Simulation & Gaming

An Interdisciplinary Journal of Theory, Practice and Research

Official journal of the Association for Business Simulation and Experiential Learning (ABSEL), the International Simulation and Gaming Association (ISAGA), the Japan Association of Simulation and Gaming (JASAG), the North American Simulation and Gaming Association (NASAGA), and the Society for Intercultural Education, Training, and Research in the USA (SIETAR-USA).

The editor and publisher gratefully acknowledge the support for *S&G* provided by the Université de Nice Sophia Antipolis, France.

FOR SAGE PUBLICATIONS: Scott Springer, Kristin Nelson, Scott F. Locklear, and Katinka Baltazar

Simulation & Gaming
An Interdisciplinary Journal of Theory, Practice and Research

December 2001
Volume 32, Number 4

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Sage Publications Thousand Oaks • London • New Delhi

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SIMULATION & GAMING (ISSN 1046-8781) is published four times annually—in March, June, September, and December—by Sage Publications, 2455 Teller Road, Thousand Oaks, CA 91320; telephone (800) 818-SAGE (7243) and (805) 499-9774; fax/order line (805) 375-1700; e-mail order@sagepub.com; http://www.sagepub.com.

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Editorial: State of the art and science of simulation/gaming

The area of simulation/gaming is so fraught with terminological and methodological hurdles and variation that anyone embarking on a volume devoted to its state must either be in need of a serious dose of reality (that is what gamers thrive on!) or something of a dreamer (inspiration to some gamers?). At least, that is what I thought when the initial idea for this special issue came up. Fortunately, Professor Jan Klabbers falls into neither of those two categories. Jan is something of a renaissance man in the world of simulation/gaming, and has the breadth of scope and depth of experience to take on such an ambitious task. Perhaps it should be said that Jan would not for a minute claim that this issue is the last word on the state of simulation/gaming. I would clip his wings if he did! However, this issue fulfills its mission admirably by presenting clear glimpses of the state of simulation/gaming. Of course, many gaps remain, but then no one issue of this journal, nor indeed several volumes, can adequately cover this vast and growing field. Jan has pulled together a set of articles that, individually and collectively, give a clear idea of recent progress in several areas in simulation/gaming, accompanied by some pointers for the future. One singular advantage of this review of the state of simulation/gaming is that it manages to weave together the practical and the theoretical, the pragmatic and the philosophical, the technical and the visionary, the methodological and the epistemological, and the past and the future aspects of the profession. This in itself is valuable, especially in a field that is so varied in its approaches and spirit, and in a methodology that is employed across such a broad spectrum of disciplines and professional pursuits. This special issue allows simulation/gaming professionals to stand back a little and examine some of the assumptions on which they work and some of the practices that they tend to take for granted.

For all the above reasons this issue is a valuable addition to our thinking. It can and should be read in conjunction with other articles, both in *S&G* and beyond. I am thinking here of other special issues that also aim to review some aspect of simulation/gaming, for example, the recent special issues on research in business simulation (Vol. 32, No. 1), on medical simulation (Vol. 32, Nos. 2, 3), on system dynamics (Vol. 31, Nos. 2, 3, 4), and even for this journal's 30th Anniversary (Vol. 30, No. 4; Vol. 31, No. 1).

We should all be grateful to Jan for his grasp of the innards of simulation/ gaming, for his clear vision of simulation/gaming over time, and for his hard editorial work. Without those three ingredients, this very special issue would not have been possible. Thanks, Jan, for bringing to fruition this special, special issue of *S&G*.

An additional reference can be made here to Jan's role in the International Simulation and Gaming Association (ISAGA, one of the supporting organizations of this journal). Some would admit that for many years Jan has almost single-handedly held

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ISAGA together and helped it to develop into what has become a prestigious international organization. Thus, this special issue can perhaps also be seen as part of his overall contribution to simulation/gaming. Many will join me in saluting this esteemed colleague. Thank you, Jan. I look forward in a year or two to another issue on the state of the art and science of simulation/gaming.

—David Crookall
Editor

Interactive video negotiator training: A preliminary evaluation of the McGILL NEGOTIATION SIMULATOR

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The authors investigated student reactions to an interactive video training program called the McGILL NEGOTIATION SIMULATOR designed to teach negotiation skills using a sales negotiation scenario. They also determined whether the program increased learning of negotiation concepts, as measured by a pretest and posttest. The authors conducted two studies. In Study 1, undergraduate students taking a sales class used the SIMULATOR and demonstrated significant learning relative to a control group. Study 2 replicated the findings from Study 1 using a bargaining and negotiation class. Discussion focuses on the implications of the findings from the two studies on the use of interactive video to teach negotiation skills in the classroom.

KEYWORDS: *bargaining; computer-based training; negotiation; training evaluation.*

Instructors of courses where negotiation and persuasion concepts are taught (e.g., bargaining courses in management, sales courses in marketing) usually must strike a balance between (a) lecture and discussion of topics related to bargaining theory and (b) opportunities for students to practice and implement the concepts taught in class. Furthermore, most opportunities for students to practice and implement course-related concepts involve students bargaining against other students in role-playing exercises (e.g., Smith & Carrell, 1991) rather than against a professional negotiator, which diminishes the learning that could be accomplished with a role-playing exercise. Asking inexperienced students to negotiate against each other is a potentially serious problem in that negotiation concepts and skills that are not effectively learned in college courses are probably learned on the job, where the cost of mistakes is much

AUTHORS' NOTE: We thank Ryan Kotowski, Brice Smith, Karen Hamilton, Heath Ahnen, and Karin Bast for installing and maintaining the computer hardware and software needed to conduct this research. This article is a part of an ongoing study funded by a University of Wisconsin–System Undergraduate Teaching Improvement Grant. An earlier version of this article was presented at the International Association for Conflict Management conference in College Park, Maryland, June 1998.

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greater. Some have advocated the use of multimedia forms of training as a way to more effectively simulate complex work experiences (see Goldstein, 1993, for an early review). Whereas computer-based simulations have been employed with negotiation training, previous applications have focused on using negotiator Decision Support Systems (e.g., Wilkenfeld, Kraus, & Holley, 1998) or on identifying optimal solutions for negotiators (e.g., Winter, 1985). Applications of multimedia simulations for training students in more effective bargaining behavior have been noticeably absent, probably due in part to the complexities of any but the simplest negotiation situations.

The purpose of this project is to evaluate student reactions to and the effectiveness of a new interactive video simulation designed to teach negotiation concepts. Interactive video is a technology that combines both computer and videodisk (e.g., laser disk, CD-ROM, DVD) technologies in a manner that captures the superior qualities of each technology. The interactive video program that is evaluated in the present research is Program 1 of the MCGILL NEGOTIATION SIMULATOR (MNS). This product uses a simulation scenario where the participant plays the role of an airplane manufacturer's sales representative; the participant attempts to sell an aircraft to a representative for a Greek airline. The MNS was developed with the consultation of prominent negotiation experts and is sold for use with college and professional business training courses.

Interactive video and negotiation

With the MNS, the student sees a full-screen, prefilmed opponent on the computer monitor; the video quality is comparable to that found on most CD-ROM products. In addition, the opponent's remarks are heard via headphones; the simulator also provides computer-generated screen overlays with written text, giving students dialogue choices at key decision points. Using a computer mouse, the student selects from appropriate menus of choices that are presented at these key decision points.

For example, the on-screen opponent might say, "I am afraid that there are too many issues upon which we disagree. I suggest we break off negotiations." After hearing such a statement, the student might be presented with four response options such as, "(1) Agree to the request for a recess," "(2) Respond with a lower offer on one issue (click the '$' button to lower your offer)," "(3) Suggest that both parties negotiate over each issue—one at a time," and "(4) Suggest that the parties identify tradeoffs among the issues." Negotiation theory (e.g., Fisher & Ury, 1981) suggests that Option 4 is the best response.

The full-screen video, the prewritten menu options, and the ease of using the program with only a mouse suggest that students will enjoy using the SIMULATOR. The fact that they bargain against an opponent whose style can be described as "tough but fair-minded" will also be appreciated. Finally, the novelty of this assignment, when compared to traditional classroom-based instructional methods, will make using the SIMULATOR appealing.

Therefore, our first hypothesis is as follows:

Hypothesis 1: Participants will have a favorable reaction to using the MCGILL NEGOTIATION SIMULATOR.

In their review of various types of communication media in relation to various types of tasks, McGrath and Hollingshead (1993) observe that many negotiations occur using face-to-face interaction. They proceed to offer a contingency model suggesting that richer media such as face-to-face interaction and video will usually be superior to other media (e.g., telephone, e-mail, written messages) for complex tasks such as problem solving and negotiation. Johansen, Vallee, and Vian (1979) offer additional support for this position. They suggest that nonverbal cues provide information and feedback to the parties, enhancing the effectiveness of face-to-face interaction and video relative to other media. The general conclusion from this body of literature is that video media produce similar dynamics and effects when compared to face-to-face negotiations. Therefore, by implication, using interactive video to simulate a face-to-face negotiation session may generate (and train) behavior that is similar to what would occur with actual face-to-face negotiations and is a reasonable medium to use for training.

In their review of the literature, Poole, Shannon, and DeSanctis (1992) conclude that various types of media each have different strengths (e.g., negotiations using face-to-face media usually produce less conflict intensity than do negotiations using text-only media). Because experienced negotiators are aware of this fact, their negotiation sessions often utilize different types of media in combination. One relatively common combination is when the parties supplement face-to-face negotiation with written proposals for formal, detailed, or complex material (such as wage tables in union-management contract negotiations). If visual and written media are often used in combination, then we suggest that utilizing interactive multimedia incorporating both a visual component (i.e., simulated face-to-face discussion) and a written textual component (i.e., purchase offers displayed in text mode on the screen) is an appropriate training method for capturing the multimedia nature of actual face-to-face negotiations.

Mayer (1997) carries these ideas further. He offers a "generative theory of multimedia learning" that suggests that students actively learn through two different presentation modes—a visual mode and a verbal mode (note that the verbal mode may involve either auditory explanation or written text). Students select words and images, organize these, and, if the training is successful, integrate both forms of new information with each other and with their existing knowledge structures. He posits that multimedia applications work best when visual images are combined with appropriate verbal (either aural narration or written text) stimuli in temporal proximity. This is the case with the SIMULATOR used in the present study: Background information includes both video clips and narration, film clips representing the on-screen opponent show facial expressions while his remarks are conveyed via an aural soundtrack, poor choices made by the student early in the negotiation are immediately followed by on-screen textual feedback messages explaining why their choice may not have been a good one, and both sides' proposals are displayed in one corner of the screen in text mode, even as the video negotiation continues. Thus, the SIMULATOR's design is consistent with the recommendations of media theorists (e.g., Mayer, 1997; McGrath & Hollingshead, 1993) and should enhance student learning.

The SIMULATOR requires that students make choices from among the on-screen menu items presented to them during the negotiations. By actively making choices, students might better learn to recognize important decision points in negotiation and might better apply negotiation theory as they make decisions. The MNS computer program is written in such a way that whatever choice is selected, the preprogrammed opponent usually responds in a way that rewards decisions that are consistent with the underlying negotiation theory. Students encounter numerous decision points throughout the program and their decisions lead to their either securing an agreement or failing to do so, thus giving them immediate feedback. Students may also repeat the exercise, learning from their mistakes as they seek to secure favorable outcomes. For additional consideration of issues related to student learning with negotiation programs and simulators, see Saunders and Lewicki (1995). They suggest that students participating in such negotiation simulations be given a paper-and-pencil pretest and posttest so that the amount of learning that any simulator provides may be determined. Mayer (1997) also suggests that pretest and posttest measures be used to determine whether students understand the new concepts by being asked application-type "transfer" questions rather than just definition-type questions. Given the characteristics of the MNS (e.g., reinforcement for correct responses), we anticipate that such learning will be substantial.

This logic suggests a second hypothesis:

Hypothesis 2: Participants will show improved scores on a negotiation concepts test after using the MCGILL NEGOTIATION SIMULATOR.

In spite of the apparent advantages of interactive video, this method of teaching negotiation and persuasion concepts remains unproved. Therefore, the present study sought to evaluate the effectiveness of this method using two college courses where these concepts are taught: a sales course and a bargaining and negotiations course.

Study 1

The purpose of Study 1 was to determine whether Program 1 of the MNS improved student learning about negotiation techniques in a sales class. The SIMULATOR used a sales negotiation scenario and thus a sales class was an appropriate class for conducting a preliminary evaluation. Indeed, there is substantial overlap between both academic and popular literatures in the negotiation and sales fields (e.g., Cialdini, 1988;

Dawson, 1985; Karass, 1993; Kipnis, Schmidt, & Wilkinson, 1980; Perloff, 1993). A second goal was to gauge student reactions to the SIMULATOR.

Method

Participants

Ninety-six students enrolled in a senior-level sales class taught by the Marketing Department of a comprehensive regional university in the upper midwestern United States participated in Study 1; participants received course credit for participation.

Design

Study 1 was a 2 × 2 repeated measures pretest and posttest design with two time periods and two groups: an experimental group (n = 73) and a control group (n = 23). Measures included reaction measures (Kirkpatrick, 1959, 1960) (measured only at Time Period 2 and only from the experimental group) and learning measures (measured at Time Periods 1 and 2 and from both groups). The relationship between completion of this exercise and course scores was also assessed. Reaction measures included responses to the following three items (the first two were measured with a 5-point rating scale with anchors of 1 = *not valuable at all* and 5 = *extremely valuable*): (a) "How valuable was using the SIMULATOR as a learning experience?" (b) "How valuable was the SIMULATOR for teaching bargaining skills?" and (c) "How enjoyable was using the SIMULATOR?" (this item had anchors of 1 = *not enjoyable at all* and 5 = *extremely enjoyable*). Because of the high correlation among these three items (average r = .73; Cronbach's alpha = .89), they were combined into one scale whose scores could range from 3 to 15. Other reaction measures asked whether the computer program had crashed or "frozen" on them and whether they felt the MNS should be (a) dropped from the course, (b) an optional course assignment, or (c) a required course assignment.

Learning measures (Kirkpatrick, 1959, 1960; also see Mayer, 1997) consisted of a series of 20 multiple-choice problem situations devised by two of the authors and patterned after successful preparation or bargaining strategies (according to the MNS), plus some bargaining concepts (e.g., integrative bargaining concepts) taught in the course and used with the simulator. The test-retest reliability of this "Negotiation Concepts" test was confirmed with a separate sample of students who took the test and then took it a second time after a 1-week interval (none of these students had yet used the simulator). The test-retest reliability of the measure was .75 (n = 18).

Procedure

Prior to using the MNS, all students in the class completed the learning measure as a pretest. This was given at least 2 weeks prior to any student using the MNS to reduce priming effects. The SIMULATOR was the sole application of a stand-alone security workstation located in one of the computer laboratories. Students participated individually outside of class. They were seated facing the computer monitor located in the work station; they listened through headphones. Sound barriers blocked both noise and visual distractions.

The MNS operated as a self-contained CD-ROM program; students using the SIMULATOR had access to only the screen and the mouse. The keyboard and the central processing unit of the computer were locked in the lower cabinet of the security workstation. Thus, students could not tamper with the program code or steal the CD-ROM. However, experimenters could later use the keyboard to access each student's data.

Each student used the mouse to select his or her class and section from the list and to select his or her name from among the students in the group. A predetermined password had been given to each student; a student moved the mouse and then clicked on the letters on the compute screen to "type" the password and thus to enter the computer program.

The MNS offered students the opportunity to do background research prior to negotiating. The research topics appeared on the screen and the student could select which, if any, he or she wished to research. Full-screen video clips accompanied each research topic. Following a period of up to 30 minutes for research, the student could spend up to 1 hour negotiating the sale of an airplane to the on-screen opponent. The student could pause the program at any time to review background information. The MNS opponent made statements and/or offered proposals, and the student was required to select from an on-screen menu of responses and to make counter-offers. An "irritation counter" feature of the program was activated. A participant's response increased the counter if it: (a) reflected a lack of preparation, (b) established a pattern of very small concessions, or (c) violated common rules of bargaining (e.g., by retracting an offer or trying to recover a previously made concession). If the irritation counter reached "six," then the participant would receive a warning that the opponent was becoming irritated. If the irritation counter reached a value of "eight," then the on-screen opponent would break off negotiations and the session would end. Thus, participants were fully aware of the time remaining for negotiation, their opportunity to review any research material, the value of each side's offers, and whether an agreement had been reached or not reached. Students were required to bargain until either (a) they reached an agreement or (b) the computerized opponent (named "Mr. Pavros") had broken off negotiation three times. Therefore, the number of times Mr. Pavros got irritated and "walked out" on the student could be used as another measure of learning—a measure that is internal to the training situation itself (Goldstein, 1993), yet also behavioral (Kirkpatrick, 1959, 1960).

Each student was required to use the SIMULATOR at two different times—once during the first half of the semester, and then a second time during the second half of the semester. After completing the assignment for the second time, participants were asked to write a two-to-three-page typed "reaction paper." This assignment was made at the beginning of the semester so that students would pay close attention as they used the SIMULATOR. Finally, students completed the reaction and posttest learning measures at the course final examination period.

Results

Reaction measures

Sales student reactions toward the MNS were normally distributed ($M = 8.98$ on the 15-point scale, $SD = 3.37$, $n = 71$); clearly, they were not overly enthusiastic about the program. Initially, we suspected that this reaction was due to the fact that 23 of 70 students (32.9%—the rest did not answer the item) reported that the SIMULATOR had “crashed” or “frozen” when they were using it (note that since this study, a new MNS “Program Manager” program has been released that was designed to reduce this problem). However, a *t* test comparing the means on the reaction scale suggested that little difference existed between those for whom the SIMULATOR had crashed ($M = 8.86$) and those for whom it did not ($M = 8.98$), $t(66) = -.29$, *ns*. So this was not the cause of the negative reactions of some students. Nor was the number of times that the opponent broke off negotiations related to participant reaction ($r = .01$, *ns*). Anecdotal comments suggested that some students felt limited by their prewritten on-screen menu options; however, we have no data on this. Therefore, at this time the best conclusion that can be drawn is that sales students’ reaction to the SIMULATOR was normally distributed. This distribution is shown in Figure 1.

More positively, of those who had used the SIMULATOR and answered the item on the posttest, 66 of 70 (94.3%) reported that the SIMULATOR was easy to use. When asked about the future use of the MNS, only 1 person (1.4%) out of 71 said that the SIMULATOR should be dropped from the course. Thirty-nine (54.9%) felt it should be used as an optional assignment, and 31 (43.7%) felt it should be a course requirement. Clearly, the students felt that using the SIMULATOR was a valuable learning experience. These latter findings support Hypothesis 1.

Learning measures

The mean score on the pretest was 10.15 ($SD = 2.36$, $n = 72$) for the experimental group and 11.13 ($SD = 2.03$, $n = 16$) for the control group (a *t* test indicated that this difference was not statistically significant). The mean score on the posttest for the experimental group was 12.51 ($SD = 2.46$) and 11.69 ($SD = 1.78$) for the control group. A repeated-measures General Linear Model (GLM) analysis conducted using SPSS (version 7.5 for Windows 95) indicated that this linear time trend was significant, Wilks’s Lambda = .88, $F(1, 86) = 11.61$, $p < .001$, $\eta^2 = 11.9\%$. The between-subjects main effect was not significant, $F(1, 86) = 0.02$, *ns*, $\eta^2 = 0.01\%$. A Time × Group interaction was also statistically significant, Wilks’s Lambda = .95, $F(1, 86) = 4.40$, $p < .04$, $\eta^2 = 4.9\%$. Thus, after using the MNS, participants’ scores on the paper-and-pencil test

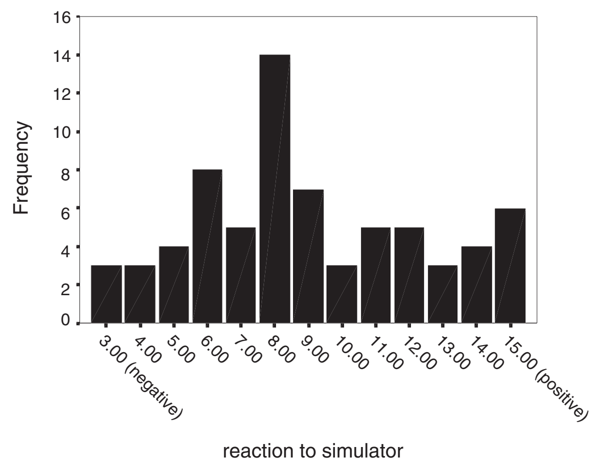

FIGURE 1: Reaction of College Students Taking a Sales Class to the McGILL NEGOTIATION SIMULATOR

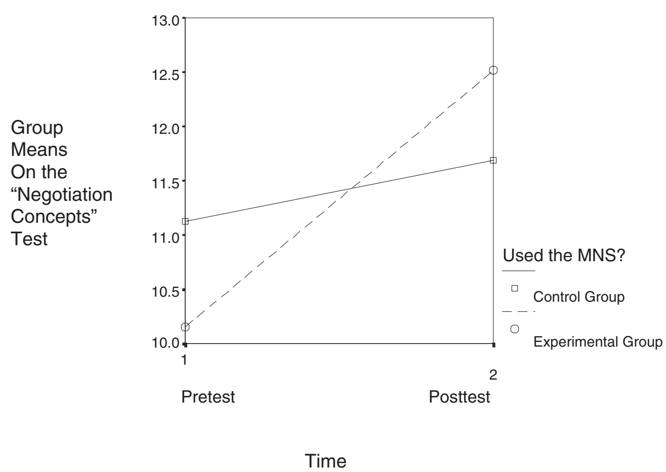

FIGURE 2: "Negotiation Concepts" Pretest and Posttest Scores for College Students Taking a Sales Class to the McGILL NEGOTIATION SIMULATOR (MNS)

increased significantly; by contrast, those in the control group had little change in their scores. This interaction is shown in Figure 2.

When asked, "How many times did Mr. Pavros [the on-screen opponent] get irritated and walk out?" 23 of 73 respondents (31.5%) indicated that he did not walk out at all, 41 (56.2%) reported that he walked out once, and 9 (12.8%) reported that he walked out two or more times. The correlation between the number of times the computerized opponent broke off negotiations and the paper-and-pencil test score at Time 1 was –.27 ($p < .05$), suggesting that the participants with high pretest scores were more successful in completing the negotiations. Together, these findings provide some support for Hypothesis 2.

Discussion

The results from Study 1 suggest that students in a sales class generally viewed interactive negotiation training in a positive light. They felt that it made a valuable contribution to the course and that the SIMULATOR was easy to use.

Students who did well on the pretest were more successful at not irritating the computerized opponent (to the point where he broke off negotiations), suggesting that knowledge of relevant negotiation concepts was significantly related to successfully concluding an agreement. Furthermore, the experience of negotiating using the SIMULATOR constituted a valuable training experience: Test scores improved significantly from the pretest to the posttest. The improvement was 23.5%. By contrast, the control group's score improved by only 5.1%. Even so, neither score was significantly correlated with overall course grade ($r_{\text{grade, pretest score}} = .08$, *ns*; $r_{\text{grade, posttest score}} = .12$). The reader should note that simply participating in the study (or an alternative assignment) contributed to the course grade; neither the SIMULATOR pre- or posttest scores nor whether the participant secured an agreement affected course grade—thus, no part-whole correlation exists. The lack of a significant correlation is probably due to the fact that the sales class covered a much broader range of topics than were measured with the SIMULATOR.

This study had its limitations. Students in both the control and experimental groups had occasion to interact with each other as both were taking the same course during the same semester. Thus, diffusion effects (Cook & Campbell, 1976; Goldstein, 1993) may have occurred. However, the improvement in the control group on the learning measure was minimal, suggesting that this was not a serious problem.

A second limitation was that students were allowed to decide whether they wanted to complete the MNS assignment or an alternative assignment. Thus, students were not randomly assigned to the experimental and control groups. Perhaps students who chose to use the SIMULATOR differed in their motivation and/or their proficiency in sales negotiation areas, thus accounting for their improvement in posttest scores.

A third possible limitation was that the class was a sales class. Although the MNS used a sales negotiation situation, it was entirely possible that students in this class did not view it as "making a sale" or "selling a product to a customer" as much as "a negotiation exercise." Therefore, they may have been less enthusiastic about the appropriateness of the SIMULATOR to the course than would students taking a negotiation class. In order to address these limitations, a second study was conducted.

Study 2

Study 2 sought to replicate and extend the findings of Study 1 using a bargaining and negotiation course. In this study a quasi-experimental design was employed so that a control group could be employed, even though the sample size was relatively small. This design (Campbell & Stanley, 1963; Cook & Campbell, 1976) was as follows:

	Time 1 Observation		*Time 2 Observation*		*Time 3 Observation*
Group 1	Test 1	Use SIMULATOR	Test 2		Test 3
Group 2	Test 1		Test 2	Use SIMULATOR	Test 3

With this design, Group 1 first acted as the experimental group and Group 2 first acted as the control group. Then, Group 2 used the SIMULATOR. It was anticipated that Groups 1 and 2 would not show significant differences on Test 1, yet they would show significant differences at Test 2 (Hypothesis 2). Finally, it was expected that Group 2 would show similar improvement as Group 1 had shown earlier and that both groups would have similar, higher, scores on Test 3 and that these scores would not be significantly different. Such a design was used with other training evaluation studies (e.g., Latham & Saari, 1979).

Idealized graphical representations of such an experimental design have often shown that scores for each group should not increase when they were not receiving the experimental treatment (the MNS in this case). In other words, one might expect the scores for Group 1 to increase and then remain flat, whereas the scores for Group 2 would remain flat and then increase. However, we did not anticipate the scores to remain flat during the control time periods. This was because both groups were part of an ongoing negotiation class. Therefore, both groups' scores were expected to increase throughout the semester. Thus, this design should tell us how much greater value, if any, the MNS added to the students' learning, over and above what the course offered.

Method

Participants

Forty-eight students enrolled in a senior-level bargaining and negotiation class taught by the Management Department of a comprehensive regional university in the upper midwestern United States participated in Study 1; participants received course credit for participation. All students had previously taken a principles of labor-management relations course and thus were somewhat familiar with terms such as *integrative bargaining*. Like the students in Study 1, participants received credit for participating in the study; however, the amount of credit was not contingent on whether they reached an agreement.

Design

The two-group, repeated-measures quasi-experimental design described earlier was employed with this experiment. Although originally, students had been divided randomly and equally into Groups 1 and 2, we discovered with the administration of Test 2 that only 17 students in Group 1 had actually used the SIMULATOR (all had reached at least one agreement). Therefore, these 17 were treated as Group 1 and the remaining students were treated as Group 2. Other aspects of the design were the same as in Study 1. The same dependent variables were used as in Study 1.

Procedure

The procedure for Study 2 was identical to that from Study 1, except that students were only required to complete the simulator (either agreeing or reaching an impasse) one time. This was because students needed to use the MNS within a specific time period (approximately 1 month for each group) to conform to the quasi-experimental design. Students were debriefed regarding the design of the study and the relevance of the SIMULATOR to the course following their completion of the final evaluation measure.

Results

Reaction measures

Participants in the negotiation course were quite enthusiastic about the MNS. Of 15 points possible, the mean reaction scale score was 11.81 (*SD* = 2.11) and only 4 of the 48 participants had responses below the neutral point on the scale. A bar chart of the distribution of scores is found in Figure 3.

The crashing or freezing of the SIMULATOR continued to occur in Study 2. Ten of the 48 participants (20.8%) reported such problems. Nevertheless, all but 1 participant (97.9%) reported the SIMULATOR to be easy to use, and approximately two thirds of the students (*n* = 33, 68.8%) felt that the MNS should be a required course assignment; the remainder felt that it should be an optional assignment, and no students reported that it should be dropped from the course. Taken together, these results provide strong support for Hypothesis 1 and suggest that the participants had a very favorable reaction to the SIMULATOR training.

Learning measures

The mean score on the pretest (Test 1) was 10.57 (*SD* = 2.89, *n* = 48); this increased to 12.52 (*SD* = 2.93) at Test 2 and to 13.02 (*SD* = 2.79) at Test 3. A repeated-measures GLM analysis indicated that this linear time trend was significant, Wilks's Lambda = .52, $F(2, 39) = 18.32$, $p < .001$; $\eta^2 = 48.4\%$. Thus, participants' scores on the paper-and-pencil test increased significantly throughout the semester, regardless of

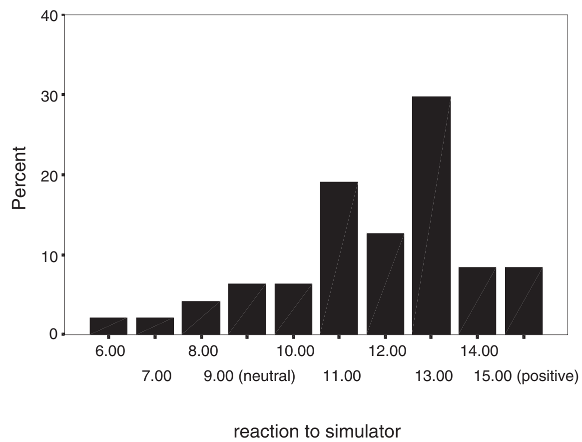

FIGURE 3: Reaction of College Students Taking a Bargaining and Negotiation Class to the McGILL NEGOTIATION SIMULATOR

when they used the MNS. This finding was not surprising, given that all students were taking a negotiations course.

To determine whether the SIMULATOR produced an incremental effect above that of the main effect of time in the negotiations course, the pairs of scores at each of the three observation periods described in the quasi-experimental design were examined using the *t* test contrasts that emerge from a repeated-measures GLM analysis. This was also an appropriate set of analyses because the anticipated results (no difference at Time 1, significant difference at Time 2, no difference at Time 3) do not readily correspond to the polynomial contrasts tested with multivariate repeated-measures GLM analysis; indeed, for these data, the Time × Group interaction was not significant, Wilks's Lambda = .94, $F(2, 39) = 1.05$, *ns*, $\eta^2 = 5.1\%$. Thus, whereas caution is always in order when the multivariate test is not significant, in this design it is quite appropriate to examine the specific contrasts hypothesized according to the quasi-experimental design. These results are shown in Table 1.

As shown in Table 1, the results follow the predicted pattern; the only significant difference between the two groups occurred at Time 2, when Group 1 members had each used the SIMULATOR and Group 2 members had not yet participated, $t(44) = -2.39$, $p = .022$, $\eta^2 = 12.5\%$. The pattern of results is shown graphically in Figure 4. Together, these findings support Hypothesis 2.

One concern was that if the scores for Group 1 were consistently higher than the scores for Group 2, then a significant between-subjects effect would appear, making interpretation of the data difficult, given that the two groups should not differ on Tests 1 and 3. Fortunately, such an effect was not significant, $F(40, 1) = 3.83$, *ns*.

When asked, "How many times did Mr. Pavros get irritated and walk out?" 13 participants (27.1%) responded that he did not walk out at all, 21 (43.8%) reported that he

TABLE 1: Group Means on Paper-and-Pencil "Negotiation Concepts" Test (Study 2)

	Time 1 Observation	*Time 2 Observation*	*Time 3 Observation*
Group 1	11.41 (3.04)	13.76 (3.03)	13.47 (3.22)
Group 2	10.00 (2.69)	11.68 (2.59)	12.72 (2.39)
t test (*df* = 44) comparing Groups 1 and 2	–1.58	–2.39*	–0.85
η^2	6.0%	12.5%	2.0%

*p = .022.

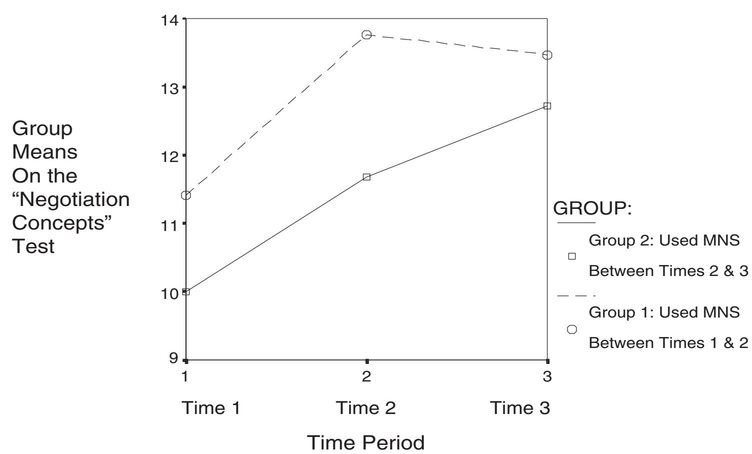

FIGURE 4: "Negotiation Concepts" Test Scores for College Students Taking a Bargaining and Negotiation Class to the MCGILL NEGOTIATION SIMULATOR (MNS)

walked out once, and 14 (29.2%) reported that he walked out two or more times. Participant answers to this question generally corresponded with the actual number of times the opponent broke off negotiations, as recorded by the simulator: Actually, 11 did not have Mr. Pavros walk out at all, 20 had him walk out once, 8 saw him walk out three times, and 4 suffered this indignity four or more times. However, in this study, unlike Study 1, we did not obtain any significant relationship between test scores and the number of times the negotiations were terminated prematurely.

Exploratory analyses involving negotiator behaviors

The MNS stored all of the information about each negotiation session within the computer in a transcript format; no summary data were tabulated. To obtain data in a usable form, one of the authors looked at the computer records for the last negotiation for each participant and coded information, writing it in a notebook; the researchers were interested in answering specific exploratory questions (e.g., "Did the participant conduct research prior to bargaining?"). These retrieved and coded data were later entered into the larger data set. We retrieved, transferred, and coded information from the MNS for all of the Study 2 participants. Although preliminary and exploratory, these data tell us the following:

1. Most participants ($n = 44$ of 47; 88%) reached an agreement on their last session of negotiation. Of these, 30 (68%) included a Winter Lease (a distracting minor issue that was not necessary for either party to settle in order to secure an agreement—its net effect was only to reduce the participant's profit slightly) in their agreement and 14 (32%) did not. Interestingly, there was no difference in either price (overall M = $8.02 million) or profit (overall M = $1.06 million) based on whether the participants included this issue in their agreement.
2. The MNS designers programmed the SIMULATOR so that a failure to research topics prior to bargaining was likely to lead to incorrect choices by the participants, which would in turn irritate the opponent. However, we did not discover a significant relationship between those who conducted such research ($n = 15$; 30%) versus those who did not ($n = 32$; 64%) and either price, *M*s = $8.00 million versus $8.02 million, respectively, $t(41) = -.153$, *ns*; or profit, *M*s = $1.063 million versus $1.062 million, $t(41) = .15$, *ns*. Of course, it was possible that those who did not research their topics prior to the last session may have done so for previous negotiations. This possibility remains to be examined.
3. Whether a subject stopped an ongoing negotiation session to research (or review) a topic ($n = 12$; 24%) or not ($n = 34$; 68%) had no significant effect on either the negotiated selling price for the aircraft, *M*s = $7.96 versus $8.03 million, respectively, $t(41) = 0.54$, *ns*; or profit, *M*s = $0.95 million versus $1.10 million, $t(41) = 1.25$, *ns*.
4. We found no significant relationship between sales price and the grade in the negotiations course ($r = -.03$). Note that completion of the MNS (or an alternative assignment) contributed toward 5% of the course grade; however, whether an agreement was reached or how well the student did in the MNS did not affect that student's grade.
5. There was a marginally significant linear relationship between sales price and Test 3 score ($r = .25$, $p = .10$), suggesting that those who were more successful during the simulated negotiations were later somewhat more able to give more correct answers on the paper-and-pencil negotiation test. A similar finding emerged for the profit variable ($r = .29$, $p = .055$). However, given the marginal effect and small sample size, these findings should be interpreted with great caution.

Discussion

As shown in the Results, students taking a negotiations course believed that the MNS was easy to use and constituted a valuable addition to the course. Most also felt that it should be a required course assignment. Thus, the participants' reactions to the SIMULATOR were quite positive, supporting Hypothesis 1.

Students also seemed to show improvement in their negotiation test score, supporting Hypothesis 2. Generally, the changes in group scores followed the quasi-experimental design: At Test 1 (the pretest), the two groups' average scores did not differ significantly. Group 1's average score increased to the point where this group differed significantly from Group 2 at Test 2. Then, Group 2 used the SIMULATOR and its average score improved, whereas Group 1's average score declined slightly at Test 3; at this final testing, a significant difference between the groups no longer existed. This small decline may have been due to memory decay, because approximately 1 month had passed since the participants in Group 1 had used the SIMULATOR. However, it was not a sharp decline and suggests that most of the concepts that had been learned were retained.

Group 2 showed an increase in test score from Test 1 to Test 2 even though they were the control group for this phase of the study. This suggests that they were learning some concepts from the ongoing negotiations course, although not as much as those who used the SIMULATOR. Even so, other explanations are also possible. For example, those who were in Group 1 may have shared some of their experiences with those in Group 2 (diffusion effects; see Goldstein, 1993), enabling Group 2 to improve. The questions from Test 1 may have primed students to pay particular attention to these concepts throughout the semester. Unfortunately, there were not enough students in the class to create a Solomon Four-Group Design (Solomon, 1949) where separate control groups could test this. In future semesters, it may be possible to gather the data necessary to draw such firm conclusions. However, even if students were simply learning from the course, from their fellow students, or were primed from Test 1, then both groups should have been affected. If the SIMULATOR had no incremental effect, then one should then expect both groups to increase at similar rates throughout the semester (depending on the amount of diffusion, of course). The results would not follow the pattern shown.

No significant correlations existed between reaction measures and learning measures. Nor were there significant correlations between test score learning measures and behaviors shown during the simulator. This was not entirely unexpected. Goldstein (1993) reports that correlations between various types of training criteria are often less than one might anticipate.

General discussion

The general conclusions from these two studies appeared to be the following:

1. Both sales and negotiation students enjoyed using the SIMULATOR, but negotiation students enjoyed it more. A *t* test comparing the two classes was statistically significant, $t(92) = -2.83$, $p < .001$.
2. The SIMULATOR appeared to contribute to the quality of the learning experience; in both classes, mastery of negotiation concepts (as measured using a paper-and-pencil test) improved as a result of using the simulator.
3. However, performance on neither the SIMULATOR nor the test was related to overall course grade. This was obviously due to the fact that the MNS focused on only a narrow range of topics such as the following: preparation, asking questions, understanding the other side's underlying interests, and integrative bargaining. It did not deal with the full range of topics covered by either a sales or a negotiation class.
4. Although the sales class used the SIMULATOR twice and the negotiation class used the SIMULATOR only once, test scores showed similar improvement for both classes. Test score differences following use of the SIMULATOR were similar for the sales class (*M* improvement, experimental group = 2.36) and for the negotiation class (*M* improvement, Test 3 to Test 1 = 2.45). A *t* test comparing the final posttest scores for the two classes was

not significant, *M* for sales class experimental group = 12.51, *M* for negotiation class = 12.98, $t(119) = -1.08$, *ns*. Although these were different classes and no intermediate test was given to the sales class to facilitate additional comparisons, at present the best conclusion that we can draw is that there appears to be no incremental gain in requiring students to complete the SIMULATOR twice at different times of the semester.

There were several limitations of the present two studies that might be corrected in future research. First, only Program 1 of the MNS was available for testing at the time of this study. Eventually, two additional programs, each with increased complexity and realism, will be available. Presumably, they will be sequenced and this sequence can be tested in future research. They may also cover additional negotiation concepts that may increase the relationship between success on the SIMULATOR and overall course grade.

A second limitation was that the MNS used only a negotiation scenario to train students in negotiation skills. No online tutorial covering bargaining strategies or persuasion concepts was provided prior to the negotiation. Apparently the MNS designers anticipated that students would learn by doing. Although such an approach was effective, the effectiveness of the SIMULATOR could perhaps be enhanced if an online tutorial was added prior to the negotiation exercise. After all, even the best group (Group 1 of Study 2) only answered about 69% of the questions on the paper-and-pencil test correctly. Future research might test whether such a tutorial (either as part of the multimedia simulator or as a more conventional computer tutorial) enhances learning.

A third limitation was that we had no external behavioral measure of negotiation success. Such an external validity measure would provide a desirable test of both negotiator behaviors and consequences (Kirkpatrick, 1959, 1960). Ideally, this measure would occur independently of the larger class structure, or, if that were not possible, at the end of the course term, perhaps in a controlled bargaining experiment. Again, a control group of students not taking the course would also be desirable.

A fourth limitation was that this study used relatively inexperienced college student negotiators. It would be interesting to determine whether this type of training would achieve similar results when incorporated into a training program for professional sales representatives or professional negotiators (e.g., union officer training).

In conclusion, multimedia instruction holds great promise for negotiation training (Saunders & Lewicki, 1995). As this research has demonstrated, students can learn sales negotiation concepts through multimedia application and can have an enjoyable time while doing so. The challenge remains of finding the correct mix of instruction, application, and entertainment value of any multimedia presentation to maximize student learning.

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Guest editorial: State of simulation/gaming

This special issue on "State of the Art and Science of Simulation/Gaming" looks at the state of the art and science of simulation and gaming and takes several areas of application as illustrative examples. It aims at reaching a broad audience of professionals and newcomers.

In the 1960s and early 1970s, several international and national societies and associations in systems science and cybernetics were founded. They had a common interest in the transdisciplinary growth of knowledge and the related development of interdepartmental institutes. This institutionalization was the result of a crystallizing process that started in the 1930s with the advancement of general systems theory, gaining momentum after World War II with the development of computers in the late 1950s. It was an attempt to broaden the scope of science and to address limitations of the reductionist epistemology in the biological, human, and social domains.

In line with the spirit of the 1970s, associations such as the International Simulation and Gaming Association (ISAGA), North-American Simulation and Gaming Association (NASAGA), and Society for the Advancement of Games and Simulations in Education and Training (SAGSET) were established. Their common purpose was to further the development and use of methods of simulation and gaming. Although the systems societies focused more on theoretical issues, the "gamers" focused more on the design of interactive learning environments to enhance the production and transfer of interdisciplinary knowledge to practical settings and practitioners. They paid attention to instrumental questions of design and use. General systems theory and gaming/simulation have much in common with respect to research methods and techniques.

As we stand in the year 2001, it is useful to look through the rearview mirror into scientific progress and asses the state of the art and science in this field. What accomplishments have been achieved in simulation and gaming since the 1960s? Was the field of simulation and gaming influential in:

- enhancing existing methodologies,
- generating new tools,
- raising new research questions,
- improving quality and quantity of knowledge production,
- improving educational and training practice, and
- enhancing our understanding of complex issues and our capacity to manage them?

Given the broad variety of approaches to the field, this retrospect looks into particular areas of practice to see what has been accomplished. They can shed light on differences and commonalities in various areas of application. An examination of these

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activities and accomplishments will provide a rudimentary, but empirically based, metadisciplinary perspective on gaming and simulation.

It is my hope that this retrospect, and to some extent prospect, will stimulate further debate about and research into the theory and practice of simulation/gaming and help to provide a useful balance among instrumentality, philosophy, and methodology. Let us not forget that the subtitle of this journal was changed awhile ago to "Theory, Practice and Research." It is also my hope that this body of knowledge, covering three to five decades of research and education, will allow both newcomers and professionals to build a coherent picture of recent developments and challenges that lie ahead.

It is with great pleasure that I, as guest editor, present this special issue. To my knowledge, *Simulation & Gaming* is the only transdisciplinary journal that can take on board such a broad view on the state of the art and science of gaming and simulation. I thank the editor, David Crookall, for his support and valuable advice.

—Jan H. G. Klabbers
Guest Editor

The emerging field of simulation & gaming: Meanings of a retrospect

Jan H. G. Klabbers
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The author presents a framework for addressing the state of the art and science in the field of gaming and simulation and an overview of topics covered by the articles that fit into this scheme. Many empty cells still have to be addressed. Such a synthetic perspective on inquiry allows the gaming and simulation community to accumulate understanding on the field by looking for commonalities. Differences between a disciplinary and transdisciplinary review are explored from the viewpoint of knowledge development in the social field of power. In that respect, designers and facilitators of games and simulations have to cope with putting their institutions at risk, as the form of knowledge generated through gaming and simulation (i.e., their social capital) may not count as recognizable currency. The articles give ample evidence of the related obstacles in research, teaching, and practice. Nevertheless, the articles show what has been accomplished and which major puzzles gamers still need to address to improve professional practice in research and education, in management and governance.

KEYWORDS: *diachronic perspective; disciplinary review; social/cultural capital; synchronic perspective; transdisciplinary review.*

The field of simulation and gaming that emerged since the 1950s has been developed and practiced by professionals from a variety of disciplines. Simulation and game design on the basis of varying tools such as paper, pencil, boards, computers, simulation software, multimedia hard- and software, the Internet, and so forth, has become a well-established field of inquiry and practice. To keep in mind the diversity of the field in the human and social domains, the International Simulation and Gaming Association (ISAGA) has developed the following frame of reference (see Table 1). In addition to this field, simulation and gaming methods are being used in the natural sciences such as physics, chemistry, biology, and engineering, especially by those who are active in advancing cybernetics, control theory, and systems science. In economics, mathematical game theory has gained a solid position among the many formal and empirical approaches.

As a consequence, the field of simulation and gaming represents a metadisciplinary view on a wide variety of questions in and approaches to the human and social domain. This diversity brings forward an enormous challenge for those entering the field to grasp the big picture. This is especially the case in a scientific tradition that stresses monodisciplinary rules of inference to research and a reductionist approach to complexity.

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TABLE 1: Realm of Gaming & Simulation

	Foci of Interest: I. Theory & Methodology, II. Instrumental Design (tool development), III. Research, IV. Training & Education						
	a. collective competence	*b. individual competence*	*c. intra-, cross-cultural communication*	*d. learning & education*	*e. management & planning*	*f. organizational development*	*g. policy development*
Areas of interest (reference systems)							
1. Business							
2. Economy							
3. Education							
4. Environment							
5. Health care							
6. Human/cultural resources							
7. Human services							
8. International relations							
9. Military							
10. Natural resources							
11. Religion							
12. Technology							
13. Urban/rural settlements							
14. . . .							

Questioning the state of the art and science links various areas of research and education. As the articles will show, they offer a diachronic and synchronic perspective. Therefore, it is worthwhile to reflect on the meaning and purpose of a scientific review to characterize the typical character of knowledge development in gaming and simulation.

Multiple meanings of a retrospect

A review is a form of knowledge accumulation and generation. A synthetic perspective on inquiry allows the gaming and simulation community to accumulate understanding on the field by looking for commonalities in the literature. Gamers need to master conceptual, technical, discursive, and communicative competence, that is, cross-disciplinary, cross-cultural competence.

To understand the scope of gaming and simulation, the following frame of reference will be applied. I will distinguish between domain-specific theories and game theory, gaming as a tool or method (i.e., the schematic model of a game) and apparatus (i.e., a concrete game), and gaming as a session for experimenting with the tool. By paraphrasing Hacking (1999), the following can be said about gaming as a method of inquiry:

> Game scientists have theoretical models, and speculative conjectures couched in terms of those models. They also have views about how gaming works and what you can do with it; how games can be designed, modified, adapted. Typically, the game does not behave as expected. The world resists. Scientists have to accommodate themselves to that resistance. They can do it by correcting the major theory under investigation, they can revise beliefs about how the game works and they can modify the game itself. The end result is a robust fit between all these elements. (p. 71)

Considering the variety of the field (see Table 1), many different theoretical models have to be taken into account. Whether they have in common a metatheoretical perspective remains an open question. Here lies a joint task for all those involved in the design of games and simulations.

Models, experiments, metaphors, design methods, evaluations, and debriefings have depicted the scholarly and practitioners' literature on gaming and simulation as the construction of a wall of graffiti. Reviews are architectural examinations of that wall (Graue & Grant, 1999). What images on gaming and simulation can be interpreted from this wall of graffiti? Approaches to research with and practical use of gaming and simulation have proliferated into a variety of disciplinary inquiries as well as cross-disciplinary views on their use. So what can the reader expect from a reflection on the state of the art, which more or less explicitly functions as a review? A review can focus on concurrent advances in a field depicting a synchronic perspective. It also can draw attention to advances in a single line of inquiry stressing a diachronic perspective.

Lather (1999, p. 3) points out that a review is gate keeping, policing, and productive rather than merely mirroring. It is not exhaustive. It is situated, partial, and perspectival. Those who benefit from a review are the editor, the author, and the profession. The editor benefits by paying attention to the politics of what is put forward in the journal, what is at the center and what is marginal, and how the journal can contribute to the development of the field. The author benefits because it brings his or her work into more visibility. The profession benefits to the extent that the review can become a reference for constructing a critical collegiality (Lather, 1999, p. 4). A reflection on the state of the art may provide a basis from which new theories and methodologies can spring in terms of the development of a transdisciplinary science more adequate to contemporary complexities. It is marking the landscape for new excavations.

Disciplinary review

In general, disciplinary reviews are processes and products that serve as an assessment and linking of already published work to (re)define a given knowledge domain. Such domains are constructed according to social and epistemological commitments and conventions of the discourse community in which such a review is situated. Moreover, it is political as the terms of the material conditions underlying research and practice, its social utility, and the power relations out of which it is produced are framed in a political context. Knowledge thus produced is a form of cultural capital (Apple, 1995). The kinds of knowledge that are recognized as legitimate or of high status enable universities to use this recognition as a form of social capital (Apple, 1999, p. 344). Knowledge is a form of power. It operates as a regulative mechanism, which is expressed by the meaning of discipline. Bourdieu (1993) notes that people and institutions exist in determinate and overlapping fields of power.

> Thus, markets over capital exist in structured ways, in contexts. For particular kinds of knowledge to be a valued form of capital, the knowledge itself must be recognized both within that field of power as important and in the connections between that specific field and more powerful fields as high status as well. (Apple, 1999, p. 344)

Knowledge is a covert and implicit form of power and it operates through discourses (Foucault, 1979, pp. 3-31). Popkewitz (1991) argues that such power

> is embodied in the ways that individuals construct boundaries for themselves, define categories of good/bad, and envision possibilities. Power, in this latter sense, is intricately bound to the rules, standards, and styles of reasoning by which individuals speak, think, and act in producing their everyday world. (p. 223)

The traditional form of power, adhering to organs of the state, is explicit. Knowledge as a form of power is embedded in the language of a discourse. Discourse, according to Foucault (1969/1972), is a system consisting of rules of formation and volitions that control what can be said within a particular field. Such a straightforward view on disciplinary knowledge and its status in the form of social capital is for several reasons more difficult to capture when dealing with the transdisciplinary field of simulation and gaming.

Transdisciplinary review

In the transdisciplinary field of simulation and gaming the discourse is not similar to the one used within one particular monodiscipline. One reason is that which constitutes knowledge and social capital is less straightforward. By crossing knowledge domains, simulations and games link multiple and often incompatible realities into one framework. That framework in itself (i.e., the apparatus or tool) encompasses various forms of knowledge. Two kinds of knowledge play an important part in simulation and game design, that is, declarative and procedural knowledge. Declarative knowledge refers to facts, concepts, principles, and laws. It is knowing that. Procedural knowledge concerns procedures and strategies. It is knowing how. In addition, in a gaming context players interact and shape local tacit knowledge. Sternberg, Wagner, Williams, and Horvath (1995) mention that procedural tacit knowledge involves knowing how the system functions in which one is operating. As a matter of convenience, I will further pay attention to simulations in which actors are involved, excluding pure computer simulations from the discussion.

Simulation and gaming produce interactive learning environments. They aim at developing expertise. Six interacting key elements of such learning environments are metacognitive skills, learning skills, thinking skills, knowledge and motivation (Sternberg, 1998), and competence of acting. Metacognitive skills refer to people's cognition of their cognition, which is their understanding and control of their own cognition. Therefore, metacognition is a second-order concept. It refers to itself. Sternberg mentions seven modifiable metacognitive skills: problem recognition, problem definition, problem representation, strategy formulation, resource allocation, monitoring of problem solving, and evaluation of problem solving.

Examples of learning skills are selective encoding, distinguishing relevant from irrelevant information, selective combination, putting together the right information, selective comparison, and relating new information to information stored in memory (Sternberg, 1985).

Thinking skills are as follows:

- critical (analytical) thinking (i.e., analyzing, critiquing, judging, evaluating, comparing, and contrasting);
- creative thinking skills (i.e., creating, discovering, inventing, imagining, supposing, and hypothesizing); and
- practical thinking skills (i.e., applying, using, utilizing, and practicing) (Sternberg, 1997).

Designing interactive learning environments that embed such a variety of knowledge and skills puts the designer in a powerful position by constructing boundaries for the participants. Often the designer implicitly defines categories of good and bad and envisions and offers possibilities of action. The game developer's power is intricately expressed via the rules of the game. By defining the decision space and the possible interactions, the designer influences the styles of reasoning by which individuals speak, think, and act in producing their gamed or simulated world. The paradox, however, is that by giving the participants a voice in knowledge production, the designer and later the game operator/facilitator are not the owners of the knowledge generated during a simulation or game. The participants become the co-owners of that knowledge. What a simulation and/or game produce is to a large extent their social capital. For a university or research institute this form of social capital does not count as recognizable currency in the knowledge market. It cannot be converted at a high enough price into other forms of social and economic capital so needed by universities in times of economic crisis in higher education. To paraphrase Apple (1999, p. 345), the designer (facilitator) may thus put the institution at risk by engaging in "low status" activity with little capacity for conversion. No matter how important to the field of simulation and gaming, the social field of power in which academic institutions operate provides a context in which critical syntheses (as in simulations and games) are hardly recognized as being a form of cultural capital. This applies especially in a context that favors a narrowly technical rationality.

This is particularly disappointing when a particular simulation/game addresses questions at the science/policy interface and the participants are decision makers. Those decision makers may subsequently use the knowledge gained during such a simulation/game session to exercise overt and explicit power through the institutions of the state or the company. Designers are not in the position to claim "the intellectual property rights" of a simulation or game session in ways similar to producers of disciplinary knowledge. They can claim ownership of the apparatus, but in the end, that plays a minor role in the struggle to acquire social and cultural capital. At last, they play the role of intermediator among disciplinary knowledge domains and between science and the field of practitioners such as policy makers. The popular view is that "it is not the truck that is important, but the goods that are delivered by the truck." University departments of methods and techniques in social sciences face similar problems. This makes a transdisciplinary review on simulation and gaming less tangible than a disciplinary review. From the viewpoint of social capital, the following key question needs to be addressed. Are games and/or simulations liabilities and/or assets in the struggle for social/cultural power?

Against this background it is interesting to see how the authors deal with the design and use of simulations and games. Within the framework of Table 1, they place themselves in different locations. They draw their knowledge and experience from different and common domains, cope with different and common types of puzzles, and report about different types of social capital.

In his article "Ecology of International Business Simulation Games," Hans B. Thorelli (2001 [this issue]) reviews the history of a classical management game that he and his colleagues developed since the early 1960s. By focusing on INTOPIA, he stresses a diachronic review of one general simulation game, which can be considered a benchmarking study on the whole field of general management and business simulation games. A review of the whole field of management games is out of the scope of this special issue. Explicit design principles, assumptions included, and the source listing of the computer program are preconditions for such a synchronic assessment. In many cases, that information is not available. Therefore, I have chosen a narrative approach that enlightens practical matters of game development based on experiences with one game. This bottom up approach from the designer's perspective illustrates how gaming works and what you can do with it; how games can be molded, modified, and adapted. Game developers have to accommodate themselves to a changing world. Thorelli speaks about his brainchild from its initial steps to a mature product. He does not present and discuss evaluation studies with the game. It is interesting to notice the impact of advances in computer hard- and software on the instrumentality of the business simulation game and the pragmatics of simulation sessions. Key concepts are integration of the functional areas of business and the interaction among structure, strategy, and performance. The open systems approach is central to this article.

In their article "Simulation/Gaming and the Acquisition of Communicative Competence in Another Language," Amparo García-Carbonell, Beverly Rising, Begoña Montero, and Frances Watts (2001 [this issue]) review research in the field of second or foreign language acquisition. They focus mainly on a synchronic perspective and discuss advantages of various types of simulations and games. Through experimenting with several types of games, they present remarkable results. In their approach, they pay attention to simulations as vehicles for communication and interaction. Within the context of their article, they disregard the specific content of the games they used. The distinction between computer-assisted and computer-based simulations enables them to use different interactive learning environments that are more or less rule driven. Computer-based simulations have a structure familiar to the design of INTOPIA. The International Communication and Negotiation Simulations Project (ICONS) is an example of a computer-assisted simulation.

Dennis L. Meadows (2001 [this issue]) discusses in his article "Tools for Understanding the Limits to Growth: Comparing a Simulation and a Game" the history of three decades of global modeling by comparing lessons learned from the computer simulation WORLD3 and the computer-supported game STRATEGEM. Although Thorelli speaks about ecology and environment, he uses those terms metaphorically. Meadows's article is really about global environmental issues. Both the simulation and the game reflect a systemic approach to the complex interrelationships between population, capital, agriculture, nonrenewable resources, and persistent pollution. Here again the designer, who knows all the ins and outs of his brainchild, has the floor. Consequently, the review is mainly diachronic. It is a benchmark on integrated environmental modeling and education, showing in its use the impact of evolving information technology on the two learning environments.

Arnaldo Cecchini and Paola Rizzi (2001 [this issue]) reflect on four decades of urban gaming simulation in their article "Is Urban Gaming Simulation Useful?" They address similar questions of integrated modeling and gaming as Thorelli and Meadows, and link their scientific views to evolving conceptions about governance and social planning of cities. They identify a coevolution of the shifting power of simulation and gaming with the changing social order and the shifting attitudes toward social planning. Scientific approaches underlying simulation and gaming and political attitudes can strengthen one another. Political attitudes can also cancel out the use of simulation and gaming. Accordingly, Cecchini and Rizzi characterize a crisis in urban simulation and gaming.

Brigid A. Starkey and Elizabeth L. Blake (2001 [this issue]) review 50 years of "Simulation in International Relations Education." They focus on the educational applications of simulations in international relations and trace the history of international relations simulations by examining ICONS at the University of Maryland. They present a synchronic and a diachronic view on their field of inquiry. Like Thorelli, Meadows, and Cecchini and Rizzi, they pay attention to the impact of information technologies on facilitating and delivering simulations. They look into the future by mentioning how computer-assisted simulations have anticipated trends in the real world of diplomacy and what simulations must do to accurately reflect real world trends. The shift from physical to virtual presence in the world of diplomacy may indicate an emerging property of globally interacting systems. It may raise the awareness of the potentials of gaming and simulation in this regard and increase its cultural capital. By presenting an international scope similar to Meadows's global perspective, improving competence in governance is one of their objectives.

The sequence of the articles may mirror a linear image. This is not correct. They form a network of theories, tools, and applications. For example, Thorelli's article and Starkey and Blake's article present the type of learning environments used by García-Carbonell et al. to teach second language acquisition. Most articles discuss the way information technology affects their work.

García-Carbonell et al. show the potentials of simulation and gaming to enhance communicative language acquisition. It is a story about gaining knowledge and skills to speak a second language and its impact on the educational discourse. They deal with communicative competence as such, taking into account the subject matter that is relevant for their students. By using computer-assisted and computer-based simulations, they rely on types of interactive learning environments, as presented by the other articles. The other articles address knowledge embedded in the transdisciplinary language of systems models. Users of their simulations and games are students and practitioners, that is, decision makers in the private and public sectors of society. As such, they deal with the intricacies of the science/practitioners' interface and the decreasing span of attention of decision makers. The evolving policy context will influence the further design and use of integrated simulations and games to the extent that Meadows, Cecchini, and Rizzi present the idea of a family of games centered around a specific theme. Time constraints and advanced technology will define which simulation/game will be used in practical circumstances. Starkey and Blake address the potentials of the Internet to broaden the reach of games and simulations. It is obvious that information and communications technology form both a barrier and accelerator to applications of simulation and gaming. Meadows and Thorelli are originators of well-known products that have a history of three and four decades. They have experienced several scientific and political cycles, in combination with fast advances in information technology.

García-Carbonell et al. argue convincingly that theory development in communicative competence moves consistently into the direction of simulation and gaming, which enable the linking of several types of competence with cognitive and affective skills. They have a strong point in declassrooming the classroom.

The five authors are in the vanguard of this reflection on the state of the art and science in simulation and gaming. They cover the following fields of Table 1. Thorelli emphasizes instrumental design (tool development) (I) and training and education (IV) about business (1) and management (e). His article is characterized by the array {I,IV,1,e}. García-Carbonell et al. focus on {III,IV,3,c}. Meadows pays attention to {I,II,IV,2,4,6,10,12,a,g}, and Cecchini and Rizzi refer to {I,IV,13,e,g}. Starkey and Blake emphasize {II,IV,8,d,g}. This assessment implies that many fields are not yet represented. Once the overall field, depicted by Table 1, has been covered to a fair extent, we can start making inferences about major puzzles the field of simulation and gaming is facing. In the end, I hope we will better be able to frame a coherent game theory covering the various social and human realms to revise beliefs about how games work and to modify games themselves.

The authors, while covering the state of the art and science in their particular fields, have presented their cultural and social capital gained over many years of inquiry and practice. How can we build on their accomplishments? Thorelli mentions that a behavioral theory of the firm is needed. Guetzkow regrets the "lack of development of a Big Social Science" (see Note 2 in Starkey and Blake's article). I add to this that a coherent game theory is needed and speculative conjectures couched in terms of such a theory. It is evident that such a theory is transdisciplinary in nature. In recent articles I have initiated development of such a theory (Klabbers, 1999, 2000a, 2000b, 2000c). Similar to the institutionalization of research in physics, chemistry, and genetics, the field of gaming needs institutional backing, a long-term research policy, and related funding. This is not an activity of one singular scholar or university department. What I have in mind is a concerted action of many scholars and professionals under the auspices of something like a Santa Fe Institute. As is shown in Table 1, gaming needs a transdisciplinary, transcultural setting to be productive. The combined intent conveyed through the articles points in that direction.

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Simulation/gaming and the acquisition of communicative competence in another language

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For more than three decades, researchers and practitioners in the field of English as a foreign language have faced the issue of communicative competence as a goal in language acquisition and how to reach this goal. In this article, the authors address the issue from the point of view of a theoretical and practical meshing of simulation and gaming methodology with theories of foreign language acquisition, including task-based learning, interaction, and comprehensible input, showing how simulation and gaming can be used in those phases of language acquisition in which formal instruction has proved less ineffectual. The objective of this article is to describe the close relationship between the acquisition of foreign language competence and its components and experiential learning through simulation and gaming, with specific reference to two experiments in this area.

KEYWORDS: *communicative competence; foreign language acquisition; nativist and environmental theories; simulation and gaming; task.*

Research in the field of second or foreign language acquisition is relatively new and no one theory of at least 40 available, according to Larsen-Freeman and Long (1990), is universally accepted. The many theories of foreign language acquisition are spread on a continuum ranging from nativist theories, which explain language acquisition through an innate biological mechanism such as that proposed by Chomsky (1965) or Krashen (1985) and his Monitor Theory, to environmental theories, in which education and experience are more important for language development than natural or innate gifts, as found in Schumann (1978) and acculturalization and pidginization. Numerous theories come between the extremes, such as Givon (1981) and the theory of functional types, which combines natural and environmental factors in interaction, or Hatch, Flashner, and Hunt (1986) and the model of experience.

All of these language learning theories have had their effect on language teaching to a lesser or greater degree, converging in the communicative approach to language

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learning that is presently the moving force in the field. The recognition of the interdependence of language and communication gave rise to the identification of the grammatical-semantic notions and communicative functions to be mastered by the language learner. The programs and syllabi resulting from notional and functional concerns naturally took into account the situation or context in which the notions and functions were used, thus bringing into play sociolinguistic principles. The conjunction of linguistic, psycholinguistic, and sociolinguistic principles is the essence of the communicative approach to language acquisition.

Simulation and gaming theory relates clearly to communicative language acquisition, especially in the area of interaction and experience. This article describes the close relationship between foreign language competence, experiential learning, and communicative factors that intervene in language acquisition. It also presents current definitions of foreign language competence and describes how the components are enhanced through simulation and gaming. The use of simulation at two Spanish tertiary institutions exemplifies this enhancement.

Experiential education and simulation and gaming

For the purpose of this article, we draw on Jones's (1995) definition of simulation, which considers a simulation to be

> an event in which the participants have (functional) roles, duties and sufficient key information about the problem to carry out these duties without play acting or inventing key facts. (p. 18)

This definition implies that in a simulation a so-called reference system is represented that provides key information to carry out tasks. A simulation is an exercise in which participants are competing against nature. A simulation is different from role-play in that the participant in a role-play plays or acts a part, often before an audience. In a role-play, there is usually a minimum of background information and participants invent much of their scenario. Consequently, the reference system is not made explicit as in the case of simulation or game. In a game, individuals or teams are involved in overt competition. Both simulations and games operate under a set of guidelines or rules specific to the particular game. The duty of the players is to play to win according to set rules, so naturally there are winners and losers, which is the most noticeable difference between a simulation and a game. In addition, simulations and games can be rule-driven or free-form, generating different types of interactive learning environments. For the purpose of this article we consider gaming and simulation as one common approach to language acquisition (for a more elaborate discussion on the taxonomy of games and simulations, see Klabbers, 1999).

Simulation and gaming theory is based on the learning theories in which behavioral, attitudinal, and cognitive changes due to experience are foremost. The learning environment propounded in these theories involves students as active participants in their own process of learning. Student participants apply their knowledge or skills to the current experience and perceive a real feeling of success or failure on seeing the results of their performance. For there to be a change in attitude, behavior, or knowledge, learning must be cyclical in which, for example, there is a phase of concrete experience followed by observation and reflection on that experience, then a phase of abstract conceptualization followed by new experimentation—and the cycle repeats itself (Kolb, 1984). In simulation and gaming, the cycle of experience is simulated and therefore can be manipulated by the teacher/facilitator for pedagogical purposes.

Early pedagogues such as Piaget (1929), Dewey (1928), or Ausubel (1968) underlined the importance of real experience for learning. Later educators such as Henderson (1989), Pffeifer (1995), Joplin (1995), or Cowan (personal communication, 1996) added the aspects of emotional input, teacher feedback, focus, and debriefing as elements in the learning cycle. Foreign language teachers and educators incorporate these same ideas in recognition of the need for authentic communication in language acquisition and to account for the affective factors that can facilitate or impede acquisition. In recent years, the task-based approach to language acquisition is one of the ways experiential learning theory has been put into practice.

To define language tasks we can refer to Bachman and Palmer (1996, p. 44), who affirm that language tasks are activities that involve individuals in using language for the purpose of achieving a particular goal or objective in a particular situation. This definition includes the specific activity and the situation in which it takes place. Nunan's (1989) definition of a task is another important referent: "A piece of classroom work which involves learners in comprehending, manipulating, producing or interacting in the target language while their attention is principally focused on meaning rather than form" (p. 10). These tasks promote conversational adjustments or interactional modifications on the part of the learner, promoting comprehensible input, which in turn promotes acquisition.

The task-based approach allows the classroom rehearsal of tasks and skills needed for communicating outside the classroom. Students are given the opportunity for productive language use and the negotiation of meaning. The task-based concept entails a flexible approach in which "content and tasks are developed in tandem" (Nunan, 1989, p. 19). The task-based approach has been welcomed to language teaching for its usefulness in foreign language acquisition and has gained considerable emphasis as a result of widespread interest in the functional views of language and communicative language teaching.

The tasks used in simulation contrast with the artificial tasks of language learning that are imported into the traditional classroom. In simulation sessions, the classroom provides its own rationale for communicating about the materials and tools required to carry out an activity. A wide range of speech acts has to be performed in the classroom due to the striking amount of negotiation on the materials needed for a task and the different communicative needs that arise in simulations. The learner has the chance to initiate as well as to respond in communicative exchanges where he or she is able to interact by using a full range of grammatical-semantic notions and communicative functions.

The task-based approach used in simulation stresses the ability to perform a task instead of explicitly teaching grammatical structures. The learner is provided with opportunities that require that his or her own speech be comprehensible because it is only through such opportunities that learners are pushed to mobilize their grammatical competence; that is, the tasks required stimulate learners to mobilize all their linguistic resources and push their linguistic knowledge to the limit.

Inducing communicative language acquisition through simulation and gaming

Hymes first proposed the term *communicative competence* in 1972 to describe a person's ability to communicate in an appropriate way. By adding aspects related to culture and context, Hymes broke with earlier theories such as Chomsky's, which had divided speech in two parts: (a) the competence or knowledge of rules and principles and (b) the performance or practical use of these rules.

Canale and Swain (1980) elaborated on Hymes's concept of competence to include four types of knowledge or abilities: grammar competence, sociolinguistic competence, discursive competence, and strategic competence. Competence in grammar includes knowing the linguistic code and vocabulary. Sociolinguistic competence takes into account the situation and purpose of communication following the norms and conventions of use. Competence in discourse is related to the different genres of written or spoken texts. Strategic competence has to do with getting the message across effectively.

Canale and Swain's (1980) definition of communicative competence, most influential in the 1980s, was followed by Bachman's in 1990, which has prevailed until now. Given that the term *communicative competence* had come to include notions of state and process (see Taylor, 1987), Bachman's utilization of the term *communicative language ability* was welcome. However, the new definition was only clarifying in part, due to the model's comprising different types of competence, as in Canale and Swain. The 1990 definition was revised by Bachman and Palmer in 1996, replacing the term *competence* with the term *knowledge*, except in a few labels. The Bachman and Palmer model of communicative language ability, therefore, encompasses multiple types of knowledge, as well as a metacognitive competence, which includes affect in the use of the language. Language knowledge includes two broad categories: organizational knowledge and pragmatic knowledge. Organizational knowledge can be divided into grammatical knowledge and textual knowledge, whereas pragmatic knowledge consists of functional and sociolinguistic knowledge.

In spite of all the advances of the past three decades in defining the taxonomy of the components that make up communicative competence or ability in a foreign language, the puzzle as to how to induce its acquisition has not yet been solved. In the 1960s, foreign language instructors began to emphasize the importance of their students being able to speak the language itself rather than only talking about it. Krashen (1982) proposed a difference between language acquisition and language learning, the former being a subconscious process that can only take place in informal settings (not the classroom) and the latter being a conscious knowledge of a second language in which the rules are known and can be discussed, but not internalized for natural production. The subsequent question was and is, Can students really learn to speak a language in the classroom?

The answer is not clear cut, but it does seem evident in any case that the introduction of a maximum of practice time and authentic registers in the classroom are beneficial. Unfortunately, no matter how hard the teacher may try to elicit conversational language in the classroom, teacher talk predominates because he or she is the one who decides who will talk, when they will talk, and about what they will talk. The register of informal talk or argumentation in a situation of equality is not frequent and thus does not foster communicative language ability and proficiency.

Simulation and gaming tends to correct the teacher-student asymmetry of the conventional classroom and allows the introduction of exactly the type of authentic communication referred to in the previous paragraph. There is a move away from the authority structure of the traditional classroom and students become more active and involved. As expressed by Sharrock and Watson (1987, p. 36), simulation and gaming is a way of “declassrooming the classroom,” thereby giving impulse to real-world communication.

Another element existing in simulation and gaming that optimizes the possibilities for language acquisition is the amount and quality of exposure to language. Foreign language learners who participate in a simulation receive a lot of comprehensible input, that is, language input that is a slight step beyond the learner’s present level. According to Krashen’s Comprehensible Input Hypothesis (1982), learners understand language using cues in the situation. The ability to generate language is said to emerge naturally and need not be taught directly. The theory also proposes that the best input for low-level learners might be from other learners, because their input will generally be at a comprehensible level.

The good qualities of simulation and gaming in second language acquisition are apparent in declassrooming the classroom and in the comprehensible input provided to the learner. Scarcella and Crookall (1990) affirm, “Simulation can compensate for the limitations of the traditional teacher-centered classroom by relocating the locus of conversational control and allowing other language models to be introduced and experienced” (p. 228).

These qualities are, however, only two of a stock of virtues that simulation and gaming has for language learning. Another quality concerns how simulation and gaming can facilitate lowering a language learner’s affective filter that influences acquisition. According to the hypothesis originally formulated by Dulay and Burt (1978) and later included in Krashen’s Monitor Theory, the affective variables, such as attitude, motivation, and personality factors including anxiety and self-confidence, act to facilitate or impede the psycholinguistic process by which linguistic data are stored in memory. Krashen asserts that the absence of motivation, low self-esteem, anxiety, and so forth can combine to "activate the filter" or create a mental block that prevents comprehensible input from being used. When the filter is up, that is, when there is a negative affective disposition, acquisition will be less or lacking.

Schumann (1975, 1978) also drew attention to the importance of the learners' wishes, feelings, and attitudes in the learning process. Gardner (1985) is well-known for his studies on motivation and the conviction that a process that requires some type and quantity of reidentification to maintain long-term motivation is necessary in second language learning. In this line, many simulations are designed with the potential to create low anxiety environments that foster positive affective learning atmospheres, permitting the participants to try new behavioral patterns with a minimum of stress.

In our opinion, a final element found in simulation and gaming that induces communicative language acquisition is perhaps the most interesting: interaction. Comprehensible input becomes comprehended input through interaction in which the speakers clarify, confirm, repeat, paraphrase, or ask for information. For example, when a listener does not understand, the speaker speaks more slowly, simplifies what he or she has said, changes vocabulary, chooses topics that are more easily understood, uses simpler structures, or checks to see that the listener understands. Hatch (1983) says that to acquire a foreign language the most useful form of interaction is a conversation that has no predetermined (by the teacher or others) outcome and where the results are negotiated among the participants. This is precisely what happens in simulation and gaming.

According to Ellis (1984, p. 14), it is by negotiating the exchange of meaning through conversation that the learner typically obtains information about the target language, which enables him or her to revise the existing interlanguage system. Simulation is an ideal medium for achieving this exchange because it reproduces a real situation that requires the understanding and use of the language that is being acquired, leading to the internalization of new linguistic knowledge.

Experiments in simulation and gaming in tertiary education

The practice of simulation and gaming as a methodological approach guarantees an experiential foreign language acquisition process. In the process, there are certain stages in learning/acquisition that are based entirely on experience and reflection on that experience, focusing on training not only in linguistic abilities but also in social and communication skills considered part of communicative competence, because they provide experience in those aspects directly related to social and communication variables.

Exploring the use of simulation and gaming in foreign language learning on a practical level in Spain, two tertiary institutions, Universidad Pontificia Comillas in Madrid and the Universidad Politécnica de Valencia, were the only significant settings in which there was found to be a fully experiential process. Through the use of simulations and games in these institutions, students use the language they are studying in "real contexts" where notions and functions of the language of study occur together.

This notional-functional concurrence engages the stage of reflection on process found in the experiential learning cycle. Students become so immersed in the simulated events that the use of the language is a real communication tool.

These Spanish institutions used computer-assisted simulations (CAS), in which the computer is a mere instrument for obtaining and exchanging information. Crookall, Martin, Saunders, and Coote (1986) described CAS as a means that "most effectively encourages experiential learning when the objectives are the human and social aspects of a field of study" (p. 360). They also said that "the greater the participants' control over the content and form of simulation events and evolution, the less the computer has control; the more inter-participant interaction, the less participant-computer interaction there is" (p. 356). Engineering, law, and business students in English as a Foreign Language for Specific Purposes at the Universidad Pontificia Comillas in Madrid were shown by Rising (1999) to attain higher levels of communicative language ability.[1] Students in Telecommunications Engineering at the Universidad Politécnica de Valencia, which has 7 years of experience in using telematic simulations[2] for learning advanced English, were found by García-Carbonell (1998) to present even more positive results.[3]

Telematic simulation establishes contacts among participating teams through the Internet to create, at least in the case of those used in Valencia, an international forum for negotiation and debate. Like any simulation, telematic simulation has three essential phases. Phase I is the briefing, the preparatory phase in which the general objectives of the simulation are determined. Additionally, in the case of the Universidad Politécnica de Valencia, the different groups within the large group are organized, the individual and group roles are defined and assigned, the different topics of debate are researched and studied, and the papers regarding team policy and position on the issues of debate are drawn up. This phase usually lasts approximately 1 month. Phase II is the simulation proper, the main phase during which discussion and negotiation take place on a local and internal group level as well as openly on an international level using the information obtained in the previous phase via synchronous and asynchronous network communication. This phase can take up to 3, 4, or 5 weeks, depending on the simulation. Phase III is the phase for debriefing, reflection, and evaluation of the preceding phases. Additionally, each of the participants orally reports on his or her portfolio, which is a written, reflective description of the entire activity. The total debriefing phase takes about 3 weeks to allow for the in-class talk sessions, the oral presentations, and the actual writing of the portfolios.

At both universities, communicative language ability is encouraged by providing students with real linguistic situations in which communication produces native-like, imitable language patterns. There is immersion in a situation and immersion in the language, making students' communication needs become real. Simulations at the Spanish institutions require studying background information, receiving precise oral or written instructions, and participating in oral interaction that are one step beyond the learner's present level and are the input that is given to a person to comprehend, undertake, and carry out a task successfully.

Another factor that influences language acquisition is affect, which is a type of variable that, if analyzed and accounted for, makes communicative models become less rigid and therefore more effective. When students assume the roles of managers, government representatives, or executives, they use language as a real communication tool. In a simulation, they always have an audience ready and waiting for negotiation to receive their argumentation so that they can plan and take decisions. Interaction in simulation with groups of students from other disciplines in real time, as happens in the School of Telecommunications Engineering of the Universidad Politécnica de Valencia, increases certain affective filter variables such as motivation, self-confidence, and esteem, among others (García-Carbonell, 1998). In the psycholinguistic part of the learning process, negative affective filter variables such as anxiety and stress decrease.

All simulations or games imply performance, and all performance implies interaction. In language simulations, there is, on one hand, full interaction with the language teacher facilitating the activity; and on the other hand, interaction between and among participants or groups of participants. Interaction also occurs because content and task are developed in tandem (Nunan, 1989) and because the abilities to perform tasks are fostered rather than teaching grammar explicitly, thereby focusing more on meaning than on form.

Conclusion

In the previous sections we have attempted to link simulation and gaming with certain factors that intervene in communicative language acquisition. There are many questions to answer, which constitute the items on our agenda for future research. For example, how does simulation help to improve oral proficiency in a foreign language and how can it be reliably measured? Having experimented with advanced students, does telematic simulation work for lower level students? Does retention of language content vary over time with computer-assisted simulation?

In this article we first reviewed experiential learning and its connection to task-based language learning. After then reviewing the state of affairs in communicative language ability and how to induce its acquisition, we explored initiatives in simulation and gaming used in language programs at the tertiary level in Spain to support the concepts presented. It is clear to us that current thinking in the field of language acquisition ties in very well with simulation and gaming. However, practice of the methodology has yet to become a widespread reality.

Notes

1. See Rising (1999). This research assessed the effectiveness of computer-assisted simulation in the teaching of vocabulary to students of engineering, law, and business studies. The study sets out to test two basic hypotheses. The first hypothesis is that vocabulary acquisition in English as a foreign language is significantly higher by using simulation than by means of traditional teaching. The second hypothesis is that

computer-assisted simulations show a significantly higher degree of success in terms of learning effectiveness than computer-based simulations. Computer-assisted simulations are examples of free-form exercises, whereas computer-based simulations are more rule-driven learning environments; the computer setting conditions the performing of tasks. The simulations approached the specific vocabulary of each area of knowledge by making the student become an expert in each field of studies, performing as a professional of these fields with decision-taking activities in an enterprise, factory, or court. The simulations created a real situation in which communication and negotiation among students in each working group reflected real life and took place in an atmosphere that allowed errors without additional costs or prejudices to the participants. To confirm initial hypotheses, the study carried out different statistical analyses on empirical data about the effectiveness of simulations. Pre- and posttreatment results of 722 university students in 26 experimental groups and 11 control groups were compared by using four different simulations: three computer-assisted simulations and one computer-based simulation. The experimental groups showed significantly higher levels of vocabulary acquisition at the end of the simulation when compared with conventional groups. The study also proved the greater effectiveness of computer-assisted simulations over computer-based simulations. From this we can infer that computer-assisted simulations may be effective, positive, and motivating for language learning, providing the learners with plenty of opportunities to engage in meaningful discourse. The interaction and communication created by simulations are the kind of exercises proposed by current foreign language acquisition theories to create communicative competence.

2. Project International Dimensions in Education via Active Learning and Simulation (IDEALS), Project International Communication and Negotiation Simulations (ICONS), and Project Intercultural Dimensions in European Education through On-line Simulation (IDEELS). All three projects consist of large-scale, computer-assisted telematic simulations (see Starkey & Blake, 2001 [this issue]).

3. See García-Carbonell (1998). This PhD research had the testing of the effectiveness of telematic simulation in learning English as a foreign language in a technical setting as its main objective. The principal hypothesis was that telematic simulation is an efficient method to improve reading comprehension, listening comprehension, grammar, and writing skills. The first part of this study presents the fundamental assumptions directly related to the theory/methodology of simulation and gaming and the connection to language acquisition. The second part of the study presents an experimental design based on the telematic simulation ICONS. In this simulation, teams from all around the world are involved in bilateral and multilateral negotiations that take place synchronously and asynchronously. The main objective of the experiment was to quantify and compare the results obtained by the experimental groups and the control groups. Statistical results show that experimental groups improved 31% more than the control groups in listening comprehension. In grammar, experimental groups improved 44% more than the control groups. In reading comprehension, experimental groups showed an improvement of 96.8% over control groups and, in writing, the experimental groups improved 395% more than the control groups. These results confirm that telematic simulation is a most suitable tool for foreign language acquisition in the specific setting of the study.

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Ecology of international business simulation games

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Human ecology deals with the interaction of human organizations as open systems and their activities in the environments that surround them. The purpose of this article is to apply an ecologic approach by emphasizing the market as the dominant business environment, excluding such broader ideas of ecological space as our natural environment and sustainable development. It is a case study describing the development of the International Operations Simulations (INTOP and INTOPIA) to illustrate the practice of management games in the past 40 years. It is not a review of the development of and experience with comparative general management games. Special attention is given to relating the design process to such environmental influences as the globalization of business, international economic relations, computer technology, and education. Integrative use of the game in multimedia pedagogy and their potential application in research on the behavioral theory of the firm are subjects briefly discussed.

KEYWORDS: *business games; human ecology; intercompany networking; international business; INTOPIA; multinational corporations; negotiations; scenarios.*

The globalization of business and markets is now accepted as a fact, explaining the proliferation of international business (IB) games in recent years. What a different environment 40 years ago! Whereas a number of large U.S. multinational corporations (MNC) had made major engagements overseas, such as IBM, Standard Oil of New Jersey (now Exxon), DuPont, and McDonnell-Douglas Aircraft, American business was essentially focused on the huge domestic market. IB simply was neither an "in" topic among businessmen nor among business schools. In a 1962 University of Chicago faculty meeting facing a proposal to introduce an International Business Program, Nobel Prize winner-to-be George Stigler made the unforgettable comment that "all you need to do business in Brazil is Chicago economics and a copy of Berlitz, Portugese edition." The proposal was not approved.

You may ask how the development of the International Operations Simulation (INTOP) came to pass in this kind of environment. Ex post it would seem to be due to a constellation of almost random circumstances. The author was a GE executive when he first became excited about management games. This was the Sales Management game developed by G. R. Andlinger, published in the *Harvard Business Review* in 1958. It was a hand-scored board game (in the same sense that Monopoly is a board game). If not the first, Andlinger's was certainly a pioneer effort. Joining University of Chicago in the following year, the author brought the game into his marketing and business policy classes, pending the development of a new, computer-based game.

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Origin and objectives of INTOP/INTOPIA

An underlying educational premise was a strong belief that different people learn in different ways—calling for a varied set of pedagogical instruments. A related idea was that business schools—like other professional schools—should have the mission to strike bridges between classical (as well as applied) disciplines on one hand and practical applications on the other hand. Aside from class discussions of cases, relatively little was really being done in this area at the time.

Perhaps the single most important objective was to develop an exercise to demonstrate the interaction between structure (of the organization as well as the task environment), strategy, and performance (SSP) in the business world. By making the game international, participants would naturally expect different business environments and presumably they would begin to see the interactions of SSP variables. It was easy to foresee the imminent rapid growth of IB and its importance to management. Both to reach a broader audience and to focus on cross-functional interaction, the aim was to create a general management game useful in functional (production, marketing, finance, etc.) and integrative capstone courses. The notion of a business management laboratory was prominent in our minds. With colleague Robert L. Graves and then graduate assistant L. T. Howells we spent the next 3 years developing the first IB strategy simulation on the UNIVAC 1. Some of the trials and tribulations on the way have been discussed elsewhere (Thorelli, 1994).

Game development process

A few factors influencing model design may be mentioned. For geographical areas we chose the United States and Europe, then immersed in the European Free Trade Association and the beginnings of the Common Marke, and Brazil as a major developing country characterized by a hyperinflationary economy. The choice of Brazil inspired our selection of the two consumer products in the simulation. We chose vacuum cleaners as an everyday appliance in the industrialized world with little appeal in Brazil, where the middle class was still perceived as relying on servants (perception included in the players manual). On the other hand, transistor radios—recently developed at the time—were included for their perceived appeal as a necessary luxury item even in the favelas in Rio de Janeiro and Sao Paulo. The reader may be surprised to learn that, for three good reasons, there were no local currencies in the model. The world was, at least in principle, in a regime of fixed currencies. As the dollar was the hardest one of all, and widely used even between nondollar nations, it became our only currency.

The UNIVAC (and other mainframe computers emerging at the time) made possible the development of sophisticated management games. At the same time, the state of technology imposed severe problems in terms of memory, speed, and time. When many of the scores of dry runs failed, one had to struggle to find out whether the failure was due to a miscue of programming, one or more wrongfully punched of a thousand or more IBM cards, or simply one or several of the thousands of vacuum tubes in the machine having burned out!

Clearly the game would have to build on a model of the company and its markets. The specifications of the design—especially at Chicago—was (and remains) based on the neoclassical theory of the firm and its markets. This theory, predicated on the postulate that economic rationality is the only concern of mankind, was felt to be in crying need of being integrated into an encompassing behavioral theory of the firm, which is viewed as an open system. We thought the best way to approach this problem was to design a game model around classic economic theory, with participants supplying the behavioral elements. The hope that such a game would vastly stimulate researchers interested in developing the behavioral theory of the firm turned out to be overly optimistic.

The management game was oriented to the consumer market. However, we realized that to simulate IB realistically, we would have to include intracompany transfers (transactions between the MNC headquarters and its operating subsidiaries, as well as among the subsidiaries themselves). Having accepted this notion, it was a natural step to extend our reach to intercompany transactions among MNCs themselves. This would also permit Company A, the manufacturer of, say, cleaners in Europe, to export goods to Company B, a wholesaler in Brazil. Such business-to-business transactions would also introduce a modest but critical element of bargaining and negotiations between participant groups representing different companies and maybe even cultures. Provision was made for both long-term, trust-based contracts and spot deals to get rid of or replenish inventory. Intercompany transactions were an original idea in business games at the time and are still rarely encountered.

Figure 1 gives a view of the transactions and the flows of data, funds, and goods between the MNC, its subsidiaries, and its multiple environments. These are some of the features of the standard model of the game, detailed in the players manual. We recognized that other administrators might prefer other countries/regions or products. Furthermore, it should be possible to introduce environmental events changing the initial settings of game parameters. To achieve such flexibility it was sufficient to change a single punch card (or a set of them) for each event. For these reasons, several hundred parameters were identified in a dictionary that was available to users. This idea was new to business games, so we labeled this module the Wonder Card Program (Thorelli, 1995a).

Computerized games were still a relative novelty at the beginning of the 1960s, which was reflected by the title of our book for administrators (as well as designers) (Thorelli & Graves, 1964). We hoped to be of assistance to developers by including a chapter detailing the specifics of the econometric model. It was initially delivered in several large punch card trays. Soon, however, we were able to switch to 800-foot mainframe tapes, supplemented by a couple of card trays for each decision period carrying company decisions and implementing environmental events.

Despite its relative complexity, the game was a success from the outset. We quickly found out the significance of the fact that the software was actually bug-free. Meantime, mainframe computer technology development proceeded by leaps and bounds.

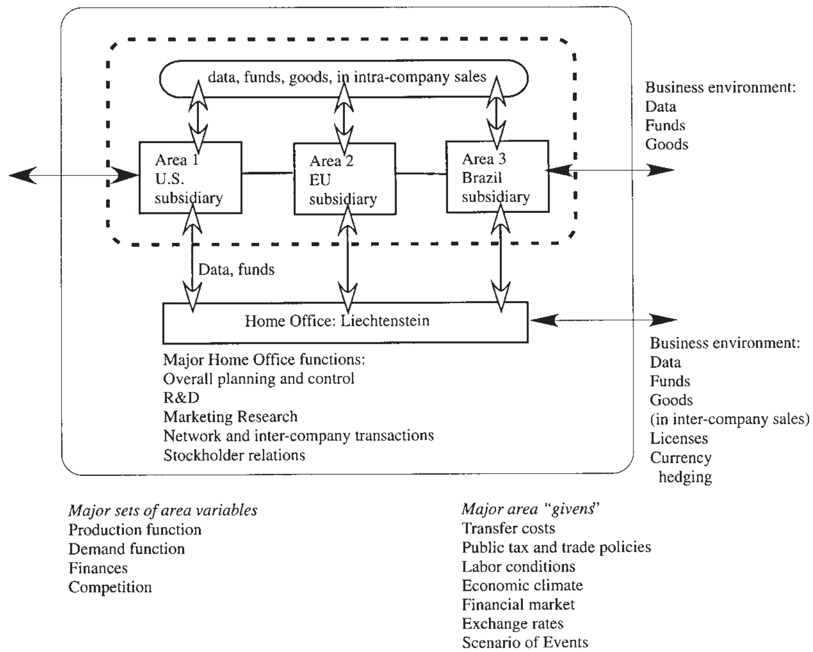

FIGURE 1: Simplified Representation of INTOP/INTOPIA
NOTE: EU = European Union, R&D = research and development.

Thanks to the efforts of various users, the master program was converted to IBM, Control Data (CDC), and VAX mainframes, facilitating and complicating servicing new users. By the beginning of the 1980s, INTOP was fully developed.

Personal computer technology had been emerging in the 1970s, and the PC revolution began in earnest in 1984 with IBM launching its first model. It became obvious that conversion of the game to PC operation would be a vital matter. However, we had begun thinking about the next version of the game and were in no mood to waste time on this effort. Fortunately, Erasmus University in Rotterdam came to the rescue, and produced the PC version on a cooperative basis. It was a blessing to proceed from centrally handled punch cards to company disks managed by participants (Thorelli & Graves, 1989)!

Redesign of the second-generation game

The mid-1980s witnessed rapid change in the IB gaming environment. Participants could now interact directly with their PCs, calling for a functional and also a visually pleasing decision input module. With pocket calculators, currency conversion became trivially simple. Students could and should focus their attention on planning the underlying transactions and judging the actual and potential managerial implications of changes in exchange rates. Additional challenges were the emergence of competitive IB games and the perennial scarcity of programming talent.

Foreign currency (FC) management had become an indispensable element of a realistic IB game in the new world of flexible exchange rates. Business in general, and in IB in particular, evidenced renewed enthusiasm in building relationships, based on the belief that cooperative advantage may be just as important as competitive. This called for free play in the area of strategic alliances and joint ventures and all manner of business-to-business relationships and contracting arrangements. It also required greater opportunity for synergy. In the logistics area, air freight was becoming competitive with surface transport even in industrial goods.

These considerations were taken into account in the conceptualization and development of a second-generation game. Although essentially a new product, we decided to capitalize on the experiences with INTOP, dubbing its successor INTOPIA 2000. INTOPIA sports four currencies, one for each operating area and the home office located in Liechtenstein. Why Liechtenstein? This alpine stronghold uses the Swiss Franc, a traditionally hard and stable currency. More important, it is a neutral country beyond any nationalistic outlook among participants. It offers low corporate tax rates and is the legal residence of a great number of MNCs. Room is left for a fifth currency, a useful feature in runs emphasizing international finance.

The incentive for intra- and intercompany transactions and negotiations was greatly increased by introducing the notion that one of the products is a component of the other. To provide for consumer and industrial markets in a high technology environment, we chose microprocessors (chips) as the essentially industrial component and the PC as the final, essentially consumer-oriented product. Note that some consumers will also buy chips for replacement or upgrading purposes, and governments and large corporate buyers will procure hundreds or thousands of PCs for schools and offices. This option gives the instructor ample room to introduce Dutch auction-type bidding for large orders.

As innovation is vital in hi-tech industries, the number of possible patents was increased from 3 to 10 for each product, and royalty-tied licenses as well as outright sale of patents were introduced. INTOP had featured intra- and intercompany sales/purchases, and standard-type intercompany loans as well as patent sales. We added custom-tailored financial services and currency hedging/options to these transactions types, and in the blossoming area of logistics, air transport to ocean shipping. Air transport permits resale in the consumer markets of the destination area (or, alternatively, the incorporation of components shipped into the production of PCs) in the period of shipping. This was a key difference with the former version of the game, in which surface shipments, for PC production or consumer sales, arrived in buyer inventory only in the following period.

Other environmental developments influencing the design process included the aggressive globalization of business, evidenced by intensified competition in such industries as electronics. We provided guidelines for facilitators wishing to show the impact of such rivalry by introducing Nippon Electric Co. as a strong outside competitor. Oliver Williamson's (1987) pioneering theory of transactions cost in business economics provided new theoretical views. This was reflected in a natural way by the personal time commitment of team executives in negotiating and maintaining intercompany contracts. The increasing emphasis on learning by doing and hands-on experience encouraged us to raise our design to a new level of sophistication.

The team was fortunate in being able to add as a member Juan-Claudio Lopez of Universidad Católica in Santiago, an outstanding programming expert. To save time, it was decided to continue the use of the original FORTRAN language. Technological advances had made FORTRAN obsolete for PC screen management. So, doses of Hi-Screen and Clipper modules had to be injected as well. The plethora of programs proved a major if temporary obstacle to program compilation. Lopez designed a new module, labeled FORMIN, for interactive use by participating teams delivering decision form inputs (hence the name) and receiving outputs on their company disks. In this and other ways, care was taken to simplify administrative procedures around the simulation. (The simplified handling of computer-technical tasks—coupled with the new emphasis on learning rather than teaching—has led to a gradual shift in the role of game operator, moving from administrator to facilitator.)

Beta-testing was performed in l990 to 1993; Robert T. Green of the University of Texas at Austin provided valuable independent input. INTOPIA/MARK 2000: EXECUTIVE GUIDE and the *Compendium for the Administrator* were ready for publication in 1995 (Thorelli & Lopez, 1995). Academia is still regarded as our primary audience.

A great challenge in the technology environment relates to PC operating systems. Beginning with Windows95, Microsoft's DOS prompt was woefully inadequate to be compatible with DOS programs of any complexity. The mix of languages embodying the master program aggravated the problem. (For inscrutable reasons it runs on Windows NT.) For the time being the problem is shunted aside by providing users with a DOS6 startup disk. Fortunately, Windows will accept the company disks of participants. The number of potential adopters familiar with DOS is clearly declining. In the long run, conversion to Windows is necessary. Belatedly, a major effort in that direction is taking place, including some material improvements as well. The next version will definitely emphasize the special nature of the game in the area of supply chain (or value added) management, the related in- and outsourcing, and logistics aspects of IB strategy and entrepreneurship. Meanwhile, we are about to release a procedure permitting e-mail operations, our first venture into the burgeoning area of distance learning.

Gamers' problems

A few problems are unique to IB simulation design. One of the most challenging is how to reflect adequately intercultural differences and notably their likely impact on the demand for the products/services embraced by a given game. INTOPIA and MARKETPLACE would seem to do the most credible, if not necessarily creditable, job in this regard.

Another problem in IB is that reality sometimes may be fantastic enough to make a direct link with the gamed reality, which seems incredible to the participants. Hyperinflation and sequential major currency devaluations in Brazil constitute good examples; inflation and devaluation rates must be scaled down to retain credibility among participants!

Problematic, too, is FC management. To exclude FC management entirely would be to remove a crucial component of IB. It is important to weigh just how many FC issues to include in a game, as such issues can easily take an undue share of participant time and attention. For instance, they might get snowed under by entirely focusing their attention on currency operations in times of changing FC rates.

This is not the place to go into detail in issues facing all business gamers, such as the limitations of batch processing of simulations in a world of continuous change, what to do with participants (and their evaluation) when companies go into bankruptcy or are bought out by other teams, and so forth.

Gaming/simulation as basic research vehicle. An impressive body of empirical research—often of a basic nature—is focused on educational and pedagogical issues around gaming. A puzzling question of personal concern is the relative scarcity of research involving the subject matter that is the content and dynamics of games. It would seem self-evident that sophisticated games constitute behavioral science laboratories. This issue is badly neglected at a time when behavioral theories of the firm have only begun seriously challenging and enriching classical economic theory (Thorelli, 1995b). Initially, such research could be expected to generate fruitful hypotheses for further testing.

An exemplary focus might be looking for determinants of group decision-making behavior with respect to research and development. Another topic concerns groups facing and handling risk, uncertainty, and emergency situations. The relative roles of trust and opportunism in deal making is another fascinating subject, as is the role of interpersonal relationships in the maintenance (or breakup) of standing contracts and networking arrangements between companies.

Administrative pragmatics

A thorough discussion of business game administration requires a monograph. As IB simulations do not inherently differ from other games, such a discussion is beyond our purview here. However, a few observations seem appropriate.

Specifics. Theoretically, there is room for 98 companies with aggregate initial market sizes by product and geographical areas scaled automatically by the number of teams. Each team may have 3 to 6 members. Two is the smallest number of teams possible. However, to permit a desirable range of alternatives in intercompany contracting requires at least a handful of companies. A typical university class will comprise 10 to 20 teams. If the number of students is much more than 60, running two (or more) parallel worlds may be advisable.

To provide a realistic set of environmental events to occur sequentially—such as inflation, interest rate changes, business cycles, strikes, currency devaluations, or new environmental protection rules—the facilitator needs a scenario. To simplify matters, a built-in model scenario is implemented largely automatically as the decision periods (90 days) roll by. The *Gazette*, the trade journal of the Computer Industries Association (CIA), handles forecasting and reporting on the events, copies of which are furnished. The facilitator may or may not elect to use the model scenario and is free to make any changes he or she wants or design a different scenario. A typical run will comprise 8 to 10 periods; a practical minimum for a worthwhile run would be 4 periods.

Competitive intelligence is indispensable in business. We were faced with two challenges. The first one was to provide hard-core financial and market-share data, similar to company quarterly and annual reports. Not all firms publish quarterly data. So we decided to make this type of data available only for a consulting fee. On request, the computer automatically produces the item. Companies get free consolidated financial data of all industry members of the kind one finds in annual reports every four quarters and, of course, in the final quarter of a run.

Soft information (e.g., rumors or facts about industry members), being company- and run-specific, cannot be preprogrammed. Facilitators are encouraged to produce a gossip edition of the *Gazette*. A guide gives examples of reportable items, such as research and development (R&D) breakthroughs; rumors of new standing supplier, license, and loan contracts; examples of good and bad cash budgeting; global expansion; out/in-sourcing; and growth/decline of companies or subsidiaries. There is room for a highly condensed version of a message board at the end of the quarterly balance sheet, which may substitute for the *Gazette* gossip. To save time further, the facilitator may just make a few gossip-style remarks in class.

Student and facilitator time commitment. Students typically need 2 hours of class time for the first decision period. As they gain experience, this time will be shortened. By period 8, only 30 minutes may be required. Under all circumstances at least 1 hour per period should be spent out of class for analysis of outputs, forecasting, strategy discussion, intercompany negotiations, and preliminary decisions. The game stands for decentralized administration. A facilitator, new to business games, may need 2 to 3 weeks of full-time equivalent work to get fully immersed (including a desirable dry run with a few colleagues, assistants, or student volunteers). This time may be cut in half by on-the-job learning. Given this initial investment, the facilitator has on hand a pedagogical resource with many possibilities for future years. A facilitator will have the capacity of integrating the case method with the dynamics of competition (and cooperation) during the game. The only computing skill needed is everyday word processing; virtually no programming is involved.

Team composition: Participants as instructors. The typical participant is an executive or student enrolled in an MBA or undergraduate honors program. Often, IB games will be run with participants from various nations or types of business. As decision making proceeds during the game, team composition should be deliberately mixed to permit a lively interchange among participants concerning business culture and practice. In runs emphasizing cultural integration, participants (be they executives or students) should be given positions not corresponding to their personal specialties. It is a joy hearing a veteran production manager stating on debriefing day, "I resented being handed the marketing job in our team. However, it actually gave me quite an experience. Why? I found myself in our discussions using the same arguments as the marketing people back home!"

Simplification. Sometimes the background of participants, time constraints, and other concerns may call for simplification of complex games, either during an initial break-in period or throughout the run. For example, foreign currency management effort may be reduced by about half by not changing the exchange rates during the run. (Participants should be informed about this from the outset.) Experience indicates that procurement and disposal of FC—while avoiding costly overdrafts—will still be a challenge to neophytes. Placing the simulation on an all-cash basis is another major simplification. Additional examples of simplification are given available.

Ethics and social responsibility. As considerable variations exist in perceptions of ethics in various cultures, this is a sensitive area in IB. Facilitators should probably avoid marketing a particular set of ethics. They should rather emphasize that any decision affecting others inescapably involves ethical concerns. Intercompany and intersubsidiary transactions also involve elements of trust and good faith that must be taken into account in any appeal to the facilitator as adjudicator. Simulation of corruptive practices should be avoided, as there is now clear-cut evidence that corruption is a block in the road to development.

Like life itself, simulation involves qualitative as well as quantitative dimensions, such as social responsibility. This can take a variety of forms, such as voluntarily investing in protective devices attached to products (without participants knowing in advance about the effects on demand), and giving excess or possibly old technology products to the poor or schools.

Built-in competition. In all games—especially in IB (and particularly where intercompany networking is possible)—it is a good idea to have some built-in competition to make sure that cooperation among teams has positive rather than cartel-type effects. Facilitators of the game typically run Nippon Electric as a worldwide competitor, with products, grades, and prices posted in advance; Nippon also does not advertise, which should facilitate demand analysis.

Central versus decentralized administration. MARKETPLACE appears to manage its runs centrally from the University of Tennessee (alma mater of the game) and is experimenting with automated analysis and feedback to individual teams. In part this may be to protect its copyright in the era of distance operations on the Internet. In the meantime, whether the gaming world would prefer a single institution having centralized control over its particular game when other games are available on a decentralized basis remains an interesting question.

Symbiosis in pedagogy. As individuals learn in different ways, it is desirable to use an integrated set of educational tools when possible. Of course, time constraints must be taken into account. In a 1-week seminar, for instance, the time for other inputs rather than the simulation itself is somewhat limited. The ideal time for a university course around INTOPIA is 10 weeks or more, involving relevant lectures, readings, and written assignments to ensure symbiosis around the course topic. Naturally, relevant lecture and readings will depend on the purpose and subject matter of the course/seminar at hand. A sample of integrative lecture topics are available, including such topics as:

- organizational mission, concept, and objectives;
- the SSP model (structure, strategy, performance model) and organization ecology;
- intercompany networking;
- IB entry modes and technology transfer;
- coordination of the MNC with focus on transfer pricing, internal service payments, and taxation problems;
- actual/potential currency devaluation and adaptive behavior on company operations; and
- Economic Value Added (EVA), discounted cash flow, and other evaluation criteria.

MARKETPLACE comes with a special readings book with integrative chapters by a bevy of authors, the CORPORATION enriches the game with its in-basket incidents type of exercise, and the MULTINATIONAL MANAGEMENT GAME brings in the Compaq case materials, covering the history and challenges of a real company in the industry simulated (Keys & Fulmer, 1998). The BUSINESS POLICY GAME carries in its international version references to suitable integrative readings.

Simulation dynamics: Contents, process, outcome

In theory, one may find neat distinctions between contents, process, and outcome of dynamic activities such as gaming/simulation sessions. This is neither in practice nor in simulation the case. Nevertheless, as the distinctions are of didactic interest we shall attempt to use them here in an overall view of what may be considered a typical run. It would comprise eight decision periods (quarters) by 10 to 20 teams, each of them composed of three to five self-selected graduate students. We assume two weekly class sessions of 90 minutes each, the first session essentially devoted to decision making for a quarter, the second to feedback, lecturing, and so forth. Each week teams will devote 1 to 2 hours of outside time to analysis and preparation. To keep the discussion reasonably tight, we will exclude such topics as integrative lectures and readings.

Content. After the initial briefing session and outside study of the *Executive Guide*, the team is faced with making a preliminary set of entrepreneurial decisions, comprising product(s), operating area(s), functions performed, and clienteles to be served, as well as time-framed objectives. In a student run, venture capitalists will provide SF 20 million for each team. If major emphasis is placed on entrepreneurship as such, the facilitator may differentiate the amount of starting capital according to the quality of the entrepreneurial decisions and initial objectives and plans.

The next step is intelligence search. The preliminary entrepreneurial profiles are circulated among the teams. They will introduce redefining of some businesses that see too much competition ahead, whereas others may see opportunities for synergy through outsourcing and networking. Thus, negotiations and contractual and network arrangements leading to supply chain management will typically involve two-thirds (or more) of all teams.

Another important early strategic decision involves innovation. The R&D function is the only module in the total program that is semirandom and semideterministic (all other functions are deterministic with marginal stochastic influences). A number of teams will find this source of uncertainty unbearable. They may settle for making or marketing economy models, or resort to second-hand innovation by means of buying patent licenses from others. Some eager-beaver companies will engage in their own R&D programs and license (or cross-license) patents. The outlook on R&D may also depend on clientele to be served: Some groups of consumers are willing to pay for technological frontier products, whereas others prefer basic economy models. In Brazil, demand is greatest for the economy model. There is also a small super-luxury group of customers. In the United States, the higher the grade (patent), the better. Europeans tend to take a middle ground.

The degree of ambition in company definition and statements of objectives, plans, and strategies (written assignments) vary all over the lot. In large part this is probably due to the awareness that a significant element of end-year evaluation is a comparison of initial prescriptions with actual results.

In the course of the run there are plenty of pitfalls to avoid. Examples include the avoidance of lemons (worthless patents), failure to foresee a pending currency devaluation, overdrafts of FC, inventory accumulation of unsold products, or, conversely, incurring goodwill loss due to stock-out. Most pitfalls may be avoided by careful reading of the quarterly *Gazette* and its gossip edition, by swapping information with other companies, and, not least, by timely spending on marketing research and consulting. Teams may also learn by mistakes: The facilitator may present them with accurate estimates of losses incurred by making/selling a lemon versus spending a modest amount on marketing research. There may also be more or less unpredicted opportunities, such as an upturn in the business cycle, Brazilian government purchases of economy computers for schools, the introduction of bare-bones network subcomputers, or a strike by production workers in an operating area in which you are not active and now have an export opening.

In the strategy area, teams have found Michael Porter's (1980) classification of practical values. His generic strategies involve cost leadership, differentiation, and focus and stuck in the middle. However, INTOPIA goes beyond Porter in emphasizing the strategic value of cooperative advantage in addition to competitive. Cooperative advantage seems to be especially relevant to firms that otherwise might likely be stuck in the middle.

Process. From a research potential point of view, the group dynamics developing in the teams is of special interest. Teams have a task-oriented mission offering cooperative as well as competitive opportunities.

Self-selection of team members is the most common practice. When teams typically start from scratch it is important that the group has at least an hour-long discussion about the concept and objectives of the firm before the election of president. It is important that in structuring the team some real division of labor (especially for analytical purposes) is established. Committee decision making about everything is too costly in terms of time. At mid- and end-game, team members evaluate each other; the president's evaluation of fellow members counts for 50% of their scores. At mid-game, the author provides for rotation of management in the teams. Rotation includes the president. Interestingly, the only exception from rotation typically granted on team request is the position of network liaison. Incidentally, in intercompany negotiations, teams tend to learn that the delegation of fairly broad authority to one or two members provides a far better prospect of a fruitful agreement than plenary negotiations involving all members of both teams.

A characteristic of long-term standing contracts is that as the macroenvironment changes, the impact of a contract will be uneven on the parties. A situation may well arise where one party would like to get out while the other one wishes to enforce the agreement. At this stage, questions of opportunism versus trust and legitimacy arise, as well as considerations of short-term gain/loss versus possible mutual gain over the long term. Teams are encouraged to resolve differences on their own. To resort to the facilitator as judge or mediator will involve a substantial charge for both teams. Furthermore, the facilitator relies exclusively on written contracts plus any facts not questioned by either party. This avoids waste of everybody's time and minimizes the possibility of unfair judgments. In addition, standing supplier contracts have a standard escape clause, whereby a party may withdraw for no particular reason by paying the other party damages of 10% of the aggregate outstanding value of the contract. Few contracts are broken unilaterally. The overall lesson to be learned: No contract drawn by human hand can ever encompass all possible contingencies. With regard to organizational structure, teams initially tend to prefer functional organization—emphasizing their professional specialties. At mid-term rotation, they often switch to product, regional to clientele-group orientation.

Outcome. Debriefing is necessary and subject to facilitator preference. It can take a wide variety of forms. We have found a cross-company management audit being publicly performed a useful procedure. If time is limited, company self-reviews are a good alternative. In addition, a rhapsodic overview by the facilitator is worthwhile. It behooves the facilitator to keep in mind that debriefing on decision-making processes and strategies, used by the teams, may be just as instructive as debriefing on results.

Participants may also be encouraged to exemplify what they have learned from the simulation. There is a danger in overemphasizing the role of the debriefing—the main learning must occur in the course of a run, or the game is not administered properly, or it was not suitable in the first place. Debriefing especially pays attention to the learning that has occurred during the course of a session.

Even more controversial is the selection of evaluation criteria. ABSEL Standards and Registration Procedure for Assessment Instruments stress a (single) objective score of performance (such as some profitability measure). A strong argument can be made for the view that different groups of stakeholders will use different criteria, and that complex games do (or should) reflect this fact (Thorelli, 1997). In INTOPIA, profitability counts—if nothing else—as a means of long-term survival. Two other measures are equally important. The first is a comparison of results with objectives and plans—as initially conceived and with any mid-term revisions. The second is emphasized as the single most important criterion: action potential for the future at the end of the game. Such potential is indicated by cash flow, patent position, cost structure of plants, market share, win-win contracts with other teams, and so forth. The accent on action potential also means total absence of dysfunctional behavior in the last quarter of the game (e.g., cutting out advertising and R&D).

Learning experiences. Personal observation suggests that participants—whether corporate executives or students—learn useful lessons such as:

- entrepreneurial challenge of defining a new business concept;
- importance of understanding the cultural differences between the various business functions, and of overcoming the temptation to focus on one's own functional silo;
- vital role of trust in long-term contracts;
- respect for the fact that information costs money (even in Internet times), this lesson being especially critical for participants from developing countries;
- a portfolio of countries is often as valuable a means of growth as a portfolio of products;
- being first mover is not invariably desirable;
- product life cycles are getting shorter (illustrated by Gordon Moore's law concerning the capacity of sequential microchip generations), yet there will always be a niche for economy models;
- challenge of internal coordination in the MNC;
- challenge of external coordination (intercompany networking), and strategic adjustments in different environments (SSP);
- providing room for rational and intuitive approaches in strategic decision making; and
- realization that your best friend socially may not be the ideal teammate in a task-oriented situation.

As game designers we have also learned some lessons, as may be derived from the balance of this article. The prime lesson by far is moving with or even being ahead of the times. After all, inherent in the ecological perspective is the observation that we are capable of changing the environment, not merely adjusting to it.

Future of IB games

The 1990s witnessed the emergence of several IB games (a handful appear in our reference list) demonstrating the rapidly growing richness of the field. One may confidently predict further development of the IB gaming industry. Barring trade or shooting wars, IB will continue to grow more rapidly than national or even regional economies. Telecom and the Internet are making distance education a living reality for anyone who wants to learn. Cross-cultural runs of games will be especially exciting. Predictably, e-commerce will be introduced in sophisticated games, both on a business-to-consumer (B2C) and a business-to-business (B2B) basis. Transactions will involve individually and collectively negotiated contracts as well as auctions. As games continue to reflect ongoing reality in the auto and electronics industries, we may find that given the opportunity, simulated companies will increasingly outsource major parts of their manufacturing operations. The competition—as well as cooperation—between established and newfangled educational institutions of all kinds (such as corporate universities) and in all countries will intensify.

Although the time may not yet be ripe, one might also envisage a trend arising in game development somewhat similar to the creation of Lego modules or old-fashioned erector sets, in which standard parts or entire modules could be used in a great many ways and serve many functions. At the opposite extreme, special purpose games are likely to develop for particular industries and applications, actually becoming parts of the kit of strategic planning and/or reorganization tools of management in the real as well as the virtual world. It will become increasingly natural to make tailored services part of the offering of what would now often be treated as product business. Means may be found of placing games on a continuous rather than staccato (batch-processing) basis. Not least, one would hope that simulations in the game form be given their due as basic research vehicles, initially perhaps on an exploratory basis.

In summarizing our experiences and trying to identify the unifying theme in our effort in the IB gaming area, one word comes to mind: *integration*. Integration of the functional areas of business into the concept of strategy, the integration of competition and cooperation, the integration of the MNC and its multicultural subsidiaries, the integration of economics and (other) social sciences into a behavioral view of the firm, and integrating organizations and their environments into an overall human ecology perspective.

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Is urban gaming simulation useful?

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The authors discuss epistemological, theoretical, and practical reasons for the crisis of gaming simulation in urban studies. The enormous successes obtained by hard sciences (particularly physics) in interpreting and changing the world have driven many scholars of the so-called soft sciences to believe that the methods and tools that had proved so successful at the so-called court of the queen of science might also be successful in the drawing rooms of the social and behavioral sciences. This belief has given birth to urban models. Its terminology revealed an inferiority complex toward so-called true science. It is with this set of issues that whoever deals with social sciences has to come to terms. This applies specially to urban sciences, which must take into account the social and the spatial (physical) dimensions.

KEYWORDS: *artificial life; gaming simulation; participation; planning; urban models.*

Although it is true that Urban Gaming Simulation (UGS) had implicitly taken into account the social element of urban systems by removing part of the closed simulation model from its algorithmic description, it is undeniable that during the 1970s and 1980s the general crisis involving algorithmic models of social systems backfired on them as well. The origin of this crisis could be condensed to the question, Can UGS be useful not only for training but also for experimenting and predicting?

Claiming that gaming simulations are mainly training and predictive tools is sensible and useful, even if they map urban systems insufficiently. Obviously, it all depends on the questions, What are good UGS models? and What do we mean by prediction?

It is easy to see why and how UGS can be useful to experiment with and to use as tools for prediction. They offer us clues to identify sensitive conditions and outcomes, a sense of the right direction, short-term and long-term contradictions, and a few effective policy changes.

There is nowadays a renewed interest in regulative urban planning. The idea that it is necessary to guide the dynamics of urban development is now being accepted again. Gaming simulation has a future, as long as we connect it to new paradigms (such as that of artificial life), new models (such as those based on cellular automata), new tools (such as telecommunication networks), and new goals (such as forecasting based on scenarios), or to new forms of planning (such as those that see participation and interactive planning as essential elements). This article pays attention to all these aspects by means of theory and practice.

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Origins

UGSs appeared at American universities in the early 1960s, following the successful applications of gaming simulations in military and business administration. American cities were at that time in a severe social crisis: racial riots, increase of crimes, birth of gangs of teenagers, and urban decay. This atmosphere of strong tensions was, however, counterbalanced by great trust in the future, as exemplified by President Kennedy's dream.

UGSs, in fact, are mainly urban training tools for planners and administrators, learning tools for students, and research tools for scientists. Like all gaming simulation techniques, UGSs are tools for simulating the effects of decisions made by people, assuming roles that are subjected to rules. Simulation refers to an urban model or, more in general, a land-use model. The general structure of UGS is depicted in Figure 1, which shows the three dimensions of role, simulation, and game that constitute the abstract space for UGSs.

In short, and essentially for educational reasons, part of the overall model is removed from the algorithmic description, which describes the mechanical or physical aspects of urban systems. This choice implies that the close model is becoming open to influences by the free game of social actors. Thus, the gaming part is linked with the mechanical side of the model. It defines the decision space for the actors. In this sense, UGSs are hybrid models that connect different epistemological traditions. It is important to underline that the techniques that find their basis in the definition of UGS are numerous. They depend on the positions taken in the three-dimensional space (see Figure 1).

As it invariably happens to gaming simulations, UGSs have proved to be excellent training tools. In addition, there was hope that in contexts of operational urban planning and design they could be useful as instruments of analysis, prediction, and policy making.

During the 1960s and 1970s we have witnessed a diffused flourishing of games for land use planning, even outside the North American and British breeding grounds. Then suddenly came the crisis that made UGS almost obsolete. In the first place it was a crisis that ended the reformist dream of social planning. In addition, it was a crisis of the paradigm on which UGSs were being built.

In the following sections we will point out that notions on urban planning coevolve with the epistemological and methodological considerations underlying the design of UGSs. We will start by paying attention to the crisis of urban models (especially large-scale models), such as in UGS.

Crisis in model building

Lee (1973), in his article "Requiem for Large-Scale Models," describes what he considers the seven mortal sins of urban models. Harris (1994) has pointed out in his acute criticism of Lee that four of them have been overcome (at least partially) by

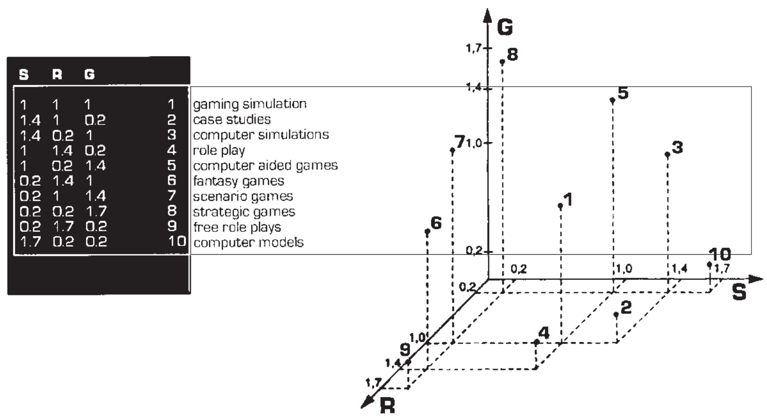

FIGURE 1: Illustration of Three-Dimensional Space of Simulation, Gaming, and Role Play
SOURCE: Cecchini and Frisenna (1987).

technological developments. These are hungriness for data, wrong-headedness of ideas, design complexity, and high costs. The remaining three sins (that large-scale models are hypercomprehensive, gross, and mechanical) are inherent to the logic of large-scale models. Later, Lee (1994) focused his criticism on three aspects. Large-scale models are fundamentally black box models, which claim to be general purpose and are inspired by the top-down approach steering in terms of command and control. However, the most acute critique of those types of models is probably the one described by Allen (1997). His statement has considerable consequences for anyone who deals with models. Allen pointed out:

> There is a critical difference between asking whether a systems obeys the laws of physics or whether its behaviour can be predicted from a knowledge of those laws. (p. 2)

Allen observes,

> We cannot really predict, but we can explore possible futures, and can help to imagine some of the properties of these. (p. 258)

Complex systems are very sensitive to initial conditions and—at some stages in their evolution—small changes in initial conditions can produce big, structural changes in the behavior of the overall system:

> History is made up of successive phases of relatively predictable development along a particular branch, separated by moments of instability and real change during which the future of the systems is laid down by some rather indeterminate chance events which push it onto one or another branch. (Lee, 1973, p. 18)

Urban systems add another element to the unpredictability of complex systems, namely the fact that people interact and their preferences are linked in a complex, coevolutionary way (Allen, 1997, p. 3). People often do not necessarily act on the basis of rational and sound reasoning, but follow sensations and opinions that depend on other people's choices and their changing sensations and opinions. This fact is important to those who build models for two different reasons: The first concerns the type of models that should be used, whereas the latter involves the purposes for which they could and should be used. Models are not for forecasting what will happen at one moment in time or designing the one best future:

> Just as central planning failed because of its rigidity in a changing world. The lessons seem to be that plans, which encourage variety and diversity tend to lead to creative and adaptive systems, capable of generating their own development and in responding to the challenges of the economic, natural and social environment. We should not conclude that the adoption of an unplanned free market system will necessarily produce success. As our models show, there are different possible structures that might emerge, and they can have qualitatively different attributes. It is important therefore to understand what kind of structures are possible, and to have some ideas of their relative merits, and what actions or policies might lead to which type of situation. (Allen, 1997, p. 252)

Models are tools for defining possible alternative strategies, for supporting decision making and understanding consequences of several simultaneous decisions, and for dealing with tensions between short-, medium-, and long-term effects. Furthermore, the computational and representational potentials available today enable us to build sophisticated yet user-friendly models whose structure and dynamics are easily understood. They enable the decision maker to effectively and straightforwardly simulate alternative choices:

> Through this process of exploration and testing, users will both improve the model, and improve their understanding of both the real system, and the model that is supposed to represent it. This learning process may perhaps be the most valuable part of the whole enterprise, since it can genuinely build mutual understanding and consensus between the actors. (Allen, 1997, p. 173)

Crisis in social planning

The crisis in social planning coincides—but not at all accidentally—with the styles of rationalistic planning, as described by Peter Hall (1988) in his impressionistic history of planning and by Alexander (1992) in his functional classification. As Scandurra (1997) writes:

> Town planning came about with the Industrial Revolution, when for the first time in human history, society appeared to be organised definitively in the concrete form of the Nation State, a system which provided protection for its citizens in the form of the so-called Welfare State. It has since developed as an independent discipline (independent

> from architecture and economics) that deals with the structuring and usage of physical spaces for the safeguard of health, social assistance, education, and ever-widening social policies. A discipline, therefore, inherently reformist, and characterised by a utilitarian view (enlarging, edifying, measuring, rationalising, beautifying). . . . As a discipline in function of the social compromise between productive bourgeoisie, waged workers and the middle classes, town and regional planning has indeed played a decisive role in the organisation of physical space, but now perhaps that role has been exhausted in that modern society is increasingly less representable. Town and regional planning has designed cities on a Ford style model of productive and social organisation; a model that has since changed greatly: the organisation of labour has changed, as has the conception of nature, and finally, what else has changed is the model of scientific rationality elaborated by Galileo and Newton that led us to believe (and hope) that we might be able to predict and govern (control) the world; the secret certainty in the magnificent destinies and progress of humanity. (pp. 16-17)

The crisis

We will discuss epistemological, methodological, and practical reasons for the crisis in UGS.

Epistemological reasons. As with all branches of knowledge, not strictly or genetically scientific, land use analysis has also passed (consciously or not) through a period of physicalism. It is well known that the positivist project, discarded almost at once in the 1970s, has been a paradigm dreamed of by all those disciplines that received less consideration and academic status than physics. The enormous successes of the so-called hard sciences (particularly physics) in interpreting and changing the material world have driven many scholars of adjacent disciplines to believe that the methods and tools that had proved so successful at the court of the queen of science might also be fruitful in the drawing rooms of the social sciences. That explains the birth of urban models. In their terminology they revealed a sort of inferiority complex toward true science (e.g., consider the application of the notion of entropy or the use of gravitational models). Whoever deals with social sciences has to come to terms with the approach of the hard sciences. This applies particularly to urban sciences, as they must take into account the spatial dimension of human settlements.

There is another crucial aspect to add: The aim of urban planning is not only to describe, analyze, and interpret urban development, but its aim is above all to predict and devise strategies to reach feasible futures. By removing parts of the overall model from the algorithmic description of formal models, UGSs had somehow implicitly taken these goals into account. Yet it is undeniable that the crisis involving large-scale, algorithmic models, on which they were based, has been transplanted to UGS.

Methodological reasons. The origin of this crisis involves the use of gaming simulation techniques. It could be condensed in a question: *Sic stantibus rebus*, can UGS be useful not only for training and analysis, but also for prediction?

It is fairly obvious that what serves as a means to learn about a complex system has an inherent heuristic function. In addition, when it explains how a system works, it also enables us to make predictions. Understanding even partially how complex systems work helps to formulate correct questions and consequently to increase and enlarge our ability to analyze. The claim that UGSs (or gaming simulation in general), in addition to being training tools, are also sensible and useful for predictions depends on what one considers a good model. Are purely algorithmic urban models better than hybrid models that are based on a mechanical submodel connected to a system of actors? An answer to this question also depends on what we mean by prediction and what criteria are being used. In this regard, the following question needs to be addressed: How to cope with a fundamental conflict between the short- and long-term consequences of a policy change? If skepticism is a realistic attitude in this context, it is easy to see under what conditions UGS can be useful to make predictions. It all depends on the clues they offer to identify sensitive issues, to identify right and just directions, to explore short- and long-term contradictions, and to enhance a few effective policy changes. Here comes the crux of the problem. Urban gaming designers confined themselves to use UGS mainly for training purposes. Moreover, when they enlarged them for analytical and forecasting purposes, they had to come to terms with the epistemological crisis of the paradigm underlying large-scale modeling.

Practical reasons. Finally, during the 1980s doubts emerged about a question that urban planners had taken for granted. To what extent is it possible to drive urban development processes through a rational and enlightened planning? Previously, a plan devised by competent scientists was viewed as a valid governing tool. It was assumed that it could improve the ability to manage social processes, to take economic interests into account and bridle them, and to predict social dynamics.

Before the 1980s we witnessed a rapid development of society as a whole. Both social control and use of the market were considered possible and necessary. Reformism in its various versions was able to reaffirm itself from the American Roosevelt model to the North European social democratic one. Moreover, since 1945 the world (with the exception of few prophets of woe) had regained its sense of rationality and direction. UGSs were considered effective planning tools, and as such they profited of this favorable atmosphere that made us believe that conflicts could be rationalized and once understood they could be settled.

The bitter awakening during the 1980s caused a crisis in these strong convictions. During the 1980s, what Leopardi (1836) called "the extraordinary and progressive destinies of history" were rediscovered. The heritage of a past made of racial conflicts, poverty, casting out of groups of citizens, the loose appetites of speculation, economic stagnation, and regional disequilibria had to be overcome. All the techniques and methods of UGS, which were associated with such a naive perception of progress and reformation, had been swept along with the crisis. That is why public management has stopped using UGS. It is not easy to offer exact figures. Very few games have been designed since the mid-1980s, and fewer and fewer have been the articles on UGS and even fewer the sessions of games played.

The crisis of classical urban planning has emphasized the epistemological and methodological crisis in gaming simulation mentioned above. It hit even those UGSs that were more innovative and less connected to the reductionist and positivist statute of physics. However, history is shrewd. UGS, hardly surviving in the academic world, has flourished in the great world, in the market of video games. SIMCITY is the most evident example. Nowadays, there is also a renewed interest in regulative urban planning, although deprived of its rationalist aspects. After the ideological excesses of deregulation, the idea that it is worthwhile to guide the dynamics of urban development is now being accepted again.

A new perspective

UGSs will have a great future, but only if we will be able to rethink and revise the epistemological and political frameworks that enclose UGSs and address the requirements they have to satisfy to be embedded in them.

The frame. Today, the epistemological framework is enriched by the birth of the paradigm of complexity. It is gradually claiming a vital part in the scientific world and establishing its methodological coordinates. The science of complexity addresses exactly those aforementioned epistemological questions. Therefore, urban modelers, if they redefine their role and know-how and reelaborate their reference models, could become principle agents of this methodology. The new technology could provide a major contribution to the construction of new models. Additional to the difficulties that relate to building urban models is the notion that many models of evolution of cities are used as metaphors rather than analytic models.

In the analysis of urban dynamics, two perspectives can be taken into consideration:

- observe the city from the top of a hill and see it in its entirety and in its physical context, and
- walk in the streets and interact with the inhabitants, and discover that those who move across the city do so for different reasons, each person for more than one reason.

In addition, from a scientific point of view, qualitative, quantitative, and mixed models are taken into account. In principle, the various perspectives and types of models help us to see things differently. In this sense they complement one another and improve our understanding. Therefore, they should not be integrated into one internally consistent whole. That would reduce variety of perspectives.

All town and regional planners have used models in the various phases of their profession. They did it in different ways. Like Monsieur Jourdain, the bourgeois gentleman depicted by Molière, planners spoke in prose without even realizing it. Nowadays, there is a return of interest in regulative town and regional planning. After the ideological infatuation with deregulation, the idea that town and regional development dynamics should be guided (perhaps through new instruments) is once again acceptable. Under stringent conditions, provided by the science of complexity, we might expect urban models to have a great future. The reasons are as follows:

- The role of the town and regional planner can no longer be considered a linear series of disjointed sectorial tasks. It requires a general skill, a savoir faire, and an ability to adapt to evolving circumstances and to deal with the unexpected. This understanding will have significant effects on their training and consequently on the organization of the educational system.
- A plan is necessary to support sustainable urban and regional development. It is no longer an enlightened plan based on a reductionist epistemology and a centralized hierarchical management system. It is developed via participating individual citizens and groups. This approach makes them coresponsible for the planning process. Such a plan is a social construct, shaped and reproduced via interactive government.

Conditions. The reference models must be reviewed, and it is therefore essential that urban models result from a long period of cross-fertilization with other disciplines and with new analytical techniques. In this area there is still much work to do. (Reference models denote those urban models that map particular aspects of cities or regions, especially the physical aspects of land use.)

Describing the behavior of urban systems on the basis of a partially closed model and linking part of the algorithm with the bounded action of the agents involves the risk of making the model unstable. Identifying criteria and conditions by which models are sufficiently robust will become vital. It is necessary to choose the most suitable technique in relation to an adequate classification of urban models. Such a classification should not only display the visible characteristics but also the underlying features. Among others, the following questions need to be addressed:

- Which theory is being addressed?
- What conception of the conflict between parties is being implied?
- Does the model have areas where it is in equilibrium?

> I personally hold that formalisation and modelling are necessary to scientific research and I greatly appreciate the efforts of those who work in this field. However, in my opinion, the "partial models" seem to be more useful than the "general" ones, also because it is very seldom that a researcher has at his disposal the appropriate amount and quality of means to be able to elaborate a "rich general model" that is up to the situation. . . . I am not a great expert on models, but I appreciate their importance and usefulness on the one condition that they add to knowledge and enrich interpretations, and do not only translate into more or less rich formulations what one already knew. The phenomenon, which is the object of our study is in a state of constant transformation, and no special attention is needed to be able to notice the signs of this transformation, in that they are so often very apparent, but the interpretation of the movements at times seems to be more complex. No instrument should be shunned, and no amount of effort should be derided; this, however, without denying that very often the "glasses" through which we observe the urban phenomenon are very diverse (but this is a matter of discussion amongst researchers). It is these glasses, then, rather than the models themselves that allow us to look beyond, to delve into reality, and grasp its profound movements. (Indovina, 1995, p. 11)

In general terms, strategic problems are not resolved by refining the tactics! The lesson to be learned is that for every discipline that has a weak epistemological basis, there should be a healthy coexistence of different competitive techniques.

How much computation is needed? Computation is understood not in the sense of brute force of modern day computers. A plumber is not a scientist per se, although practicing a scientific method. A plumber knows which tools to carry without overloading the bag, knows how to arrive at a temporary solution without losing sight of the objective, and is satisfied with solutions that are less than optimum. As we will restrict ourselves to plumbers, we are speaking of great artisans of practical reasoning. To sum up the science and art of model building: It is better to do less, but to do it better. Although the power of calculation is important in managing databases, brute force is not called for. Sophistication and flexibility are required.

The real paradigm shift in UGS lies in substituting the earlier objective of bureaucratic control with participatory impact assessment; in balancing strong and weak ideas; and in envisioning change, guidance, and direction.

Urban gaming simulation and urban models

We have indicated key elements that are necessary to regain space and perspective to that particular category of urban models represented by UGSs. The ideas presented above are forcing us to reflect more thoroughly on the reasons why description, interpretation, explanation, analysis, and prediction of urban dynamics require a real and pervasive philosophy modification. Essentially they ask for a new metabasis.

Governing cities means above all understanding the (current) limits to their development. In essence, the matter at hand is to understand the nature and dimension of the constraints, which manifest themselves in the social and economic reality of today, and in our immediate future. This can be achieved by coupling short- with long-time perspectives, by linking smart tactics with good strategy, and by generating instant satisfaction with lasting gratification, taking into account that any governor's notion of time usually does not exceed the generation of the grandchildren or term in office.

It is difficult to think about any policy whose time span is longer than half a century, considering moreover that the validity of a forecast for such a long period of time is close to zero. Perception of time in human history is completely different from the time dimension in nature. In that respect, politicians should be aware of the increasing global effects of local political decisions. Today's major risk is no longer the extinction of one specific city, but the loss of a civilization that is represented in urban culture.

In the meanwhile, we should be careful not to reiterate the prisoner's dilemma or the tragedy of the commons in the competition between cities. Governing a city means knowing how to use effective public policies while considering all viable options. First-order or classical cybernetics focuses on steering and control. Applied to cities, it represents a top-down form of government. It should be made clear, however, that whoever governs does not necessarily have to directly administer the mechanistic instruments of his or her cybernetic policies. Considering the nature of direct and indirect policies, both can be dissuasive or persuasive. Moreover, they can be regulatory, monetary, psychological, and cultural. In the case of cities, policies should be open to public debate. The role of models in the government of cities is fundamental and they should receive proper attention, especially in relation to planning. One should not forget that grand objectives are not achieved with grand policies, such as in the era of the planned economy. They should be addressed by great policies that are flexible, show the ability to maintain a sense of balance between perceptions and positions of multiple actors, and accept the possibility that many social subsystems have the capacity to recreate themselves.

A good politician will intervene effectively when and where it is needed. Decisions need to be made that are open and reversible as long as suitable on the basis of understanding the territory and emerging tendencies. Within such a political context, UGS and other urban models can simulate alternative scenarios for a defined time span. They should indicate their costs and how they can be covered.

It should be pointed out that the city is an extraordinary but costly institution, characterized by integration and exclusion. It is the habitat of many human beings, their true ecological niche. Our species is unique in the sense that its adaptability is expressed through the evolution of its memes[1] (Dawkins, 1976), which is a process that is quick, direct, and inconclusive, rather than the evolution of genes, which is a process that is slow, indirect, and finalized. The missing alignment between these two evolutionary processes can bring about disastrous consequences.

The historic centers of cities and their cultural inheritance are the storehouses of the mimetic pool, the place where the entirety of information and codes is gathered, conserved, adapted, and transformed. A sustainable city is mainly a city that preserves its past to produce and constantly reproduce its future. The city of Venice has demonstrated this capability for centuries, but its possible disappearance as a city—already quite probable and close—is due to two opposite forms of pressure: on one side, the inability to control and limit the pressure of the city on its environment, and on the other side, the loss of social functions and diversity and the full and uncontrolled domination of tourism as a type of monoculture that (like all monocultures) is unsustainable.

To model such a city adequately requires taking on board the epistemological, methodological, and practical considerations discussed above. Modeling urban systems requires the linking of many approaches and even many scientific languages. They should enhance an ongoing dialogue, an easy exchange of data and information, to achieve coherence among all parties.

This is what we expect from a good model.

A model should:

- not be a black box (it is essential that all who use it for planning purposes understand how it works and why it works that way—therefore, it should be a white box);
- enable the assessment of many alternatives;
- enhance participatory impact assessment of policies;
- be compatible with other models, even when these are different in their formulation and techniques;

- be parsimonious (it should not require an excessive number of variables, an excessive amount of data, and an excessive computational power);
- be flexible to different situations and contexts of use and be fed, processed, and handled with the available types of information and knowledge;
- be fast to build, at least compared to the time required to realize the project for which the model is built, and it should fit into the evolving planning cycle; and
- be reusable and never be something that can happen only once in time and space.

Looking carefully at all these preconditions, we can see that models are needed to design the new generation of UGSs that meet the following requirements.

We want them to:

- be useful for the end-users and designed in cooperation with them;
- be capable to linking them with other models;
- be easily reusable and adaptable (true frame-games);
- provide a diffused awareness of problems, hints on how to define and evaluate alternative scenarios, instruments of collective discussion and negotiation, and consistent pieces of communicative strategies;
- be built with the best available methods and techniques (which does not necessarily mean the most modern ones)—sometimes pure and simple role-plays made with paper and pencil can be useful and sufficient; and
- be inexpensive and accessible.

It is an obligatory path, but for that reason no less creative and fascinating.

Examples of newly developed games

In line with the conditions for models and UGSs depicted above, we will present some newly developed games. With respect to their typology, we refer to Feldt's proposal of classification that subdivides UGSs in four categories: frame games, empathy games, resource allocation games, and process games (Feldt & Rycus, 1988).

Frame games

FUTURE-X is a software version of the original game of FUTURE. Substantial innovations to the original game have been introduced. It contains a more statistically robust algorithm of execution. As a logical consequence of all the innovations introduced in the FUTURE-X game, the software THE TIME MACHINE was developed that eliminates the gaming part and puts all the accent on the extensive analysis and scenario construction.

FUTURE-GORIZIA (Rizzi & Zago, 1995) is an implementation of FUTURE-X and THE TIME MACHINE model on the relationships between two bordering cities Gorizia (Italy) and Nova Gorica (Slovenia).

MIMESI is the final product of a research program on the design of a frame-game started in the 1980s with the realization of the VAGUE game, with its successors NOUVELLE VAGUE and NEW WAVE. It is a territorial gaming simulation that allows one to experience different governance possibilities for the future of a city or a portion of territory through consensus building and negotiation.

Empathy games

SIMSCI is an adaptation of SIMSOC (Gamson, 1969, 1972, 1994). The industries are substituted by scientific laboratories, different theoretical perspectives by political ones, media by publication outlets, and judicial by granting agencies.

THE WORLDS OF NEW MILLENIUM (Cecchini & Montanari, 1993) is a role-play game: Players simulate a global conference where the destiny of the planet in its environmental, economic, and political aspects has to be decided.

Resource allocation games

CAT (Cellular Automata Tool) is based on the use of cellular automata in the territorial analysis (Batty & Xie, 1994; Cecchini, 1999a; Couclelis, 1985; Tobler, 1979; White, 1996). The software CAT allows the easy definition of entities (states of the cells) surrounded by the spatial preconditions and transition rules. Having resolved the problem of the simulation in this manner, the definition of roles and the modalities of decision making is open and can be freely defined.

AUGH! (Rizzi, 1999) represents a family of UGSs. It has taken us to the realization of specialized automata and to the idea of the multiautomata. From these experiences was born the idea of realizing scenarios based on Cellular Automata, to be used in environmental education. The software has been applied successfully in the study of the real-estate market trends in a Spanish city.

Process games

The first gaming simulation exercise that UNCRD developed in 1984 was called REPLEX, signifying “REgional Planning Exercise.” In 1995, UNCRD developed a new gaming and simulation exercise for regional planning focusing on sustainable regional development, PANGAEA (Kanegae & Kaneda, 1996). The new game is based on the building of a nation in a young virtual island-country, presumably located somewhere in Asia and the Pacific Region. PANGAEA enables participants to improve their behavioral skills such as negotiation and coordination to understand the complexity of the planning process and to formulate plans in rational manners supported by microcomputers.

Summary

Urban systems are social systems. Their physical parts, that is, their land use, can adequately be modeled in terms of formal, mathematical models. Here we do not refer to the traditional approach. For reasons expressed above, we favor so-called self-organizing models, inspired by the artificial life paradigm of cellular automata, neural networks, and multiagents models (Cecchini, 1999b). It is not necessary that these models be omnicomprehensive and completely coherent. They can be of different types, each of them adequate in describing different aspects of the physical part, but they must enable intercommunication and represent modules of a generic description. These models are open to the interventions of social actors. That social part is constituted by roles and rules. The formal model simulates physical processes and evolves partially via the roles and rules that represent the gaming component of the metamodel. As a consequence UGSs are open, hybrid models.

These models serve a new conception of planning that fits into the tradition of regulative and rational planning. They do not pursue a reductionist optimal solution based on a narrow technical rationality. They explore different possible paths and allow an understanding of the realm of complexity, the interconnections between the different parts, and the characteristics of the emerging social system. They aim at enhancing governance based on utilizing interactive learning environments for policy makers. Due to the very nature of gaming simulation, UGS models encapsulate the capacity to develop the apprehension and learning skills of decision makers on all scales by provoking the opening of the mind in a continuous search for improvement.

Note

1. Dawkins (1976, 1986) defines this unit of information as the particular patrimony of the species, that is, culture—the transmission of capabilities, knowledge, and abilities through the memes, which allows the human species a sort of inheritance of acquired attributes that accelerates and diversifies its evolutionary process.

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Tools for understanding the limits to growth: Comparing a simulation and a game

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During 30 years as a systems analyst and teacher, this author has been constructing models to understand and convey key principles related to the long-term causes and consequences of physical growth on the planet. In this article, he describes two different models that he has developed to accomplish these goals. One was employed as a computer simulation; the other functioned as an operational game. In comparing them, the author points out many differences between the two tools and indicates two important challenges for this profession.

KEYWORDS: *Club of Rome; collapse; exponential growth; gaming; global models; limits to growth; overshoot; simulation; system dynamics.*

I am writing this article for newcomers and more experienced professionals who use computer models or operational games to understand or convey basic principles of social system behavior. I am especially interested in those who want their work to produce concrete, constructive changes in the behavior of important decision makers. That goal has been the central focus of my professional life, and my approach to attaining it has slowly changed. During the past 30 years, my emphasis has shifted from designing large-scale computer simulation models to developing literal operational games to creating brief metaphorical games. I will focus on the first two stages of this development and describe two of my creations that had very similar scopes and objectives.

I intend that the discussion will reveal how the two approaches differ in their processes of creation and use. It should also provide a backdrop to my final description of two challenges that will confront the field during the coming decades.

Major questions

Global population tripled during the 20th century—from less than 2 billion people to about 6 billion. Industrial production, use of energy, and materials consumption have all grown by much larger factors. What has caused the explosive growth in these and other major physical features of global society? Where is this growth leading us? Are there initiatives that could be undertaken now to give us more attractive options

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than the ones that will be produced by simply letting nature take its course? Once you know useful answers to these questions, how can they be communicated to others?

I first became interested in these and a set of related questions in 1969. That year I started a 12-month trip that took me through 100,000 kilometers of European and Asian countryside on the roads from London, England, to Colombo, Ceylon, and back. That trip confronts one with civilizations that have gone through cycles of growth and decline and growth during the past three millennia. It gave me an enduring fascination with the long-term causes and consequences of growth.

My training had been in system dynamics, a method pioneered by Professor Jay Forrester at MIT to elucidate underlying causes of behavior in social and other complex systems. So, of course, I automatically used system dynamics techniques as I started addressing these big questions. As they say, “When your only tool is a hammer, everything looks like a nail.” Fortunately, the system dynamics tool was extraordinarily well suited to my needs.

Overview

After returning from my odyssey, I led a team at MIT that developed a global computer simulation model, WORLD3. In the period 1970 to 1972, scenarios produced by the model suggested that the planet’s limits to growth would soon be reached and declines of population and economy would be the results. This would occur within 50 years unless there were rapid and widespread efforts to stabilize population, slow the growth of material consumption, and increase equity. These results were reported in three books, which my team members and I wrote (D. L. Meadows & D. H. Meadows, 1973; D. H. Meadows, D. L. Meadows, Randers, & Behrens, 1972; D. L. Meadows et al., 1974). I will refer to these as TGE, BTL, and DGFW, respectively.

Our reports attracted a great deal of attention—there were translations into more than 30 languages and sales of several million copies. Nevertheless, I eventually concluded that most people who read the book did not understand the basic ideas we were trying to convey. They passively accepted our scenarios as predictions rather than interpreting them as illustrations of alternative possibilities for taking action. They did not accept or reject our conclusions through analysis of our underlying assumptions; rather, they became fans or foes of our research, depending on whether it agreed with their prior expectations about the future. They did not inform themselves about our model sufficiently to experiment with it and derive their own scenarios.

In retrospect, I can see that we should have anticipated all these difficulties. The concepts, even the graphical representation methods, of system dynamics are very difficult to grasp without extensive training. That training is unavailable to most readers of our book. Since I have come to that realization, an important part of my professional life has been devoted to finding other ways to communicate our basic findings, so that they would be more accessible, more persuasive, and more likely, therefore, to be adopted as the bases for effective action.

In 1984 I embedded the essential features of WORLD3 into a computer-assisted, role-playing game, STRATAGEM. That also achieved widespread interest. The game has been translated into at least 10 languages, and several thousand copies have been manufactured for use around the world.

STRATAGEM was used in entirely different ways, and it did ameliorate several of the problems we had experienced with WORLD3. For example, players were forced to study and grasp the underlying assumptions of the model to play the game. Also, each play of the game produces a slightly different scenario, so participants are less likely to accept any particular outcome as a prediction. Despite its popularity, I eventually concluded that the game, too, leaves most of its players unaware of the deeper lessons I have been seeking to convey. More recently I have been working to develop much simpler, metaphorical games that quickly illustrate key insights about exponential growth and physical limits. A recent article in *Simulation & Gaming* (D. L. Meadows, 2000) described this continuing evolution with brief descriptions of its various stages.

In this article I will concentrate in much more detail on the computer simulation and the game, summarizing some main features of each. A discussion about the similarities and the differences between two tools that were developed for the same purpose nicely serves the purposes of this special collection on the state of the art and science of simulation and gaming.

Methodological considerations

There is a set of methodological issues inherent in any mathematical modeling effort. These govern the choice between models and games, to some extent. They also constrain the uses of both types of models.

Learning in new ways

Our species confronts a revolutionary new fact. Short-term decisions taken by individual actors in a local context for the first time have the potential to cause long-term, irreversible, global damage to the planet's important natural systems. This has resulted from the expanded number of actors (individuals and firms) and from the explosive growth in the power and the scope of the technologies under their control. Understanding the mechanisms involved in this damage, developing more suitable ethics, and designing the instruments for an effective global response to it are all challenges that will become increasingly urgent during the next several decades.

Normally social learning occurs by seeing a problem, experimenting with a solution, observing the mistakes, improving the solution, and trying again. This works relatively well when the problems have only short-term, local, and reversible consequences. Problems related to growth in population and industry are long-term, global, and irreversible. If our early efforts to solve them are flawed, we will inevitably suffer grave consequences. So we have to learn in a different way. One approach is by making models of the underlying system, using those models as a kind of radar to project the future consequences of different policies, and then picking the policy set that seems to offer the best future. Doing this requires that one be clear about the function of the model or game.

Selecting the function

A model is a tool. One does not ask whether a tool is true; the concern should rather be with whether it is useful for a specific purpose. Consequently, it is important to begin any discussion of a specific model with an explicit description of the purposes for which it was intended. Generally, there is at least a pretence that any global modeling effort is undertaken out of an objective, scientific concern for important problems. However, many unscientific motivations have also lead to modeling efforts. For example, global models have been created to justify a preexisting point of view, decision, or policy recommendation. Some have been undertaken merely as a public relations strategy to enhance the reputation or credibility of their authors or sponsors.

Even where the model is created through objective, scientific efforts, many goals are possible. A dynamic model may be developed to provide at least five different types of information.

1. Absolute, precise predictions. (On which date and time will the next 100% eclipse of the sun be visible from New York City?)
2. Conditional, precise predictions. (If the reactor's emergency core cooling system fails, what will be the precise maximum pressure that must be accommodated within the containment vessel?)
3. Conditional, imprecise projections of dynamic behavior modes. (If corn prices were fully stabilized, would the fluctuations in pork prices become larger or smaller?)
4. A conceptual framework useful for summarizing and communicating a set of important interrelationships. (What terms and relationships should be used to anticipate the impact on employment in the town that might be observed from a reduction in property tax rates?)
5. A purely philosophical exploration of the logical consequences of a set of assumptions without any necessary regard for the real-world accuracy or usefulness of the assumptions. (If the force of gravity were reduced by half on the earth's surface, what would be the influence on car fuel efficiency?)

WORLD3 and the other serious global models developed in the period 1970 to 1980 were designed to provide information of the third sort. In retrospect, however, I believe the fourth goal is the more important. The problem today is less that we derive wrong answers than that we ask the wrong questions.

The goal of providing conditional and imprecise projections rather than precise predictions was mandated for three reasons. First, social systems are by their nature unpredictable in the absolute sense. Because any prediction made about the future of a social system becomes an influence on social policy, the prediction itself may change the system's behavior. This phenomenon is known as self-defeating prophecy. Second, the incomplete understanding of cause and effect relationships in social, political, and other systems combined with incomplete and inaccurate data makes accurate models impossible. Third, models are only useful if they are simplifications of reality. (For example, a full-sized map of the journey from New York to Los Angeles would obviously be of little use to a driver planning the trip.) As soon as the model omits details of the real system, it can give only incomplete portraits of behavior.

However, conditional, imprecise projections of dynamic behavior modes can be very helpful to policy makers, for those who are genuinely concerned about important, long-term problems and eager to find ways their effects can be ameliorated.

Picking the time horizon

A cardinal influence on the design of any dynamic model is its time horizon. Time horizon is the interval of time during which the model must represent the behavior of the system and the full implications of relevant policies. One could, for example, study global population with a time horizon of a few months, a few years, a few decades, or a few centuries. The choice among these does not depend on the phenomenon. It is driven by the questions that must be answered and the policy concerns of those who will use the results. The choice of time horizon is extremely influential. The causal factors and important relationships will differ enormously, depending on the choice of time horizon. For example, changes in soil fertility would be omitted from a model, which encompasses a few months. During this short a period, there would not be any change in fertility. This variable, however, might be exogenous for the short-term model. It would be endogenous for most models that seek to understand population growth for decades or longer because growth of population influences the pressure placed on the agricultural system, thereby affecting soil erosion. Loss of land fertility, on the other hand, lowers food output and raises the death rate. That affects population.

A discrete model is one in which the continuously evolving patterns of a system are approximated by a sequence of discrete points, each corresponding to a snapshot of the system at a point in time. Both the simulation model and the game program are discrete models. The solution interval is the time elapsing between two snapshots. The number of calculation cycles required to trace out one full pattern of behavior in the model will be the time horizon divided by the solution interval.

One of the most important differences between a computer simulation model and a game lies in the allowable number of solution intervals. For a model it can be arbitrarily large. In our WORLD3 analysis, for example, we used a time horizon of 200 years and a solution interval of 0.5 year. So the computer had to carry out 400 cycles of analysis to produce one scenario. For a game, practical considerations limit the number of cycles to no more than 10 to 40. Human participants have neither the time nor the patience to carry out the same cycle of analysis more than a few dozen times.

We designed WORLD3 to portray 200-year patterns of change in the material aspects of global society—from 1900 to 2100. This very long horizon forces one to bring within the boundaries of analysis many causal factors that are normally ignored or treated as exogenous, such as depletion of nonrenewable natural resources and population growth. The model has five main sectors representing the interrelation of changes in the level of population, nonrenewable natural resources, agricultural production, production of goods and services, and the generation of persistent pollutants.

In the game, time horizon is much shorter. Players interact with the model through 10 cycles of decision making; each cycle, or solution interval, represents 5 years in the development of the region in their game.

We shortened the time horizon of the game model to 50 years for two reasons. First, we wished to focus on the issues confronted by a single country or region in response to rapid population growth. Because we were not including in the model data representative of many different countries at many different stages of development, we could shorten the period of interest.

Furthermore, an operational game must balance two considerations. The interval of time between the successive states must be short enough that it does not skip over important behavior. It is impossible to have a very large number of cycles in the game without boring the participants. I normally find that 10 cycles of play are enough to permit learning in the early rounds and mastery in the final ones. So I settled with STRATAGEM on 10 cycles of play, each representing 5 years in the evolution of the region represented in the game. If we had kept 200 years as the time horizon for STRATAGEM, it would have forced us to use 20-year cycles. Two decades is a long time in the development of a region. Much can happen during that time that would fit between the cycles and be invisible.

Finally, with a computer simulation model, it is useful to include a historical period to demonstrate that the model can reproduce past data. With an operational game, that is not necessary or even possible, because the participants naturally want to start exerting their own policy influence in the first cycle of play.

Designing the appropriate physical implementation

The physical appearances of WORLD3 and STRATAGEM are very different. The first is a classic computer model. Data are entered into the model via a keyboard and the screen portrays the trajectory of different variables out to the year 2100. Normally one analyst operates the model, and one simulation of the model now takes less than 1 second on a desktop microcomputer.

STRATAGEM involves a playing board, pieces, role descriptions, and decision sheets. Players make their decisions by moving small chips around the board. The game operator translates these moves into data that can be analyzed by the model. Players receive sheets summarizing the results of their actions. STRATAGEM is complex; at least five people are required to play the game. Introducing, playing, and debriefing one 50-year session of the game generally requires about 4 hours.

Introduction to WORLD3

The model was created at MIT during the period 1970 to 1972. We started with a profoundly important asset—the global model conceptualized by Jay Forrester

(1974). The model was initially coded in the computer language DYNAMO; more recently we have expressed it in STELLA. The WORLD3 project lasted 2 years and involved a team of 17 technical and administrative staff members from six countries. The project became the foundation for three books cited previously. I directed the work; it was financed by the Volkswagen Foundation in Germany at the instigation of an international group of statesmen, the Club of Rome.

The Limits to Growth (LTG) is a short text, just more than 200 pages in English, and it was intended for a wide variety of readers who had an intelligent concern about the implications of longer term global trends. *Dynamics of Growth in a Finite World (DGFW)* is a technical treatise, almost 650 pages long, specifically intended for analysts who wish independently to reproduce the scientific findings of WORLD3 or to extend the model for application to other related issues. *Toward Global Equilibrium (TGE)* describes a collection of small models that we created to test and elaborate various features of the larger model. All three texts are still in print and are used in current teaching and research.

LTG unexpectedly became a worldwide phenomenon. The storm of debate about the findings reported in the book stimulated political and scientific interest in global modeling. It quickly led to the creation of more than a dozen groups. These were established around the world to develop their own global models for use in confirming, criticizing, or extending the results reported in *LTG*. A profound summary of these early models is provided in D. H. Meadows, Richardson, and Bruckmann (1982).

In 1992, on the 20th anniversary of the original publication, three of the original coauthors examined data on the main global trends for the period 1972 to 1992. They compared those numbers with projections that had been produced by WORLD3 in 1972. There were very minor differences. To explain and reproduce the past 20 years of history, only eight relatively small changes were required in all the hundreds of equations and coefficients of the original 1972 model—too insignificant a difference to justify changing the name of the model.

This updated version of WORLD3 was used to carry out analyses and produce scenarios for a new text by D. H. Meadows, D. L. Meadows, and Randers (1992), which reaffirmed the original *LTG* conclusions from the perspectives of the early 1990s. This book had much more limited impact. However, it was translated into nearly 15 languages and attained bestseller status in countries as diverse as Austria and Japan.

During the past few months, we have again updated the data tables presented in the *LTG* book and have revised the computer projections. Suffice it to say that the model projections still correspond with reality—we see no reason to change the basic conclusions first published in 1972. Except, of course, the global society is now 30 years closer to the turning points in population and industrial production.

Introduction to STRATAGEM

Many people were fascinated by *LTG*. They had neither the technical expertise nor the computer equipment required to analyze the model themselves. In casting about for a medium that would give a wider spectrum of the public a hands-on relation with the model, Donella Meadows and I developed a new model that was similar to WORLD3 in its goals and philosophy, although drastically different in mechanics.

The STRATAGEM model is much simpler than WORLD3. It is derived in many important ways from that predecessor. It also has five sectors representing interconnections among population, energy production and use, agricultural production and environmental protection, production of goods and services, and international trade and foreign debt. We added an international sector, which was not required in the globally aggregated WORLD3. We eliminated domestic nonrenewable resources. They are not centrally important to the economies of Central America, which were our generic reference point in developing the game.

STRATAGEM was created at the International Institute for Applied Systems Analysis during the period 1983 to 1984. It was originally coded in a simple version of BASIC. More recently we have converted it to TrueBASIC, which gives us efficient run-time code for both Macintosh and PC computers.

I directed the effort, developing the game for use by the U.S. Agency for International Development. A four-person team carried out the work in collaboration with a steering committee composed of senior personnel from the United Nations Industrial Development Organization, which is based in Vienna. It was originally intended for use by U.S. government officials. It has come to enjoy a very wide and diverse audience among high schools, universities, and corporate training programs.

WORLD3 and STRATAGEM are similar in one important way. Both use a set of mathematical equations to convert decisions into results. The technical results of the two models are reported in great detail in publications that are widely available. Bibliographic references to the most important references are given at the end of this article, so the technical results will not be the focus of this text.

Goals of WORLD3

The main purposes and convictions that motivated the Club of Rome to support the WORLD3 project were reported in the preface to *LTG*:

> To foster understanding of the varied but interdependent components economic, political, natural and social that make up the global system in which we all live; to bring that new understanding to the attention of policy-makers and the public worldwide; and in this way to promote new policy initiatives and action.
>
> All are united by their overriding conviction that the major problems facing mankind are of such complexity and are so interrelated that traditional institutions and policies are no longer able to come with them, nor even to come to grips with their full content.

The statement of objectives by our team in *DGFW* was somewhat more technical:

> There are only four possible behaviour modes that a growing material factor can exhibit over time-continued growth, asymptotic approach to some limit, overshoot of the limit

with diminishing oscillations, or overshoot of the limit followed by decline (or in severe instances, collapse) to a lower level.

The mode actually observed in any specific case will depend on the characteristics of the carrying capacity—the level of population that could be sustained indefinitely by the prevailing physical, political, and biological systems, and on the nature of the growth process itself. One of these four basic behaviour modes must characterize any physically growing quantity, such as pollution, productive capital, or food output. The purpose of WORLD3 is to determine which of these four behaviour modes is most characteristic of the globe's population and materials outputs under different conditions and to identify the future policies that may lead to a stable rather than an unstable behaviour mode.

Major assumptions of WORLD3

Two of WORLD3's sectors focus on factors that grow in the global system through their own internal, reproductive forces:

- Population: incorporating the effects of all economic and environmental factors that influence the human birth and death rate, and thus population size.
- Capital: including the manufactured means of producing industrial, service, and agricultural outputs, and their growth through investment and decline through depreciation.

Growth in these sectors tends to occur exponentially (like compound interest in a savings account). This means that the size of the important variable in each sector (people and capital) determines the size of the annual addition to that sector. In short, it takes people to make more people, and the more people you have, the more new ones you can make in the future (the same goes for machines and factories). Other factors grow in the global system. Their expansion is driven by population or capital growth.

In WORLD3, population and capital grow exponentially, unless they are impinged on by the three sectors depicting parts of the global system whose capacity for growth is limited. In the model it was acknowledged that technology can improve, raising the limits, but not indefinitely and only at progressively greater costs. These three sectors are the following:

- Agriculture: including land and other factors influencing the effects of capital inputs on food production.
- Nonrenewable resources: representing the fuel and mineral inputs required to make use of the capital stock for producing goods and services.
- Persistent pollution: representing the long-lived persistent materials produced by industry and agriculture that may reduce human life expectancy, agricultural productivity, or the normal ability of ecosystems to absorb harmful substances.

In addition to these central factors, WORLD3 included several hundred key variables that affect and are affected by what goes on in the five main sectors. For example, the effectiveness of birth control is partially determined by the overall state of development of the economy, the fertility of land is partially determined by the presence of persistent pollution, and so forth.

Major results of WORLD3

One always needs to be very careful when talking about the results of a simulation model. Such models will produce, literally, an infinite number of results, depending on the policy assumptions. The results reported especially in a popular book such as *LTG* are chosen to reflect the concerns and perspectives of the authors and the clients. In *LTG* and *DGFW*, we published output graphs showing values of seven variables:

1. Population.
2. Industrial output per capita.
3. Per capita food production.
4. Persistent pollution.
5. Remaining reserves of nonrenewable resources.
6. Crude birth rate.
7. Crude death rate.

They depict the behavior of the model during a 200-year period from 1900 to 2100 for 14 different sets of assumptions about technical progress, social policy, and value changes. The supporting technical report, *DGFW*, shows many more runs for more variables. However, the additions do not change the central results reported in *LTG*.

The dominant mode of behavior is overshoot and collapse. Population and industry grow above the levels that can be supported. Some limit intervenes (land scarcity, depletion of nonrenewable resources, high levels of pollution, or related factors). Then, population and industry decline to lower levels (often 40% to 60% of their peak values), and there is a gradual approach to equilibrium. Normally the peaks are reached in the interval 2030 to 2060.

The result should not be surprising to any engineer who has witnessed similar behavior in other systems characterized by explosive change, limits, and long delays in the control system. Seeing curves representing global population that expressed this common behavior was surprising.

All the analyses of *LTG* have been careful to point out that collapse is not inevitable. The model can be adjusted with coefficients that produce a family of much different scenarios—futures characterized by sustainable development. In these scenarios the precipitous declines in population and industrial output described above are nowhere in evidence. Instead, growth is slower during the years preceding the turn of the century and then things stabilize at a much higher level. These scenarios cannot be obtained by technical changes alone. They are only observed when technological policies that increase resource recycling, reduce persistent pollution generation, and increase land yields are combined with social policies that stabilize population and industrial output.

Goals of STRATAGEM

STRATAGEM is a teaching tool; it was not intended for use in research about development. However, it has been used by scholars in research about human decision making, in studies that focus on the capacities for individuals and groups to understand, talk about, and manage complex systems.

An advisory group was assembled to advise on the project. It collaborated in identifying about 15 major insights related to a region's success in attaining a sustainable development path. Those insights were built into the model. To play the game successfully, it is necessary to understand each of the principles and their interactions. Because the game is played iteratively, it is not necessary to understand all the principles ahead of time. During the play, teams develop their goals, analyze their decision options, and estimate which decision set will be most useful in moving them toward their goals. Then, they make their decisions and record them. Their actions are entered into the computer, which calculates their impact on the ensuing 5 years in the development of the region represented by their board. Initially, the group makes major mistakes in estimating the results of their actions. From the analysis of error comes much more powerful understanding.

Because the game is highly motivating, people work very hard to make their country successful and it can also be used for team building. Playing the game gives a unique opportunity for groups to learn how they can function together more effectively as they work to measure, analyze, and control a complex, nonlinear system with delays, and major uncertainties.

A key concept in WORLD3 and STRATAGEM is shifting loop dominance. This refers to the process by which one feedback loop replaces another as the dominant influence over the behavior of a system. For example, in STRATAGEM, in the early decision rounds when there are still many unexploited energy resources, the loop governing energy production and energy exports is the dominant influence on the system. It is in this sector that the greatest investments should be made. Once the marginal returns to investment in energy have become low, dominance shifts to social services and the environment. A decision that produces excellent results when one loop is dominant can be destructive when another loop has assumed dominance.

Readers who studied our computer projections in *LTG* were witnessing the effects of shifting dominance. They had no way to trace out its consequences without performing many experiments with the model. Participants who play STRATAGEM directly experienced this phenomenon. Teaching those involved in the game to recognize when control of the system has shifted to a different loop and giving them an opportunity to decide on appropriate responses is a major contribution of the game.

Listed one by one, the ideas underlying the game seem quite obvious. When a STRATAGEM player is under intense time pressure or is confronted by teammates who have a different understanding of the cause-effect relationships or have different goals, then keeping all these principles in mind becomes extremely challenging. Teaching how to do it is a major goal of the game.

The game is not won or lost in the usual sense of these words, although teams can compete with each other in providing the best standard of living for the people of their country. Winning is more accurately measured by the success of the players at keeping their country steadily advancing on the development path of their choosing, despite the obstacles. Players will learn that there are many paths to sustainable development. The team must agree on one strategy and pursue it consistently over the long term.

Major assumptions of STRATAGEM

There are two important differences between WORLD3 and STRATAGEM. First is that WORLD3 must be a self-contained model; STRATAGEM must be left open to influence by those playing the game. To analyze WORLD3, one sets a variety of coefficients to values that reflect assumptions about the physical and cultural world. Then, the model is run for a period representing 200 years. Adaptation, the setting of new goals, errors in perception, differences in values, and all of the social factors and processes that are relevant to the purposes of the run must be reflected in the fabric of the model's equations. With STRATAGEM, main decisions are taken by the players themselves. Goals, errors in perception, and adaptation are the responsibility of the players. So, the STRATAGEM model can be much simpler; it only needs to keep track of physical flows, financial variables, and biological processes.

The second difference is that STRATAGEM only represents a region. Shortages of food, resources, or goods within the region may be compensated through imports. Obviously, that is not true for WORLD3. So international trade, price changes, and foreign debt are important concepts for the game. They do not need to be represented in WORLD3.

Results of STRATAGEM

STRATAGEM has been played by groups as diverse as 16-year-old students in Budapest and senior corporate officials in New York. Government agencies in Canada, Hungary, Latvia, and the Soviet Union sponsored major projects to translate the game and disseminate it nationally to their high school students. It is used by management consultants. Sessions have been played by senior officials in the United Nations. The World Bank recently bought 100 copies of STRATAGEM for use in training sessions with senior third world officials. More than 4,000 STRATAGEM sets have been manufactured in nearly a dozen languages. Several tens of thousands of participants have played the game. It has unambiguously fulfilled its principal goal.

Beyond that, it has revealed characteristics of decision making that are shared by players around the world. There is a common failure to appreciate long delays in the dynamics of important variables. Phasing is very difficult to achieve by a group. For example, in the society represented by STRATAGEM, it takes much longer to build new energy supply capacity than it does to construct productive capital that requires energy. Therefore, energy shortages often occur in the course of the game because the players have built up industrial or agricultural capital without allowing sufficient time to secure the energy required to operate the capital.

People confuse average with marginal returns. Most of the economic data available on past performance and current conditions use averages. Marginal returns are the relevant criterion. For example, it may be that the average energy production per unit of capital is still quite high, even though the next dollar invested in the energy sector will generate essentially no additional energy.

There is a dominant tendency to address shortages by producing more rather than by stressing a more efficient use of what is already available. In STRATAGEM, energy shortages can be reduced by producing more energy or by building more energy-efficient production capital. Industrial production can be increased by constructing more factories or by educating the work force to be more productive. In both of these and many other areas of the game, the players' first instinct is to increase the physical means of production rather than to look for less direct ways of enhancing productivity.

And players generally ignore the externalities of their production decisions, even when the externalities are large enough to make ostensibly profitable decisions into grossly unprofitable sinks for capital. This is illustrated in the industrial sector. It can seem profitable to build more factories for production of material goods. However, every unit invested in industrial factories requires corresponding investment in energy facilities. Both industrial and energy production damage the environment. So the decision to build factories also entails either investing in environmental protection or paying the costs of lost food production that result from environmental deterioration. The tendency in the game is for players merely to compare the costs of investment in new factories with the benefits of increased material production. This can look very profitable. When the externalities are also added in, that means when the factory investments are combined with the costs of energy and environment, the expansion can be quite unprofitable.

These externalities exist in WORLD3 and STRATAGEM, but only in the latter are those using the model forced directly to calculate out and make allowances for them.

The game also reveals important social dimensions of decision making. For example, in a diverse group, seniority or rudeness often prevail over analysis, and decisions can reflect the personal, irrational preferences of a dominant player rather than any strategic plan based on the underlying dynamics of the STRATAGEM model.

In short, STRATAGEM reveals many of the difficulties that afflict decision making in real political and industrial institutions.

The game also shows the capacity for learning. Groups that live through the collapse of their country during a STRATAGEM session can draw important implications from the experience and return for a much more successful session. To do this, they need to experience the full life cycle of collapse, an experience that is denied those of us who are trying to manage global issues more effectively without an adequate learning environment.

Lessons learned and implications

It is presumptuous to pontificate about the future of an incredibly diverse field of activity from two narrowly focused tools. Nonetheless, it is not often that someone has experience during more than 15 years of using both a simulation model and a game with similar underlying theoretical structures. So I will offer a few insights. The following suggestions are not advanced necessarily in order of their importance.

Maintaining access long term

An embarrassing characteristic of our profession has always been that we produce simulation models and games without sufficient documentation to make them thoroughly understandable to analysts and users outside the group that developed them. You may be able to get the code for a model, but it is very difficult, often impossible, to obtain the empirical assumptions and the code changes necessary to reproduce published model runs. I once taught a graduate course in which each student selected a model-based article from a refereed journal. Their goal was to reproduce the published results precisely. In more than 80% of the cases, that was impossible, even with the help of the articles' authors. Most games are not documented sufficiently for others to run them; almost none come with a clear description of the nature and the basis for the causal assumptions implicit in the game's underlying model.

Now these problems are compounded by the rapid change in hardware and software. I must invest very significant resources at least every other year just to keep WORLD3 and STRATAGEM compatible with the never ending upgrading of operating system, storage media, hardware, and computer programming language. Even persistent effort is not enough. Users write me every week about difficulties they have trying to use our software on their specific systems. You can assume that any game or model developed more than 5 years ago is now unusable. The developers no longer remember precisely what they assumed, and they do not have the written records to remind them. The software, hardware, and storage media have all evolved new formats. Our field has a sort of collective Alzheimer's disease—it has lost its long-term memory. How can we advance as a discipline if our best products can no longer be used and evaluated after a few years?

Declining attention span

In the 1970s, I offered 2-week courses in system dynamics theory and practice. I got the enthusiastic participation of senior corporate and government managers. In the 1980s, I could not attract this same caliber of people to a 2-week seminar. I had to offer workshops no longer than 1 week. In the 1990s anything longer than 1 to 2 days was prohibitive. I expect the next time I offer a course on the fundamentals, senior managers will ask me just to summarize the essentials and send them in a fax. Improvements in computer technology have reduced somewhat the time required to master new paradigms and tools, but not by a factor of 10-50. How can we maintain an informed audience for our products when the people we wish to reach can no longer afford to spend much time away from their phones, e-mail, and offices?

These two problem areas may sound daunting. But in my experience, models and games give such advances in teaching effectiveness that they warrant our efforts in finding solutions.

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Simulation in international relations education

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For the past 50 years, scholars and practitioners of international relations have used simulations as experimental, predictive, and educational tools to model real-world environments. This article will focus on the educational applications of simulations in international relations (IR), first reviewing the development of IR simulations and then tracing this history by examining the International Communication and Negotiation Simulations (ICONS) Project at the University of Maryland as a representative example of this genre. It will examine in particular the use of information technologies in facilitating and delivering simulations, and conclude with a brief discussion of how computer-assisted simulations have, in some cases, anticipated trends in the real world of diplomacy, and in others, attempted to respond to new trends.

KEYWORDS: *active learning; ICONS; internation simulation; international relations; Internet-delivered simulations; POLIS; simulation/gaming; teaching with technology; virtual diplomacy.*

For the past 50 years, scholars and practitioners of international relations have used simulations to model real-world environments. Simulations can be conducted as experimental tools to allow researchers to develop and test theories of decision making and other processes. Simulations can also be used as predictive tools to help policy makers weigh various outcomes. Finally, simulations can be used as educational tools to help student participants understand the way the international system works and to apply decision-making theory to the solution of real-world problems.[1] Although the reasons for simulating the international system have remained relatively constant over time, the types and structures of these simulations have changed dramatically since 1950, owing in part to shifts in theory and politics during that period. Of particular interest is the role that technology has played in fostering innovation in the design and delivery of simulation exercises for educational purposes.

Although the use of simulations for research purposes has declined since the 1950s and 1960s, the use of international relations (IR) simulations for teaching purposes has rapidly expanded, with representations becoming more complex owing to the technology-mediated tools available.[2] In education, simulations give students the opportunity to learn experientially and have been shown to "develop different skills from [conventional] classroom teaching—especially those of being imaginative and

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AUTHORS' NOTE: We would like to thank Tim Wedig for his research and editorial assistance, and Victor Assal, Elizabeth Kielman, and Jonathan Wilkenfeld for their helpful comments and suggestions.

SIMULATION & GAMING, Vol. 32 No. 4, December 2001 537-551

innovative" (Winham, 1991, p. 417). Such exercises place participants in roles and require them to overcome various obstacles in their pursuit of goals (Walcott, 1980, p. 1). Simulations of the international system can create worldwide laboratories for learners, helping them to gain understanding of the complexity of key issues (Starkey & Wilkenfeld, 1996, p. 25) by navigating the international system from the perspective of real-world decision makers.[3]

This article will focus on the educational applications of simulations in international relations, first reviewing the development of IR simulations and then tracing this history by examining the International Communication and Negotiation Simulations Project at the University of Maryland (Starkey & Wilkenfeld, 1996) as a representative example of this genre. We will focus in particular on the use of information technologies in facilitating and delivering simulations. Finally, we will conclude with a brief discussion of how computer-assisted simulations have actually anticipated trends in the real world of diplomacy and what simulations must do to accurately reflect real-world trends.

The roots of international relations simulations

Simulations in international relations have their origins in war gaming. Militaries have long used simulations to train officers in battlefield decision making and tactics and to test strategies and develop battle plans.[4] The tradition of simulation in international relations has benefited greatly from the close relationship between the foreign policy and military (strategic and policy) communities in the years following World War II. In addition to shared research projects and public scholarship in professional journals, the communities learned from each other and built incrementally on early simulation and gaming exercises. Guetzkow (Guetzkow, 1995, p. 454; Guetzkow et al., 1963, p. 26), for example, has reflected on the utility of the Rand Corporation's early work on its POLEX simulations in his conceptualization of the Inter-Nation Simulation, but notes that it was his interest in the social psychology of groups that led to his focus on simulating the interactions between the actors in the system. In that vein, Gredler (1994, p. 104) distinguishes between "tactical-decision simulations," where participants interact with a complex situation (such as a crisis), and "social-system simulations," where participants interact with each other to drive the simulation forward. Both types of simulations are well represented in the discussion below.

Within the field of international relations, simulations have long been used to enhance the decision-making and negotiation skills of practicing professionals. Winham (1991, p. 411) traces the linking of negotiation and simulation to the early 1970s, when the U.S. Foreign Service Institute (FSI) used 1-day negotiations as a training device. Since then, a number of internationally focused nonprofit organizations and university programs have established specialization in international negotiation, using simulations as an important training tool. The dual focus is very useful in developing negotiation skills for the many conflict resolution endeavors undertaken at the official and unofficial levels.[5]

The educational use of simulations for nonpractitioners has grown as a result of its success in a training context. Some of the more well-known exercises for educational audiences have included the Model United Nation[6] and its many regional spin-offs, including Model Organization of African Unity (OAU), Model Organization of American States (OAS), and Model European Union (EU), as well as a host of other exercises representing various dimensions of international relations, including the Inter-Nation Simulation (Guetzkow, 1966), GLOBUS (Bremer, 1987), Diplomacy (Skidmore, 1993), Nations (Herzig & Skidmore, 1995), Global Problems (Lantis, 1996, 1998), and the International Communication and Negotiation Simulations (ICONS). There are also many IR simulations that have been developed and offered on a smaller scale—sometimes to individual classes or between colleagues on a few different campuses. Examples of these exercises, such as Crisis, Grand Strategy, and SALT II, were presented in Walcott's Simple Simulations (Walcott, 1980; Walcott & Walcott, 1976). Additional examples appeared in a series of articles in Foreign Policy Analysis Notes in the early 1990s, including "The 1990 Middle East Crisis: A Role-Playing Simulation" (Caldwell, 1991) and "Potential U.S. Intervention in Peru: A Simulation" (Moreno, 1992). A more recent collection can be found in Lantis, Kuzma, and Boehrer (2000). It is difficult to establish a comprehensive list of simulations, as they have been presented in such a wide variety of publications and forums during such a long period of time.[7]

These simulations have in common their effort to recreate important aspects of the international system—from the tools and levers available to state and nonstate actors in the system—to the many connections between issues of concern in the international arena. However, there are also important differences in their approaches, highlighting the competing theoretical approaches to international relations of the realist and liberal-institutional schools. Diplomacy, for example, stresses alliance behavior in illustrating the zero-sum relationships between states, whereas Nations and Global Problems illustrate non-zero sum aspects of relations as well, including trade and aid endeavors (Skidmore, 1993, pp. 49-50). The Chlorine Game (or Global Management of Organochlorines) includes nongovernmental actors and takes a collaborative problem-solving approach.[8]

Many of the exercises that have gained large followings during the past several decades, whether they be crisis-oriented or not, focus on the international negotiation arena as the simulation environment.[9] This leads to the question of why negotiation in particular lends itself to simulation activity. The answer can be found in diplomacy's inherent focus on process, for example, joint problem-solving endeavors that are a cornerstone of successful negotiations. By nature, diplomatic negotiation involves iteration, with opportunities to learn by doing and then implementing this learning in the following round of negotiations. Knowledge gained in one situation or episode can be applied to negotiations at other times—with the same counterpart(s) or on the same issue area. Knowledge in relation to the issue area(s) at stake in the negotiations grows, as does the cognitive complexity of participants who must deal with the interrelatedness of their many concerns.[10] The phases of negotiation and the subprocesses so central to its success can be successfully modeled in simulation exercises, including strategic decision making, bargaining, caucusing, decision making, and debriefing.[11] There is also ample opportunity to model the cultural aspects of international negotiation, with its emphasis on different frameworks for viewing key concepts such as cooperation and interest convergence (Cohen, 1997; Crookall & Arai, 1995).

The role of technology

The growth of computer technology following World War II has greatly affected the way simulations are conducted and delivered. This has been particularly striking in the research simulation context. A simulation starts with the specification of initial conditions (parameters bounding the simulated world), a set of actors, and rules for interaction between the actors. Before computers, the only way to generate outputs was to use humans to process and act on the simulation inputs. Although mathematical models could be used by a control team, to provide continuing inputs as the simulation progressed, these models were necessarily limited in their complexity because of calculating difficulties. Person-machine hybrids, such as the Inter-Nation Simulation, took advantage of computers to automate various simulation functions, such as calculating outcomes resulting from various actions.

The goal of using all-computer simulations was to allow outcomes to be solely dependent on the initial conditions programmed into them. This facilitated theory building by allowing researchers to formulate hypotheses derived from complex premises, to explore the effect of chance and model parameters on outcomes, and to permit replication (Guetzkow, 1995, p. 455; P. E. Johnson, 1999, p. 1511). With a sufficiently powerful computer, a researcher can develop and run an “arbitrarily complicated” model (P. E. Johnson, 1999, p. 1518). Obviously, though, as human inputs have diminished, there is greater and greater distance between simulations conducted for research purposes and simulations conducted for educational purposes. Guetzkow et al. (1963, p. 11) reflected on the use of the Inter-Nation Simulation (INS) for teaching and research purposes, but the current literature on simulations tends to discuss their use either in the context of all-machine research simulations or all-person or person-machine educational simulations.[12]

As computers have become more powerful and less expensive, their use in education has become significantly greater. Research-type simulations can be used within a classroom setting to give students the ability to track differences in outcomes that result from differences in inputs. Barry Hughes’s International Futures simulation, which simulates global development issues and allows the exploration of alternative futures, is a good example of this.[13] However, in the absence of sophisticated artificial intelligence, computer simulations (as opposed to computer-assisted simulations) are not up to the task of teaching more than the most basic concepts in the field of international negotiation and decision making.[14] As Bates (2000) notes, “Humans are still much more able than machines to deal with uncertainty, with value-laden decision-making, and with complex problem-solving. Thus, for educational purposes, it is essential to combine human-machine interaction and human-human interaction" (p. 41).

Accordingly, a very significant development stems from the use of computers as a communication, not computational, tool: the ability to link human participants at distant locations to negotiate with each other. The earliest trials of "distributed" simulation exercises were performed by Professor Robert C. Noel of the University of California at Santa Barbara, who wanted to see whether the game would retain its essential elements if the participants were physically removed from one another. Working from a scenario dealing with nuclear proliferation issues and set in the Middle East circa 1973, the participating country-teams in the POLIS simulations were students in undergraduate courses in international relations at various universities in California. Although they were not sophisticated, these trials demonstrated the feasibility of distributed gaming exercises by showing that the dynamics of the interactions were not distorted by the medium of communication (Wilkenfeld & Kaufman, 1993).

Accordingly, the most recent advance involves simulations and games delivered via the Internet.[15] There are two particularly noteworthy trends in the Internet-simulation arena: (a) second generation exercises, built around the "computerization" of older, popular simulations; and (b) a new breed of simulations that use technology to add previously unavailable dimensions to the simulation process. These developments can be seen in the work of large-scale simulation groups, such as that of the Interactive Communications and Simulations Group (ICS) at the University of Michigan.[16] ICS began to offer IR simulations in 1973, but shifted to mostly electronic delivery of exercises in the 1980s with the development of the CONFER computer-based system. Guetzkow's groundbreaking INS was transformed more than once into a technology-delivered exercise, through Bremer's work on SIPER (1977) and subsequently on GLOBUS (1987). The ICONS model is also based on an earlier model, the POLIS exercises, run by Noel out of the University of California system in the 1970s.

Improvements in the user-friendliness of computer systems have also had a dramatic effect on the use of computer-assisted simulations in education. Computers are now seen as tools to be utilized across the entire range of disciplines, and universities have made a priority of integrating information technology into curricula outside of the hard sciences, giving rise to the growing field of instructional technology. The Teaching Theater program at the University of Maryland, for example, was instituted to enhance the learning experience through the use of state-of-the-art technology.[17] Simulations, which can serve as experimental laboratories for social science students, are now much more accessible.

ICONS as an illustrative model

At the University of Maryland, home to the ICONS Project, the computer has been the vehicle for delivery since the earliest foreign policy exercises were conceived in the early 1980s. Nevertheless, ICONS has still had to respond to advances in technology and to situational changes in the international system that have enhanced the importance of many new actors and issues in the global arena. An examination of the course taken by ICONS during the past 15 years reveals much about the role of IR simulations in the post–cold war classroom, as the ongoing technology-led transformation of communications discourse changes the nature of education and politics (Blake & Morales, 1999; Starkey & Wilkenfeld, 1996; Wilkenfeld & Kaufman, 1993).

Development and structure

ICONS evolved out of the Program in Global Issues established at the University of Maryland in the early 1980s. The purpose of the program was to teach students about the "interdependence of global issues and the behavioral interdependence of nations" using simulation methodology. This was accomplished through participation in two distinct simulation activities: Hughes's International Futures (IF) simulation and a foreign policy simulation based on Noel's POLIS foreign policy simulations. The focus of the POLIS exercise was on group decision making in primarily conflictual situations, whereas the IF simulation served to illustrate the interdependence of global development issues (Wilkenfeld, 1983).

Originally, the ICONS foreign policy simulation was designed to illustrate behavioral interdependence and focused on primarily conflictual issues.[18] As late as 1989, the list of conferences conducted during the simulation reflected a Cold War emphasis on power relationships. Examples include START, NATO, Middle East, Sino-Soviet Summit, and Afghanistan (ICONS Project University Simulation Scenario, January 1989). With the end of the Cold War, though, there has been a transformation in international relations, with what was called "low politics" becoming increasingly important elements of state interest. To accurately reflect these trends, the ICONS simulation has evolved throughout the 1990s to encompass many of the issues in the IF simulations. (Current exercises have subgames focusing on issues such as global warming, public health, and the global trading system, in addition to traditional security topics such as the Nuclear Nonproliferation Treaty.) In so doing, the focus has shifted somewhat from simulating foreign policy interactions among states in conflict to simulating negotiations among states regarding issues that are not strictly zero-sum. In developing scenarios, ICONS now focuses primarily on those problems where states have distinct differences in interests and capabilities but where there are gains to be realized from cooperative action.

Despite these changes, ICONS simulations have retained the same basic form over time. It is in the underlying design or "deep structure" (Gredler, 1994, p. 12) of simulations that we find the connection of the exercise to aspects of the real world, for example, the diplomatic arena. Winham (1991) writes that the "advantage of using simulation to teach negotiation is that it promotes subjective understanding of negotiation processes that are difficult to convey through other methods" (p. 415). There are some aspects of negotiations, he goes on to say, that students are "not likely to understand fully until they have lived through them." This is certainly true of the complex process of reconciling preferences across many issues with single or multiple negotiation partners. Simulation structures involve conceptual, role design, process, and procedural components. The structure of an ICONS simulation is as follows:

Conceptual. A scenario outlines the preliminary negotiation issues to be discussed (e.g., human rights, trade, security, etc.) and describes the simulation process. Questions for discussion help to define the scope of the coming negotiations.

Role design. A class of students is assigned to play one or more country-teams in the simulation. An International System simulation includes countries from all regions of the world, whereas various regionally based simulations (such as Europe, Africa, and the Americas) quite naturally include only countries from those regions.[19] An ICONS simulation includes 10 to 20 country-teams, and is facilitated by SIMCON (SIMulation CONtrol), who is responsible for administering the simulation and providing feedback to the students.

Process. Preparation is the first step of the simulation process. Because the scenario is only a brief overview, each country-team (class of students) must conduct research on the country whose decision makers it has chosen to portray, as well as the issues to be negotiated, so that it will be able to develop national goals and strategies for the negotiations. The negotiation phase of the simulation itself normally lasts from 3 to 5 weeks. It is an interactive model, with students driving the pace and controlling the direction of the negotiations.

Procedure. Participants in ICONS's negotiations communicate in two ways, intended to mirror the kinds of interactions that negotiators have with each other in the real world. The first involves sending statements or communiqués (asynchronous communications), mirroring day-to-day contact between states; the second revolves around real-time conferences or summit meetings set at preestablished times and focused on a specific agenda (synchronous communications). After the specified negotiation period, faculty members conduct debriefing exercises, with participants reflecting on goal achievement and lessons learned.

In the end, what is important is not the number of agreements reached, but increased student understanding of the process of international negotiation. In fact, during debriefings we often emphasize that the difficulty that the students have in hammering out international agreements shows how successful they have been in determining and acting on their assigned country's interests. The ultimate effect of simulation participation, as Torney-Purta (1992, 1996) discusses, is supporting the development of more complex and sophisticated representations of the international system. Vavrina (1992) also notes that active learning promoted high levels of participation among his students and that ICONS "works in no small measure because it is fun" (p. 57).

Evolving technology

The development of the ICONS Project since the 1980s also illustrates the influence of advances in information technology. Until the mid-1990s, the software used to conduct the simulations was a variant of the original POLIS software (POLNET II), which was specially designed to support the pedagogical goals of the exercises. Participants used telnet to link through ARPANET, NSFNET, or a commercial network to a server at the University of Maryland. Although POLNET II met the needs of simulation participants, it was not user-friendly and required substantial training. By 1995, the World Wide Web and related technologies made it possible for ICONS to provide users with an easy-to-use interface, coupled with accessibility from any computer with an Internet connection and a Web browser. After examining and testing some commercial communication packages, ICONS developed an entirely new software package, ICONSnet,[20] which replicates and enhances the essential features of POLNET II in a Web-based database application.[21] The combination of ease of access and ease of use has made it possible to offer simulations to more diverse audiences than ever. Potential participants are not constrained by technical expertise.

The Internet has also improved how students prepare for negotiations.[22] Rather than relying on books and secondary resource materials available in libraries, students now have access to a wide range of primary sources, including official government statements and newspapers from the country or countries that they are researching. Besides allowing students to view issues from diverse perspectives, these documents are also likely to be more current than printed materials. For students of negotiations, this makes for a much richer inquiry into the issues for negotiation and a deeper simulation experience.

Advances in technology present further opportunities for educational simulations.[23] One obvious application is to take advantage of increasing bandwidth and use Internet video conferencing to inexpensively emulate face-to-face interactions even over great distances.[24] Moreover, tools such as "white boarding" packages could allow students to jointly edit treaty drafts and view and discuss proposed map changes. Internet2 and its related technological advances will provide even more opportunities for exploring simulated environments. The National Tele-Immersion Initiative, for example, will bring together individuals at distributed sites and allow them to collaborate as if they were in the same room.[25] Another intriguing possibility is the development of decision support systems to help teach students how to evaluate complex information to improve their negotiations under crisis conditions. The Generalized Decision Support System (GENIE) Project developed by Jon Wilkenfeld and Sarit Kraus at the University of Maryland is one such endeavor (Wilkenfeld et al., 1995). A final challenge for implementing new technology in simulated worlds will be in reflecting the growing use of information technologies in real world diplomacy, a trend that simulation programs such as ICONS actually anticipated.

Afterword: Simulating real-world trends

As Rosecrance (1999) wrote recently, "Today—as technology, knowledge and capital become more important than land, the function of the state is being further re-defined" (p. 5). Consequently, representations of the international arena, a crucial component of simulations in international relations, must be updated to meet changing realities. The end of the Cold War and the rise of a postindustrial economy have necessitated a rethinking of all educational materials used in the teaching of international relations, including simulations. Contemporary exercises should reflect two important international trends: the enhanced role of nontraditional actors and issues and the increased use of new electronic modes of communication and mobilization.

New IR encompasses ethnic and transnational dimensions of conflict in addition to the traditional state-to-state modes.[26] In negotiation, this means increased attention for Track Two approaches, for example, which focus on the societal level of analysis and "citizen diplomats" working for nongovernmental organizations (NGOs) or individually outside of the formal political arena. Issues at stake in international negotiations have broadened tremendously as well. The high politics of military security have been augmented by economic and environmental security needs and by the competing identities that threaten political stability the world over. The protests at the Seattle World Trade Organization meetings in 1999 demonstrate the growing importance of formerly "low politics" issues such as trade, as well as the increasing visibility of NGOs and citizen groups in international discourse, as well as the role the Internet plays in organizing like-minded individuals across borders.

The combination of high-speed communications and greater citizen mobilization is beginning to affect formal international negotiations as well, resulting in what the U.S. Institute of Peace has termed *virtual diplomacy*—"political, social and economic interactions that are mediated through electronic means rather than face-to-face communication" (Solomon, 1997, p. v).[27] Kurbalija (1999, pp. 186-187) discusses the impact that new information technologies are having on the practice of diplomacy, and notes that properly utilized, they can allow diplomatic systems to shift from a territory-oriented approach to a task-oriented organization. This would allow better integration of diplomatic missions into foreign policy decision making, as well as permitting more productive use of subject matter expertise, something that could be especially important for smaller countries. Langhorne (1997, p. 8) points to a concrete example of the new diplomatic age, "shared diplomatic missions" in Asia where a handful of South American countries have begun to augment their physical presence with a virtual one.

Furthermore, as new electronic communities grow and become actors in their own right in the negotiation arena, there is a new "digital media protocol" (Brown, 1997, p. x) that permeates traditional borders and manifests itself in faxes, teleconferencing, and Internet communications between parties with interests in various conflict situations. PC-based video conferencing is one such channel that is being explored in the actual international system, as well as simulated representations. The use of digital mapping devices is another area where real international negotiators have begun to experiment more with new technologies. R. G. Johnson (1999) describes how shared dynamic visual aides such as these maps can transform the conflict resolution process, something that can be replicated within a simulation environment.

As the international system becomes more complicated and technologically advanced, simulations can make valuable contributions to IR research. As P. E. Johnson (1999, pp. 1525-1526) notes, computer simulation has already proven useful for exploring cooperation in anarchic environments and could be the right tool for investigating research problems in the fields of complex systems, where there are many interdependent actors, simultaneously making decisions and adjusting their positions. Druckman (1994) notes the value of experimental simulations in research on techniques for conflict resolution, whereas Wilkenfeld (2000) observes that the experimental explorations of foreign policy can help to "fill in gaps in our knowledge and ultimately allow us to generalize beyond our limited experiential environment."

The impact of new actors and new technologies is only beginning to be felt, much less assessed. To remain current, simulations must take into account these emerging realities. By providing a flexible, dynamic learning environment, they are capable of guiding students in an exploration of the new international system. Proven long ago to be an effective mode of experiential learning, IR simulations can now provide even more realistic representations of the complex world.

Notes

1. This article will focus on educational simulations. For further insight into experimental simulations in the social sciences, see, for example, Druckman (1994) and the August 1999 special issue of *American Behavioral Scientist* (Volume 42, Issue 10) titled "Computer Simulation in the Social Sciences," edited by N. Gilbert.

2. Guetzkow (1995) regrets the "lack of development of a Big Social Science" and the increasing fragmentation of academic enterprises that has undermined the development of "cumulative research by simulation teams" (p. 461). P. E. Johnson (1999, p. 1511) notes that in political science, empirical methods and rational choice theory have almost "crowded out" simulation as a theory building tool, but observes that simulation modeling is gaining adherents because it allows researchers to investigate the behavior of more complex models. Wilkenfeld (2000) discusses his experiences investigating crisis decision making using simulation and experimental methods and speculates on how these approaches can be used in foreign policy analysis.

3. Kaufman (1998) argues for the value of using simulations as a tool for teaching international relations. Wolfe and Crookall (1998) also support their use but discuss the need for increased research on the educational merits of simulation and gaming so that the method may be used more effectively. Vincent and Shepherd (1998) give an in-depth discussion of the development and use of a simulation for international relations education.

4. See, for example, Orlansky and Thorpe (1991). In addition, Brewer and Shubik (1979) provide a comprehensive overview of military war gaming, from its origins to recommendations for improving their utility. Furthermore, the U.S. Army War College and U.S. Air Force Air University maintain bibliographies of literature on war gaming available at http://carlisle-www.army.mil/library/bibs/wargame.htm and http://www.au.af.mil/au/aul/bibs/wargame/wgtoc.htm.

5. The Project on Negotiation of the Harvard University Law School (http://www.pon.harvard.edu/) and the nonprofit Institute for Multi-Track Diplomacy (http://www.imtd.org/) in Washington, D.C., are two such endeavors.

6. For more information about the development of the Model UN movement, see Muldoon (1995).

7. Among the publications that have a committed record of publishing international relations (IR) simulation-related articles are *Simulation & Gaming*, *American Behavioral Scientist*, *Negotiation Journal*, *International Negotiation*, *International Studies Notes* (now *International Studies Perspectives*), *Academic Computing*, and some online journals, including *Educom Review*, *Journal of Interactive Media Education*, and *Educator's Technology Exchange*. For a bibliography of publications related to active learning in international relations, see http://csf.colorado.edu/isa/sections/alias/teachtip.htm.

8. For more information, see http://www.mit.edu/people/anajam/cl-game.html.

9. See, for example, Saunders and Lewicki (1995).

10. This is true of participants in negotiations and students who are simulating such involvement. See Torney-Purta (1998).

11. See, for example, Boyer (2000).

12. P. E. Johnson (1999) provided a good overview of research simulations in political science, whereas Crookall (1995) gave a general bibliography of the literature on simulation and gaming for educational/training purposes.

13. Information on International Futures (IF) is available at http://www.du.edu/~bhughes/ifs.html. See also Hughes (1999).

14. Gredler (1994, p. 106) warns against the use of "educational" computer programs that distort social exchanges, and notes that interacting with a computer rather than human beings is not an effective way of experiencing complex social processes.

15. Some Internet-based simulations are self-contained and free of charge to the users, whereas other programs are monitored, include organized participation from various locations, and charge participant fees. For Web-based exercises, see, for example, the DAYTON2 simulation at http://www.socsci.colorado.edu/ and the tech-version of DIPLOMACY at http://www.diplom.org. Various groups also sponsor simulations of international organizations and meetings that are open to all interested individuals, such as online Model UNs (e.g., the UN Online at http://www.unol.org) and the simulations of G-8 meetings at http://www.g8online.org. Simulations that require registration by organized groups include those at http://www.Worldgame.net, http://www.ideels.uni-bremen.de/, and http://www.icons.umd.edu. The Web has also had the obvious effect of making it easier to share traditional, non-computer-based simulation through sites such as the Simulation & Gaming Exchange (http://sg.comp.nus.edu.sg) and Harvard's Program on Negotiation (http://www.pon.harvard.edu).

16. The work of such simulation and gaming associations as NASAGA (North America), SAGSET (Britain), ISAGA (international), and JASAG (Japan) are also of interest if one wants to trace developments in simulation and gaming. The new Active Learning in International Affairs (ALIAS) section of the International Studies Association is another excellent source of information on new approaches to teaching IR, including simulations (http://csf.colorado.edu/isa/sections/alias/).

17. For more information on Teaching Theaters at the University of Maryland, see http://www.inform.umd.edu/TT/.

18. A similar program, Project International Dimension in Education via Active Learning and Simulation (IDEALS), used simulations to promote international understanding and cross-cultural communication skills. See Crookall and Landis (1992). Information on a successor program, Project Intercultural Dynamics in European Education through on Line Simulation (IDEELS), may be found at http://www.ideels.uni-bremen.de/.

19. The ICONS model was extended beyond international simulations to regional negotiations focusing on Europe, Africa, and the Americas by a series of grants during the 1990s from the U.S. Department of Education's Fund for the Improvement of Post-Secondary Education (FIPSE). The funding also allowed increased recruitment of participants from these regions.

20. ICONSnet utilizes Oracle database and Web server products, and is written as a series of PL/SQL database packages.

21. ICONSnet was developed to meet a number of technical and pedagogical goals that our experience led us to believe were important to successful learning from simulations, but specialized packages are certainly not necessary for running the sorts of simulation programs that ICONS undertakes. Off-the-shelf commercial products make it possible for faculty members to provide channels for synchronous (conferencing) and asynchronous (e-mail) communications. See Vincent and Shepherd (1998) for a discussion of such an exercise. The downside to this approach, however, is that users must pay increased attention to the technical aspects, which could detract from their focus on the substantive issues. For more information about how ICONSnet is structured to meet particular technical and pedagogical goals, see Blake and Morales (1999).

22. More generally, Kuzma (1998) discusses the Web as a resource for teaching international relations.

23. See Uretsky (1995).

24. Kuzma (2000, p. 323) used ISDN videoconferencing for formal sessions of her Virtual Security Council, but notes that programs like CU-See-Me could allow for easier informal caucusing among geographically separated individuals. ICONS has experimented with video conferencing but is still searching for the proper way to balance new technological possibilities with the program's pedagogical goals (Blake & Morales, 1999).

25. For information about Internet2, see http://www.internet2.edu, and on the National Tele-Immersion Initiative, see http://www.advanced.org/tele-immersion/.

26. This is one of the themes explored in Starkey, Boyer, and Wilkenfeld (1999).

27. Information on the USIP Virtual Diplomacy initiative is available at http://www.usip.org/oc/virtual_dipl.html.

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Elizabeth L. Blake was the simulation director for the ICONS Project, where she managed simulations at the university and high school levels. She is now the ICONS system administrator and is exploring her interest in how technology can be used to advance pedagogical goals.

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Simulation/Game

FOREST TIMESCAPES

Julie England
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KEYWORDS: *action planning; deforestation; forecasting; forest management; frame game; working with partners.*

Basic Data:

Instructional objective: To forecast and visualize changes in a critical area (such as forest management) in a series of specified future periods. To plan suitable action strategies based on these forecasts.
Game objective: To work with different partners and come up with best predictions and action plans.
Target audience: Participants interested in exploring environmental issues.
Playing time: 30 minutes to 2 hours. (The game can be shortened or lengthened by changing the number of time spans and the amount of discussion times for each round.)
Number of players: 4 or more; best game involves 10 to 25 participants.

Originally designed as a simulation game related to forestry management, this game can be used as a frame game for the exploration of any environmental or social issues.

Flow of the game

Brief the players. Present or review key factors and trends that affect forest management around the world. Involve players in a brief discussion of how these factors interact with each other.

Pair up the participants. Explain that the game involves 10 rounds of discussion during which each player will work with a different partner. Ask players to choose a partner for the first round.

Ponder on the distant future. Ask the first question: Thirty years from now, how would the world's forests look? How will the local communities manage these forests?

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Encourage participant pairs to discuss the topic and forecast changes in a variety of viewpoints such as environment, industry, science, technology, politics, international cooperation, and climate. Assign a suitable discussion time and suggest that partners take notes about the important elements in their forecast.

Conclude the first round. Ask partners to stop their discussion at the end of the allotted time. Ask a pair of volunteers to present a summary of their forecast. At the end of this presentation, invite any other pair of volunteers to present a better forecast. If nobody volunteers, then award 5 points to the first pair of volunteers. If another pair presents its better forecast, ask the remaining participants to vote on the two presentations and award 10 points to the winning pair. (This scoring arrangement is optional. If you prefer, you can just invite all volunteers to present their forecasts.)

Provide feedback. If appropriate, ask an expert to comment on these forecasts or give your comments. However, try lengthy lectures. Remember that the focus of this activity is to empower and encourage players to generate their own content.

Change partners. Ask each player to find a new partner for the next round of discussion.

Introduce the first action-planning discussion. Ask partners to think about the 30-year future and share the main points of their previous discussion with each other. Then ask them to develop the key elements of a 30-year forestry management plan to reduce or remove negative factors and to leverage positive ones. As before, assign a suitable discussion time.

Repeat the presentations and scoring round. As before, ask a volunteer pair to summarize the key elements of their plan. Invite other pairs to provide better or different ideas.

Conduct other rounds of discussion. Explain that the rest of the activity involves repeating the same procedure of finding a new partner, forecasting changes in forestry during a specified time period, sharing main points, finding a new partner, coming up with an action plan, and sharing key elements of the plan. Conduct these rounds with the following time periods:

- 30 months (2 years and 6 months)
- 30 weeks (about half of a year)
- 30 days

Conclude the activity with an immediate action plan. Ask players to work independently on this task. Ask each player to think back on the previous forecasts and plans and come up with a personal response to this question: What can I, as an individual, do after the next 30 minutes to take the first step in ensuring more efficient forest management by future generations? Announce a 3-minute time limit. After these 3 minutes, ask each player to find a new partner and share his or her personal plans.

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Simulation/Game Review

INFO-TACTICS: A Simulation. Sisk, D. (2000). Beaumont, TX: Lamar University, College of Education (P.O. Box 10034, Beaumont, TX 77710, USA).

Reviewed by Sandra Fowler
Washington, D.C.

Basic data:

Objectives: To learn (or relearn) aspects of the information process (analytical, chronological, emotional, and intuitive) to better sift through what is really going on as the Information Age bombards individuals with instant media images, symbols, and facts.
Target audience: Appropriate for students in the classroom; administrators and corporate employees in workshops where team building, leadership, information sharing, and communication are key issues. Can be used in multicultural situations.
Playing time: The time is 60 to 90 minutes, depending on the depth of the debriefing.
Number of players: The number is 8 to 40. Although the game could conceivably be played with 4 people (there are four teams and individuals could play as a team), the author suggests 8 as a more realistic minimum with 2 individuals per team. The optimum upper limit depends on how large the facilitator wants the teams to be. Because the teams become unwieldy at more than 10 people, multiple games could be played in a large space to accommodate a group larger than 40. The game works well with as many as 10 on a team because the intrateam interaction provides good debriefing material.
Materials included: Instructions and information for each team.
Equipment required: Paper plates, colored markers, and scissors.
Price: Send an SASE with a 55-cent stamp to the author for the instructions and team information to above address.

Teachers and trainers often are searching for an up-to-date scenario to help their students and clients learn about information sharing. Dorothy Sisk has found one in the space age. Preparation for a Mars exploration is increasing interest in the space program, so this scenario is current and likely to remain so for some years to come.

In INFO-TACTICS, four teams have been asked by Scientific Exploration International to contribute to the space program. Each request is different and the goal for each team is to convince the others of their particular contribution to the space venture. For example, the Verde Team is asked to plan a detailed chronology of a 1-year trip to the moon, whereas the Amarillo Team is asked to provide the vision of what is possible in space travel and the exploration of extraterrestrial life.

In addition to their mission, the colorful teams (Azul, Verde, Rojo, and Amarillo) are given descriptions of their communication styles. Azul team members are theoretical, analytical, and logical. They can be critical, scientific, and factual. They inevitably consider the bottom line, and technical aspects of information are interesting to them.

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Their info-tactic is “Need to Know” (in which information is given only to those people deemed to have a valid need to know), and they are the ones to decide who needs to know. The Rojo team members, on the other hand, are emotional and interpersonal. They are in touch with their feelings and exaggerate a bit, but really have trouble distinguishing between truth and misinformation. Their info-tactic is the “Vapor Tactic,” in which rumors are released along with some true facts so that others cannot distinguish truth from misinformation. These two teams provide a left-brain/right-brain contrast for the debriefing if the facilitator wants to use this.

The teams are supplied with paper plates, scissors, and colored pens to create hats that identify their teams. They make the hats by cutting out a triangle on top that creates a way for the hat to stay on their heads and then fold up the triangle so that it can be decorated and seen by others. In addition to constructing the hats, each team must prepare a 5-minute skit or scenario to inform the other teams about their group. They select a leader, think about their characteristics and goals, and are reminded to use their info-tactic. Their goal is to communicate as a team and convince the others of their leadership and the importance of their point of view regarding the space program.

The debriefing is designed to help people understand what has been going on in the game and how it relates to their everyday world. For instance, when the game was run for a hospital staff, one nurse said she became acutely aware that concealing information gives power to the person who has the information and does not share it. She said this to one of the administrators. Sisk’s goal in designing this game was to help people understand just how powerful info-tactics are. She often asks participants what they learned or relearned and uses such questions as, “Could your team actually influence the others? Did your info-tactic help or hinder? Have you used it or have you experienced it being used on you in the real world?”

The instructions for INFO-TACTICS provide a set of four debriefing questions. The first two questions assess how well the people have engaged with the simulation. The other two debriefing questions delve into the information process and leadership. Other questions could be asked depending on the overall goals of the training. For example, one of the info-tactics is Double Channel, in which the sending of alternative or contradictory messages through two different channels is used to test reactions. This is a favorite tactic of middle-school children who like to cause confusion. Playing with someone’s mind is part of the deviousness of that age. This game provides teachers with a tool for exposing what is going on and helping the victims understand how it works.

INFO-TACTICS is a very good simulation and a moderately good game. Participants do engage with the activity and enjoy preparing their skit. One problem in playing the game is that sometimes teams are so busy with their skit that they forget the other task, which is to influence others in the space program. Sisk says when that happens she stops the game to clarify the need to do both things. She finds that sometimes people are so concerned about the way they are going to say something that they forget about what it is they need to say. Dorothy Sisk is a leader in the field of creativity and it is clear that she used her creative expertise in developing this engaging exercise.

Sandra Fowler holds a graduate degree in organizational psychology, specializing in intercultural relations. In 1973, she was on the original U.S. Navy research team that contracted with Garry Shirts to develop BAFA' BAFA.' Her clients have run the gamut of the public and private sectors, domestic and international. Winner of NASAGA's Ifill-Raynolds Award and editor of the two-volume Intercultural Sourcebook: Cross-Cultural Training Methods*, she has served on the Board of NASAGA and contributed articles to* Simulation & Gaming.

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Association news & notes

ABSEL news & notes

Sandra Morgan
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Hello everyone! As this is my first column as president of ABSEL, I will begin by recapping some of the events from our San Diego meeting that have not made it into print yet. First, as Nancy reported in prior columns, we experienced much energy and camaraderie, as usual. Best paper awards went to Andrew Hale Feinstein (UNLV College of Hotel Administration) and Hugh M. Cannon (Wayne State University) for their Simulation paper, "Fidelity, Verifiability, and Validity of Simulation: Constructs for Evaluation," and to Gretchen N. Vik and Martha Doran (both from San Diego State University) for their Experiential paper, "Experiential Learning for Accountants: The Not-for-Profit Project." Marian Boscia and Brian Peach were elected as the new directors-at-large with Fernando Arellano and Jimmy Chang rotating off the board. Thanks for your international perspectives! The 2002 track chairs are Paul McDevitt for Simulation and Andy Feinstein for Experiential/Pedagogical submissions. Sharma Pillutla was elected prior to the meeting as junior proceedings editor for 2002—now he is a dual contributor as he continues as Webmaster. Thanks to Precha Thavikulwat, who has agreed to host the 2003 ABSEL meeting at Towson in Baltimore. For those of you who do not know, Baltimore is a fantastic tourist destination—many attractions, excellent baseball, great weather in late spring, and delicious food, especially crab.

For the past several years, ABSEL has focused on the three *I*s—international, integrative, and innovative. We are making progress in these areas and are beginning to focus now on our future as a "community of sharing," as Mary Jo Vaughan aptly described us in San Diego. I would add that we are also a "home community" (Morgan, 1997, *ABSEL Proceedings*, Vol. 24)—a group of people gathered together for a common purpose (i.e., learning and sharing simulations, experiential activities and research) in a certain place (i.e., usually somewhere beautiful and sunny!) who follow democratic and participative processes (i.e., support, informality, embracing differences, open communication, welcoming those who share our interests) while working together joyfully. In a home community, people feel reenergized and refreshed after meeting together; it is a place where we can be ourselves, without any posturing or politics, a place where we can feel at home. We gather together to gain energy and ideas, and to have fun—to be re-created.

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I would add a fifth "P" to the list of home community characteristics: partnership. The board discussed all five *P*s in San Diego. We considered who ABSEL attracts and whether the group could/should expand; we talked about our common focus on active, innovative business learning, which can include other program ideas beyond those we have had in the past; we agreed that we like warm, sunny locations, but need a place where it is easier to access the A-V equipment/connections we need; and we agreed that we like our current processes—the informal, collaborative, supportive nature of ABSEL, but that we need to become more electronic. We also spoke at length about forging partnerships with journals, other professional associations (we already have a strong connection to the MOBTC group in Philadelphia), and corporations. We concluded that ABSEL is healthy, but to grow and continue to be the leading organization in innovative active business learning, we need to offer something our competitors cannot.

As a result of the board discussion, four task forces were created to investigate, recommend, and act on these issues:

- Web Task Force, led by Sharma Pillutla;
- Active Learning Task Force, led by Nancy Leonard;
- Classics Task Force, led by Hugh Cannon; and
- Marketing and Membership Task Force, led by Monique Forte.

The task forces met during lunch on Friday to begin their work. We welcome additional members with an interest in any of the areas—please go to the Web site (www.absel.org) to find e-mails for the chairs and read about current activities of the Task Forces. The *ABSEL Newsletter* (Vol. 21, No. 1) on the Web site also provides more details about the task force work.

I have been actively seeking partnerships with other professional associations, one of the ABSEL outreach goals. At a meeting with Chris Poulson, OB1 (the head of the Organizational Behavior Teaching Society), and Jim Stoner, chair of MED in the Academy of Management, we agreed that active, innovative business learning is a common focus, and we are working on plans to showcase each other's best conference presentations. We also are talking about a joint international conference for 2004. I would like to get input from *S&G* readers about your interest in such a meeting. E-mail me at Morgan@mail.hartford.edu or call 860-768-4974.

I hope to see many of you in Pensacola Beach, 20-22 March, at the ABSEL meeting. In addition to our excellent program, we will have a sumptuous dinner followed by an IMAX program at the National Museum of Naval Aviation, an event not to be missed. Thanks, Richie (Platt), for your innovative local arrangements. Again, details and registration forms are on the Web site, www.absel.org.

ISAGA news & notes

David Crookall
Université de Nice Sophia Antipolis

ISAGA 2002

In 2002, we return to that magnificent northern European city of Edinburgh—during the Edinburgh festival. Book your calendars now. The information that I have is below.

Dates	Monday 26 to Friday 30 August 2002. This coincides with the Edinburgh International Festival
Venue	Edinburgh, Scotland
Hosts	Napier University. Joint ISAGA-SAGSET conference
Main theme	TBA or check SGX at http://sg.comp.nus.edu.sg/
Preliminary program	TBA or check SGX at http://sg.comp.nus.edu.sg/
Proceedings	Published by Kogan Page, London
Accommodation	From around $50 per night (B&B in student accommodation) to $150 per night in good hotel, with various mid-range options available
Cost	About $450 (including ISAGA membership fee, proceedings, and excursions)
Organizers	Professor Fred Percival and Mrs. Helen Godfrey
Address	Napier University, Craiglockhart Campus, 219 Colinton Road, Edinburgh EH14 IDJ, Scotland, UK
Telephone	+33 (0)131 455 6100
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E-mail	**f.percival@napier.ac.uk**
Web	Information not yet available

ISAGA 2003

In 2003, ISAGA may return to Japan and hold a joint conference with JASAG. Check from time to time with the ISAGA Web site, with SGX (http:**//sg.comp.nus.edu.sg/**) or with the JASAG Web site (http:**//www.fklab.world.ryukoku.ac.jp/jasag/**).

JASAG news & notes

Fumitoshi Kato
Keio University

JASAG latest activities

Please book your calendars now, as we are getting ready to host ISAGA 2003 (perhaps a joint conference with JASAG) in August 2003 in Chiba, Japan. The main theme of ISAGA 2003 will be “Social Contributions and Responsibilities of Simulation & Gaming.” We seek to explore the possible domains of our research and educational projects within the context of dramatic changes in information and communication technologies. At the same time, we hope to create an opportunity to reflect on the Association’s past activities and to redefine our contributions and responsibilities from an Asian perspective. Toward 2003, we attempt to link the conference proposals with our activities, such as JASAG’s Spring Symposium and editorials in our journal, *Studies in Simulation and Gaming* (in Japanese). Further details of the conference will be announced as we proceed to organize programs and logistics. For inquiries, please contact info@jasag.org.

NASAGA news & notes

Richard L. Dukes
University of Colorado

NASAGA homepage

The NASAGA Web site is http//www.nasaga.org. It is the clearinghouse for all information about the association. This year, information about the annual meetings in Bloomington, Indiana, appeared on the site before I saw it in the mail. Always look to the site for the most recent information.

SIMAGES, the official NASAGA newsletter, regularly appears on the site. No longer is it mailed to members. All seven issues of SIMAGES (Volume 2) can be accessed. The issues cover the span from Fall 1998 to Winter 2000.

Ifill-Raynolds award winner interview

During the next few issues of *S&G*, I will be contacting winners of this award to get their reactions to receiving the award and how the award fits into their careers in simulation & gaming. Recently I spoke with Richard Powers, the winner for 1997. He described receiving the award as "quite an experience." He was pleasantly surprised—in fact, he was "shocked." He made a presentation to the audience in which he lauded NASAGA for its work. Dick wrote about his career in *S&G* (1994, Vol. 25, pp. 226-235). A description of Dick's career can be found at http://www.nasaga.org/history/ifillwinners.htm.

As a NASAGA reporter to *S&G*, I am interested in news that concerns the organization. You may reach me by phone at 719-598-6277, or write c/o Department of Sociology, University of Colorado at Colorado Springs, 1420 Austin Bluffs Parkway, Colorado Springs, CO 80933-7150 USA. My e-mail address is: rdukes@mail.uccs.edu.

SIETAR-USA news & notes

Margaret D. Pusch
Intercultural Communication Institute

How can you enable people to learn from the experience of others? This was a topic of discussion recently, and it was agreed that you must do it experientially . . . words just are not enough. This discussion was related to helping people comprehend a different world view and way of living in the wake of the recent tragic events in New York and Washington, D.C. Experiential strategies that help people gain a visceral as well as an intellectual understanding of these complex issues are simulations, of course.

We have been using these techniques for a long time but maybe not as fully or effectively as we can. For a brief example, when asking people playing BARNGA if they are concerned about winning, how often do we explore cultural attitudes around the need to win at any cost, around conflict and how these attitudes influence actions at a collective/national level, not just at the interpersonal level? If BAFA BAFA is being conducted, the tendencies of Beta traders to take advantage of Alpha visitors can be expanded to consider how that behavior occurs in the international arena. Is this what governs trade on a macro scale? How might we be taking advantage of others by paying low wages, by allowing only a few to gain benefit from trade, and so forth? The possibilities are many.

In the end, we have to be more sophisticated in helping people apply intercultural skills and attitudes to the decisions that are made and the actions that are proposed in their communities and countries. We have to be more attuned to how we can apply our skills and knowledge to politics in public life and organizations, as well as to building effective relationships between those who work, study, and play together.

We have to become more competent in dealing with issues of ethnocentrism and ingroup/outgroup exclusionary behavior. We need to do this not only by using experiential techniques, but by reflecting on the experience that they provide at a very profound level. Maybe we will discover a new way of educating in the wake of this tragedy.

If you wish to contribute to this column, please contact me at mdpusch@pobox.com.

Announcement & call for papers

World congress

Toys, games, and media

19-22 August 2002, London, UK

The third world congress of the International Toy Research Association will be held in conjunction with the Centre for the Study of Children, Youth & Media, University of London Institute of Education. The meeting will be held at the Institute of Education, near Russell Square and the British Museum.

Call for papers

The International Toy Research Association (ITRA), founded in 1993, is devoted to the scientific study of toys in all their facets. ITRA brings together toy researchers from all corners of the globe. This is our third international meeting to discuss research, collaborate on international projects, and exchange information with other researchers, students, and leaders in the toy industry. More than 100 delegates from 15 countries attended our previous meeting in Halmstad, Sweden. The London meeting will exceed those numbers.

The Centre for the Study of Children, Youth & Media was founded in 2000 by Professor David Buckingham. It acts as a focus for research and consultancy, and for networks of practitioners in the field. Current projects focus on the uses of educational media in the home, migrant/refugee children's uses of the Internet, children's responses to sexual content on television, and media education in secondary schools and in youth/community work settings.

Conference themes

The themes of the conference are the uses and effects of toys, games, and media; toys as media; and media as toys. A wide range of approaches is encouraged from the biological, psychological, and social sciences.

Papers, workshops, and symposia are designed to explore any of the conference themes. Topics are likely to include:

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- historical analyses of children's toys and media;
- aesthetics and cultural identities in children's media;
- children's patterns of media use;
- globalization of children's culture;
- uses and interpretations of computer games;
- applications of media to health, education, and science;
- media literacy;
- comparative studies of toys and other media;
- television games;
- toy inventories at home and in schools; and
- new entertainment technologies.

To submit a paper, symposium, or workshop

If you would like to present a paper, give a workshop, or organize a seminar, please submit the requested abstract or proposal in English by 15 November 2001. Submissions may be made by post or e-mail to Professor David Buckingham, Centre for the Study of Children, Youth & Media, University of London Institute of Education, 20 Bedford Way, London, England WC1H 0AL; e-mail: MediaAdmin@ioe.ac.uk.

Papers. Papers will be limited to 30 minutes, which includes time for questions and comments. If you would like to present a paper, please submit a one-page abstract in English by 15 November 2001.

Symposia. Symposia will be limited to 2 hours, with three or four presentations on a common theme. Proposals should contain the title of the symposium and included papers along with names, affiliations, addresses, telephone numbers, and e-mail addresses of the chair and each contributor. Each proposal should include an overview of the session, not to exceed 350 words in length. The deadline is 15 November 2001.

Workshops. Workshops should be planned for a single 90-minute instructional or working session with one or two presenters/facilitators. Proposals should provide the names, affiliations, addresses, telephone numbers, and e-mail addresses of all presenters, along with a one-page abstract of the proposed workshop. Deadline for submission of the proposal is 15 November 2001. Your abstract or proposal will be reviewed by the scientific committee for its suitability to the conference. You will receive a reply in March 2002. All participants must register for the conference prior to the deadline of 30 June 2002.

Registration and fees

You may register by post, fax, or e-mail. Registration is limited, so register early. Early registration ends 30 June 2002. After 30 June, registration fees increase. Cancellations will be accepted until 15 June 2002. Registration fees will be refunded minus £25 processing costs. There will be no refunds after this date.

Registration for the conference includes tea breaks, sandwich lunch, reception, and social events.

Early registration	Until 30 June 2002	£200
Late registration	After 30 June 2002	£250
Registration for 1 day (space permitting)		£100
Student/spouse	Until 30 June 2002	£75

Payment may be made by credit card (MasterCard or Visa) or by check payable to the Institute of Education. Send registration information to Elaine Peck, Conference Office, University of London Institute of Education, 20 Bedford Way, London, England WC1H 0AL; fax: +44 207 612 6126.

Limited financial support. This is available to participants for whom registration fees and travel costs would present a hardship. Please submit your request for financial consideration before 15 November 2001, along with the abstract of your conference paper, workshop, or symposium to: Professor Gilles Brougère, Départment des Sciences de l'Education, Université Paris Nord, 99 Av. J.B. Clément, 93430 Villetaneuse, France; e-mail: brougere@noos.fr.

Deadlines.

Abstracts of papers	15 November 2001
Proposals for seminars and workshops	15 November 2001
Request for financial assistance	15 November 2001
Response from review committee	30 March 2002
Registration	30 June 2002

Accommodations. HotelScene, in conjunction with the Institute of Education, have arranged special discounted rates at selected hotels for conference delegates. Rates range from £59 to £145 per night. Further information is available from HotelScene by e-mail: confer@hotelscene.co.uk; telephone: +44 117 916 6335; or fax: +44 117 916 6336.

Some rooms are available at the student residence, John Adams Hall, 15-23 Endsleigh Street, London WC1H, a 3-minute walk from the Institute of Education. Basic study rooms are available from 18-22 August at £25 per person per night for bed and breakfast in single or twin-bedded rooms, all have washing facilities, and shared bathrooms on each floor; telephone: +44 207 387 4086; fax: +44 207 383 0164.

Social events. The Institute of Education is adjacent to Russell Square, near the British Museum, Covent Garden, West End theatres, Soho and Piccadilly. Social events are still being arranged but will include a reception hosted by the British Toy and Hobby Association. Delegates are encouraged to explore London on their own. London is one of the world's most vibrant cities, with museums, restaurants, music, and theatre to suit all tastes and budgets. If you are tired of London, said Samuel Johnson, you are tired of life.

Scientific advisory committee.

Birgitta Almqvist, Sundsvall, Sweden
Gilles Brougère, Université Paris-Nord
David Buckingham, Institute of Education, University of London
Jeffrey Goldstein, University of Utrecht, the Netherlands
Stephen Kline, Simon Fraser University, British Columbia
Brian Sutton-Smith, Professor Emeritus, University of Pennsylvania

Organizing committee.

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Sponsors.

British Toy & Hobby Association
Toy Manufacturers of America
Centre for the Study of Children, Youth & Media
University of London Institute of Education

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Telephone:		
Fax:		
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Visa/MasterCard number:	Expiration date:

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