 1988). If managers apply labels to types of events they perceive, then they may apply labels to characterize life-cycle stages and subsequently rely on those stereotypical labels.

The fundamental interest in extending stereotypes beyond individuals and groups to situations lies in the relationship between cognitive structure and behavior toward a specific instance. Research on stereotypes provides convincing evidence supporting a relationship between instances that trigger stereotypes and behavior (Sagar & Schofield, 1980; Snyder, Tanke, & Berscheid, 1977). Extending work in this area, an isolated situational cue may trigger a stereotype cognitive structure that in turn triggers behavior toward the instance. Stereotype theory suggests that observers will behave in response to the isolated instance as if it were the entire stereotype representation.

Other theories of cognitive structure (prototypes, scripts) do not offer this kind of behavioral response connection. Prototype theory concerns category structure, not the use of that structure in processing (Rosch, 1978). Individuals must rely on multiple cues that suggest commonality or distinctiveness among possible categories to make a prototypical judgment (Rosch, 1978).

Participants in the research were 42 undergraduate and graduate business students. Participants averaged 27 years of age with approximately 4 years of previous work experience.

Participants were randomly assigned to one of three treatment conditions, representing the type of information each would subsequently receive: Growth, Mature/Stagnant, or Random. Each participant was seated at a computer terminal and was directed to begin the experiment. Each participant proceeded through the experiment at his or her own pace.

Participants were provided the following instructions on starting the program.

This research concerns the responses of companies to various types of situations. You will assume the role of a company manager and advise top management of your company, based upon information you receive about the company's situation.

Your company is a manufacturing company. It is contemplating adding a new line of products. This would involve making a series of changes in production, marketing, sales, and finance. Part of the decision to add a new line of products depends on the situation the company is in.

You have a critical role in the company. Your role is to assess and interpret information you receive about the company's situation. Top management will rely upon your assessment in its decisions.

Participants were then asked to review nine separate sets of information; before moving on from one set to the next, they were asked to interpret and characterize the information. The patterns of information received by participants depended on the group condition to which they were randomly assigned. Those in the Growth treatment received sets of information that reflected underlying growth trends, those in the Mature/Stagnant treatment received sets of information reflecting an underlying flat trend (no growth, no decline), and those in the Random treatment received sets of information that were randomly generated. On viewing each set of information, participants were asked to characterize the company's situation as "growth," "mature/stagnant," or "can't tell."

The type of information varied across the nine sets. Each set of information was labeled differently, reflecting a variety of strategic factors managers might consider in evaluating a company's situation. For example, sets reflected the company's recent profits in millions of dollars, the use by customers of the company's toll-free information line, and recent levels of advertising effectiveness. The presentation of information also varied across the sets. The nine sets were operationalized in three consecutive series, each of which presented one tabular numeric display, one ordinal display using letters, and one bar graph display.

Gap filling occurs when not all information is complete. Theory suggests that people then use general information that is available to infer the presence of specific attributes typically associated with stereotypical categories (Dutton & Jackson, 1987). Gap filling is one process through which stereotypes are maintained (Owens, Bower, & Black, 1979). Thus

Hypothesis 2: When confronted with missing information, entrepreneurs will fill in the information in a manner consistent with their situational stereotypes of the life-cycle stage of their companies.

The use of general information about a category to resolve ambiguous information has also been associated with stereotypes (Sagar & Schofield, 1980). A wide variety of evidence can be used to support a stereotype (Snyder et al., 1977). For instance, Kiesler and Sproull (1982) find that even mildly disconfirming evidence is incorporated by managers into an existing mental representation. With respect to the customary conditions under which strategic decisions are made, ambiguous information is generally distorted in the direction of consistency with stereotypes (Dutton & Jackson, 1987). This leads to

Hypothesis 3: When confronted with ambiguous information, entrepreneurs will interpret the information in a manner consistent with their situational stereotypes of the life-cycle stage of their companies.

Methodology

A simulated decision-making experiment was created to test the hypotheses. The experiment was developed in the form of self-administered software, running under Windows 3.1 on PC-compatible computers. It was developed in the Asymetrix ToolBox environment, which supports high-resolution graphics, use of the computer mouse, and standard Windows user interface conventions such as pull-down menus and clickable buttons. The experiment had the appearance and functionality of a typical Windows application; however, users were restricted to sequential progress through the experiment.

One key issue in developing the simulation was the need to achieve an effective and valid treatment. The accomplishment of this objective required consideration of several elements: previous experience of the participants, variety of information presented in the treatment, length of the treatment, and learning and feedback mechanisms. Each of these elements is discussed here within the description of the program.

1a. Missing information test, requiring gap-filling:

1989	1990	1991	1992	1993
----	.07	----	.08	----

1b. Ambiguous information test, table format:

1989	1990	1991	1992	1993
.40	.50	.60	.50	.50

1c. Ambiguous information test, bar graph format:

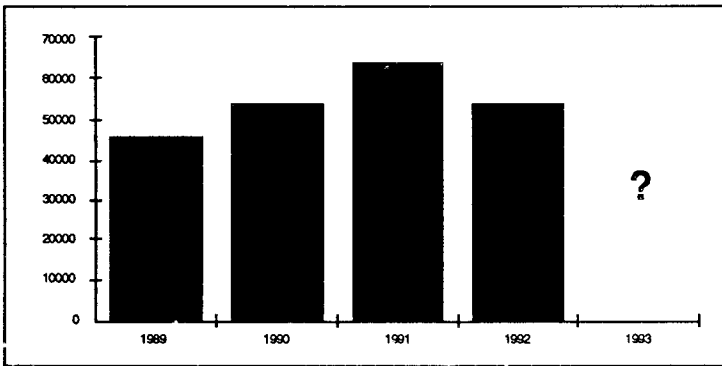


FIGURE 1: Information Presented in Hypothesis Tests

Following the simulation, students were debriefed in class about the nature of the experimental test and results. The debriefing sessions provoked lengthy and thoughtful discussions about life-cycle theory and cognitive biases.

Results

Effectiveness of Simulation Treatment

The participants' characterizations of the company's overall situation differed by treatment groups after completion of the nine treatment information sets (Table 1). A chi-square test between groups reveals a probability of

Variations in presentation and type of information reflect conditions encountered by practicing entrepreneurs and managers. Patterns of information about circumstances and situations may take a variety of forms. Not all information received and evaluated in companies is in the form of numerically sequenced, tabular displays.

The length of the treatment (nine sets of information) was used to facilitate the development of a mental representation of the company's stage. Thus the treatment length, together with the varieties and types of information, enabled participants to consciously process observed patterns of information in the context of previously received information about the company's situation.

After each of the first two series of treatment information, participants received a memo from top management commenting on their evaluations. For those participants who correctly assessed the information at least two out of three times in the preceding series, the memo indicated top management's agreement with the situation appraisal and congratulated the manager on doing an effective job. For those participants who correctly assessed the information fewer than two out of three times, the memo indicated top management's disagreement and what they thought the situation really was and asked the manager to be more careful. This feedback mechanism within the simulation proxies real-world conditions and provides the opportunity for learning by managers.

Following the treatment sets, a final question with no accompanying information asked which choice best described the company's situation on an overall basis as presented in the previous information sets: "growth," "mature/stagnant," or "can't tell."

Participants were then presented with one incomplete information set and ambiguous information sets (Figure 1). The incomplete information set was labeled "Return on Investment." Participants were asked to fill in the blanks.

Two ambiguous sets of information were then presented. The first set, labeled "Gross Profit Percentage," was a sequence of numerical data. The second set was a bar graph labeled "Production Line Efficiency." For each presentation of ambiguous information, participants were asked to characterize the current situation as either "growth," "mature/stagnant," or "can't tell."

For each set of information presented during the simulation, two measures were collected and saved automatically by the program to disk. The response to the question on characterizing the situation was encoded and saved. In addition, the time each participant took to complete the answer for each set of information was saved. A time clock stamp identified a complete set of responses with a particular participant.

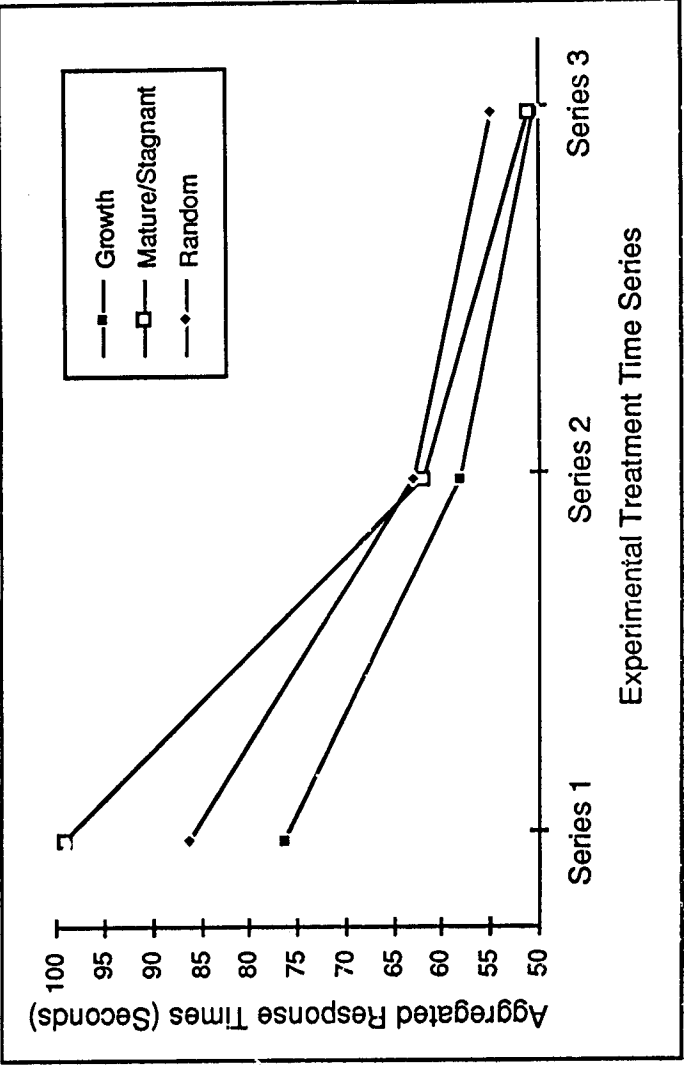


FIGURE 2: Response Times Over Treatment Series

TABLE 1: Characterizations of Company's Overall Situation Following Treatment

<i>Situation/ Characterization</i>	<i>Growth Group</i>	<i>Mature/Stagnant Group</i>	<i>Random Group</i>
Growth	11 (84.6)	0 (0)	2 (13.3)
Mature/stagnant	1 (7.7)	11 (78.6)	12 (80)
Can't tell	1 (7.7)	3 (21.4)	1 (6.7)
Group total	13 (100)	14 (100)	15 (100)

NOTE: Percentages are in parentheses.

less than .0001 that the observed characterizations occurred by chance, $\chi^2 = 27.60$, $df = 4$. However, the differences among all three groups can be directly traced to the difference between the Growth group and the other two groups. No significant overall evaluation differences existed between the Mature/Stagnant and Random groups, $\chi^2 = 3.01$, $df = 2$, $p = .22$.

Hypotheses Tests

Hypothesis 1 predicts that research participants will show evidence of stereotype formation relating to the group treatments. This was tested in two ways. First, the time participants spent considering new evidence during training was measured (Figure 2). Aggregated response times for the first series of three treatment information sets were subtracted from aggregated response times for the third series, producing change scores. A one-way ANOVA showed a significant overall decrease in response time, $F(1, 39) = 48.06$, $p < .0001$; however, the Student-Neuman-Keuls test found no significant differences among groups. This finding provides some support for stereotype development but, alternatively, may be primarily the effect of participants' practice during treatments.

A second test involved the speed with which participants interpreted information that was not necessarily consistent with developed stereotypes (ambiguous information tests). If participants draw on stereotypes, then it is anticipated that a higher response time will be found for a group whose stereotype view is not consistent with the stimulus. A one-way ANOVA showed that combined response time on these two tests differed significantly among the groups, $F(2, 39) = 4.47$, $p = .0182$. The Student-Neuman-Keuls test found that the response times for the Growth (36.8 seconds) and Mature/Stagnant (34.36 seconds) groups were not significantly different and that both were significantly higher than that for the Random group (24.2 seconds). This finding lends further support to Hypothesis 1.

Participants in each treatment group were provided with information for 1990 and 1992 and were asked to fill in three missing pieces of information

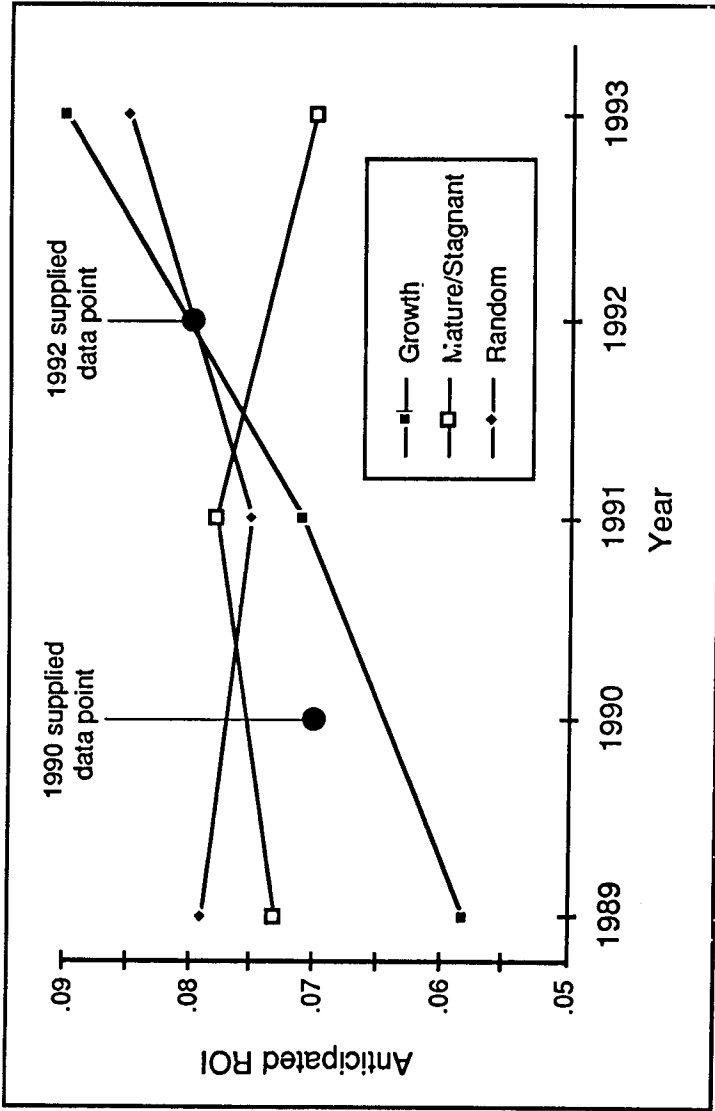


FIGURE 3: Responses to Missing Information Test (Gap Filling)

corresponding to 1989, 1991, and 1993. Figure 3 shows the set of data for the missing information question filled in by participants. Hypothesis 2 predicts that managers will fill in the information in a manner consistent with their stereotype perception of the life-cycle stage. Therefore, participants in the Growth group should fill in numbers that increase over the years, and the other groups should fill in numbers indicating little, if any, growth. Indeed, the Growth group results do indicate a constantly increasing function across years, and both the Mature/Stagnant and Random groups show indeterminate functions across years.

Change scores were calculated by subtracting each participant's 1989 entry from his or her 1993 entry. A one-way ANOVA was run to test the differences among groups on their change scores (one Random group case with out-of-range values ($> 100\%$) was removed from this analysis). Differences among the three groups were significant, $F(2, 38) = 7.18, p = .0023$. A planned orthogonal contrast showed significant differences between the Growth group and the other two groups ($t = 3.68, df = 12, p = .0031$, two-tailed) but no difference between the Mature/Stagnant and Random groups. Hypothesis 2 is therefore supported strongly.

Hypothesis 3 predicts that treatment-related differences among groups would be seen on the two questions that presented ambiguous information. However, no significant differences were seen among the groups. Therefore, Hypothesis 3 is not confirmed.

Discussion and Implications

The use of a laboratory simulation and student subjects suggests caution in interpreting the generalizability of the results of this research. In addition, this research has evaluated only growth and maturity stages; generalizability to the relationships in other stage transitions is not supported. Although subjects in this research acted as advisers and not decision makers, it is assumed that, given the opportunity to actually make entrepreneurial decisions, they would do so in a manner consistent with their views of the company's situation.

The results still have informative and useful implications for both entrepreneurs and researchers in entrepreneurship. Despite the limited amount of treatment of the research participants, there is partial support for their ability to rapidly create situational stereotypes and for their reliance on these stereotypes for critical decision making.

The categorical responses and response times in the treatment sets for both the Growth and Mature/Stagnant groups suggest that the simulation was

a situation thought of as growth. Ambiguous information, therefore, may be treated differently when a growth stereotype is operating than it is when a mature/stagnant stereotype is operating. The variance in an acceptable level of ambiguity under a growth stereotype may be much tighter than it is under other stereotype situations. Future research might investigate the nature of information variance and its relationship to stereotypical perspectives.

Implications for Entrepreneurs

One clear implication of this research is the ease with which biased mental representations of a company's past situation can be created and employed toward making decisions about its present situation. In this research, within a matter of minutes, participants acquired and used a stereotypical view of a company's situation for a key strategic decision. The potential for practicing entrepreneurs, who are inundated with information from all quarters, to be so affected is much greater. To make effective strategic decisions as circumstances are changing but before information reflecting such changes may have caught up, entrepreneurs must be careful not to place too much weight on stereotypical views. Prescriptively, one might suggest that entrepreneurs pay attention to history—but not too much.

A balance is needed between understanding historical roots and developments and considering current information on its own merits. Kiesler and Sproull (1982) propose that those who develop schemas for change will better incorporate change information. Such an approach might propel organizations to move between stages of development gradually and thoughtfully, without incurring revolutionary change and upheaval or the risk of failure. Training entrepreneurs to attend to discrepant information and new environmental conditions may help overcome the biased representations that stereotypes produce. Simulations with practicing entrepreneurs may foster this type of learning.

The implications of this research support the proposition that the view that entrepreneurs hold of their situation changes from an initial macro, environmental view to a micro, within-the-business view after start-up. The macro view leads to the successful start-up; the micro view may subsequently lead to diminished performance. The macro view is one of environmental and industry patterns, but the micro view is one of patterns of the entrepreneur's business development. In this vein, in a study of technology-based start-ups, Meyer and Dean (1990) find that founding entrepreneurs may ultimately constrain their firms' effectiveness because of an unwillingness to shed a narrow technical mindset in managing. In a computer simulation study of entrepreneurial behavior, Lant and Mezas (1990) conclude that lessons

effective in creating a mental representation of these two situational stereotypes. The gap-filling exercise lends support to the existence of these stereotypes and their use in filling in missing information.

Of some interest are the responses of the Random group participants. Their response time decreases throughout the treatment sets, suggesting greater ease of access or use of a developed mental representation in assessing situational data, despite the fact that a random set of data by definition should lack any structure. However, these participants' categorical responses in describing the company's situation throughout the treatments, and on an overall basis just after the treatments, were not significantly different from those of the Mature/Stagnant group. This may represent an argument against the contention that stereotype schemata have been formed in the treatment. On the other hand, one interpretation of this finding is that a wider range of variance in received information, such as that received by the Random group, may not be inconsistent with an interpretation of a mature or stagnating business. It may be that a random information condition in this test is not so much a control group in the usual sense of experimental research as it is a different type of stereotypical view of a situation. Alternatively, when asked, managers may feel compelled to describe the characteristics of their companies in some fashion other than simply saying they "can't tell." In business scenarios, venture capitalists might find that entrepreneurs offer some explanations or suggest the presence of specific business dynamics when in fact there are really none discernible. Entrepreneurs may provide these explanations because of a felt need to appear as if they know what is going on in the business.

The lack of significant findings on categorical responses to questions relating to interpretation of ambiguous information adds a measure of caution to the conclusions and implications drawn here. Previous empirical evidence suggests that ambiguous information should be interpreted consistent with operating stereotypes. In this research, all groups tended to categorize ambiguous information as indicative of a mature/stagnant business. However, this may be due to the limited treatment series used in the study. It is possible that ambiguous information will be interpreted differently by entrepreneurs, who typically receive much greater exposure to company information than was possible from the treatments employed in this study.

One question these latter findings raises has to do with the nature of information received by entrepreneurs. As already mentioned, one explanation for the Random group's characterization of the company's situation as mature/stagnant is that different types of categorizations may accept different patterns of information. In this instance, a stereotype situation thought of as mature/stagnant might subsume a wider variance of information than might

In addition, effective learning may develop only through multiple simulations. Randel et al. (1992) find that single-simulation/gaming "material has a greater chance of being integrated into the cognitive structures of the individuals and thus being retained" (p. 270); this effect may be enhanced with repeated exposure. Thus the organizational learning literature has recently emphasized the need for iterative feedback through multiple role-playing situations (Senge, 1990).

For simulation research on pattern recognition and information processing issues, this prescription may be critically important. Just as repeated exposure to inconsistent situational information may ultimately lead to a revision in the mental model held of the situation, repeated exposure to a pattern recognition issue in entrepreneurship may eventually lead to a broader understanding of alternative means of conceptualizing and acting on developmental patterns.

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learned from past experience can result in learning traps when the environment changes.

Implications for Simulation in Entrepreneurship Research and Education

The richness of interpretations and the interesting questions raised out of this study support more frequent use of simulation in studies of entrepreneurship. Simulation methods can extend and enhance both substantive and useful research findings as well as the educational benefit afforded to both prospective and practicing entrepreneurs.

This article has suggested that one critical domain for simulation research in entrepreneurship is a domain focusing on cognitive processes related to pattern recognition, information processing, and decision making. A variety of compelling issues lend themselves to this combination of methodology, universe, and domain. For example, these might include extending the current work to determine whether similar biasing processes operate in the transitions between other life-cycle stages such as commercialization and growth, discovering the types of information that entrepreneurs use to successfully understand changing conditions and the ways they evaluate and use information to avoid cognitive biases, identifying the distinguishing ways in which successful entrepreneurs use information to assess initial opportunities for start-ups, understanding how the interactions between entrepreneurs and venture capitalists affect the investment decisions by venture capitalists, and investigating how entrepreneurial top managers share and assemble multiple interpretations and opinions.

Some types of simulations may be more effective than others. More effective learning occurs in simulations that provide feedback to participants (Graham et al., 1992; Keys & Wolfe, 1990; Randel, Morris, Wetzel, & Whitehill, 1992). In a simulation for entrepreneurship, students' feedback was important in developing balanced decision criteria for starting a new venture (Clouse, 1990). Practicing entrepreneurs tend to view the feedback developed from their current environments as contributing more to their learning than does experience in previous firms or formal education (Reuber & Fischer, 1993).

Learning itself involves the revision of mental models through feedback. Simulation research that provides feedback on biases and cognitive processes might demonstrate to entrepreneurs how their ways of thinking affect—and possibly impede—their companies' performance. Thus simulations producing feedback to entrepreneurs on their own cognitive processes will provide opportunities for them to learn how to learn.

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Computer-Assisted Gaming for Entrepreneurship Education

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Entrepreneurship, defined as executive deal making, involves four core activities: venture selecting, planning, executing, and assessing. These activities can be supported in a computerized gaming simulation to achieve cost-effective learning by doing, to study strategic processes, and to assess business education. Computerized gaming simulations give objective scores and can be comprehensive, flexible, and easy to administer. They should game pedagogically important processes and model pedagogically incidental ones. DEAL is a computerized business gaming simulation designed to test the concept of gaming all markets (resources, products, money, and interpersonal relationships) in a multi-industry setting. Instructor configurable, network cognizant, and activity driven, it includes five instructor-configurable industries and seven participant-selectable roles. Being computer assisted, DEAL is generally very different from other computerized entrepreneurship gaming simulations, which are either computer based or computer controlled. DEAL incorporates all four core entrepreneurship activities and reveals the developmental stages of emerging organizations. DEAL resolves with computer assistance problems of participant antagonisms and conspiracies. A gaming simulation should be evaluated on the extent it games defining processes with administrative ease. Gaming simulations should have greater value in assessing entrepreneurship education than in facilitating it.

KEYWORDS: *assessment; computerized gaming simulations; DEAL; entrepreneurship; gamed markets; modeling; multiple industries.*

Designing a gaming simulation is a task that is more dependent on clear definitions than is perhaps any other research activity. A field researcher, for example, who seeks cases of entrepreneurship can rely on the perceptions of others without having to question the bases of those perceptions. The gaming-simulation designer, however, must bring forth a truthful representation. Because the representation will not be identical to the original, the designer has to know which attributes must be included because they define the construct and which ones can be left out because they are incidental. The designer needs a definition that captures the essence, and only the essence, of the construct.