THE ART OF SCENARIO DESIGN

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Ten weeks ago, the U.S. Ambassador to the Republic of China informed the Chinese Foreign Minister that the United States would henceforth be unable to guarantee the physical protection of Taiwan and recommended that the Taiwan government seek an early political accommodation with the People's Republic of China. Three weeks later, following acrimonious debate and increasing civil unrest, Taiwanese nationalists succeeded in ousting the Chiang regime and proclaimed the Independent Republic of Taiwan.

Senator Edward Wallers (Demo.; Arkansas) has served in the Senate for eighteen years and plans to run for reelection in November. Within the Senate, Wallers is considered a member of the "inner club," a small group of highly influential senators. Although critical of the expansion of federal social-welfare programs, he believes in greater federal involvement in the prevention of crime and juvenile delinquency (Stitelman and Coplin, 1969: 14).

The above excerpts are not from newspaper accounts or biographical essays. They are portions of scenarios.

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The dictionary defines a scenario as "an outline of the plot of a dramatic role, giving particulars as to the scenes, characters, situation, etc." But the development and use of scenarios have not been restricted to drama. They have been used to develop war plans and to study maneuvers (Giffin, 1965; Wilson, 1968), to forecast the future (Knorr and Morgenstern, 1968; Kahn and Wiener, 1967); and to evaluate public policy (Hitch and McKean, 1967). The construction of scenarios is at least as old as fiction itself, and their employment in games and simulations is only one (and not the most recent) manifestation of their usefulness.

The rapid growth in the use of games and simulations for teaching, training, and research has placed a special premium on the careful construction and use of scenarios. The success of a simulation or game involving human participants is increasingly dependent on the prior postulation of a credible game environment.

Scenario construction is an art and, as in any creative task, imagination is fundamental to success. Nevertheless, in light of a growing experience with scenario construction and usage, it is possible to suggest some considerations and techniques which can substantially clarify the construction process, freeing effort and attention for more creative tasks. Since experienced simulators will be familiar with many of these considerations, review of basic scenario construction may serve little more than to codify what they already practice. But as simulation usage expands, an increasing number of students, teachers, policy planners, and others new to gaming methodology may be tempted to try simulation as an innovative research or teaching tool. Yet the inexperienced simulator may well find it more difficult to plan and organize his game than to run it, or may interpret its results and apply them to his research design or course material. Too often, in such cases, novice simulators are forced to rely on the instruction manuals for particular games which deal mainly with the rules of the game and give little guidance for constructing sound, credible scenarios. For them, scenario design may appear to be both arduous and confusing;

and it is primarily to them that this paper is directed. Though in no sense constituting a formal manual, the sections which follow attempt to identify some of the considerations underlying almost all scenario construction[1] and suggest some techniques which the authors have found particularly fruitful for developing viable and interesting game environments.

Scenario-planning, of course, is only one element of simulation-planning, and the scenario is only one device among many which can be used to structure play. In this paper, we will not address rules of play, physical procedures, payoff calculations, and other elements of simulation design normally important to planning a run. Such considerations are usually quite sensitive to the particular game to be used—and, in any case, are usually discussed at length in the operator's manuals which typically accompany the game packages.

It should be noted, however, that the design of a scenario is not independent of such factors. As will be apparent from the discussion which follows, the design of a scenario will frequently be highly sensitive to the operating rules, player and staff resources, and feedback mechanisms built into the framework of the game itself.

FUNCTIONS OF A SCENARIO

The techniques employed to design a given scenario are sensitive to the multiple functions which scenarios, like games, can have. Several such functions can be suggested.

- Scenarios are used to establish the environmental conditions existing at the beginning of play.

By constructing a scenario, the simulator provides his players with information about both the nature and the structure of their simulated environment and the relationships which are operative in that environment. In general, scenarios can be used to give the following six types of information:

(1) *The character of all organizations in the game.* Do players represent nations, corporations, intergovernmental organizations, ethnic or cultural groups? Are all groups in the game of the same character? Is there more than one type of organization in the game? For example, in the Inter-Nation Simulation (INS), most player groups are nations, but one group functions as an International Organization. And in SIMSOC, players participate in a variety of basic societal groups ranging from the press to industry and the judiciary.

(2) *Team values.* What are a group's goals/ideals? What ideologies, if any, does a team possess? Is there some strategy which can result in a team's "winning" the game? In Erwin Rausch's game THE MARKET, players are instructed to use their purchasing power as consumers to maximize "utility points," and the player attaining the highest utility score wins. In SIMELEC (Simulated Election Campaign), the winning team is the one whose candidate is "elected" according to algorithmic determinations made at the end of play.

(3) *Team resources.* What means does a team have to attain its goals? What are its capabilities? In INS, capabilities include a basic capability which represents resources and industry, and a force capability representing military material and personnel. In the National Security Simulation (NSS), political, economic, and military actions provide the means necessary to attain agency and national goals.

(4) *Interteam relationships.* Which teams are friendly toward which other teams? Hostile? Neutral? How strong are a team's feelings about other teams? INS scenarios are generally written to include information about alliances and hostilities between nations. When Burgess and Robinson (1969) ran INS to study the effects of public and private benefits on coalition behavior, they identified five nations as members of a coalition which was bitterly hostile to a sixth country.

(5) *Intrateam relationships.* What are the relations among team members? Who, if anyone, is a boss or chief? Which roles within a team are cooperative and which are not? Although all players in the National Security Simulation are U.S. government officials, interagency rivalry, and even intraagency conflicts (between the Army and Navy in the Defense Department, for example) are encouraged by scenario inputs into the game.

(6) *Player roles.* Do players represent governmental decision makers, corporate policy planners, small businessmen, ghetto residents? In INS, players are government decision makers, while in SIMELEC they represent a candidate's campaign staff, and in SIMSOC they are residents from all walks of life in a society.

- Scenarios provide players with a "game culture" to which they can relate.

One frequently voiced complaint of simulation participants is that they have little or no sense of "history"; that is, no reference points which can guide their play. In many games, participants begin play in the midst of an ongoing situation. Given no information about the previous state of the situation, players must depend upon their own assumptions and conclusions about the game environment to guide their behavior. In relatively simple games, like two-person bargaining games, this may not inhibit player action. In more complex simulations like INS, however, failure to provide information about preexisting international relationships may virtually paralyze play, as participants search for guides to expected or rational responses.

As a game's correspondence to some familiar social reality increases, the players' requirement for game culture information decreases (being more familiar with the referent, players are able to rely more heavily on their own prior knowledge or beliefs); but the simulator's need for scenario information may well increase as a consequence of the need to ensure that players perceive the game situation in a particular way.

In short, the game culture will always reflect some complex interaction between the prior beliefs brought to the game by the participants and the scenario postulated by the simulator. The extent to which each element should contribute to game culture is an important design decision.

- Scenarios help to focus player attention on particular elements in the game environment.

Often simulation is used to teach a certain concept or to examine a particular variable or relationship. In such cases, the instructor will want his students to pay closer attention to some elements of the game environment than to others. By designing scenarios which emphasize these special elements, the simulator can focus player attention on any aspect of the game he chooses. For example, the instructor using an election game may wish to demonstrate the impact of mass media on campaign strategy. By constructing a scenario which postulates electoral districts with different media coverage characteristics, the simulator may be able to induce the players to give special consideration to the costs and benefits of advertising.

- Scenarios can be employed to induce conflict in the game environment.

A simulator may wish to induce conflict for a variety of reasons. He may wish to study certain aspects of conflict (its onset, its effects on player interaction); or he may wish to use conflict as an intervening variable between other elements of the game; or he may need to restimulate player involvement in a run which has become routinized. In each case, the scenario is a useful tool for inducing conflict.[2] Initial instructions to players may establish conflictual relationships at the beginning of play with adjustments later in the game used to add other dimensions of conflict. For example, in the dynamic scenario used in NSS, a scenario-postulated research-and-development breakthrough is employed to generate a roles-and-missions controversy among the players representing the military services. The resolution of this conflict frequently will become a central focus of player attention.

- Scenarios can serve as vehicles for the injection of experimental stimuli.

Scenarios for research-oriented simulations have the special function of initializing the experimental variables. The construction of a research-run scenario requires careful study of the variables involved and a well-planned research design for inserting them into the game environment.[3]

- Scenarios may be designed to reproduce a particular historical situation.

A special type of experimental simulation uses the scenario to recreate a specific historical situation, either for teaching or research. Such scenarios involve a great deal of careful study and research, since historical reconstruction necessarily demands a high degree of fidelity.[4]

- Scenarios can be used to maintain periodic or continuous control over play without direct umpire intervention.

A scenario need not end when the game begins. Often a simulator will wish to induce or influence developments in the game, but will prefer a less arbitrary and subjective method than the use of an umpire to make decisions at crucial points. This increasing need for dynamic environments calls for scenarios capable of generating inputs while the game is in progress. Techniques used for control of game progress are discussed more fully below.

In any simulation, the scenario must both establish environmental conditions and provide a game culture. But, obviously, not all scenarios need to fulfill every other possible function; in some games, conflict would be undesirable, experimentation useless, or continuing control unnecessary. In the final analysis, which additional functions a scenario must fulfill depend on the type and purpose of the game itself.

BASIC CONSIDERATIONS UNDERLYING SCENARIO-PLANNING

Scenario-planning is a complicated and time-consuming task, requiring much thought and attention on the part of the simulator. In constructing his scenario, the simulator needs to consider a number of factors. Three of these, however, are especially important.

The first major consideration underlying scenario-planning is the degree of control to be exercised by the simulation staff over the progress of the game by means of scenario modifications during the run. A simulator may find it necessary or desirable to monitor and direct the actions of players during the run, or he may prefer to leave his participants to their own devices and allow situations to develop undirected. Either decision, or any degree of control between the two extremes described above, will require adjusting the scenario to facilitate the degree of control desired.

A second consideration is the number of issues or problems to be addressed and developed in the scenario. There are advantages and drawbacks to using either a single-issue or a multiple-issue format. Single-issue scenarios are far easier to design and administer and are also well adapted to focusing player attention on certain game elements. Multiple-issue scenarios, on the other hand, are more realistic (in reality, problems seldom develop one at a time); they are far more flexible in terms of laying groundwork for postinitiation control;[5] and they ensure broader initial participation among players, preventing participants from being "cut out" of the game and losing interest in the simulation.

Finally, the simulator must decide whether his scenario should be crisis-oriented or not. Equally important, if a crisis situation is desired, should it be presented to the players at the start of the game or developed incrementally as play progresses? If a high level of tension is desirable and the simulator wishes to develop it during the run, the scenario must be written to accommodate the necessary postinitiation modification—a complex but more flexible situation in terms of studying crisis development and certain types of situations (such as bureaucratic decision-making) which are significantly altered during crisis.

Just as the successful operation of any simulation depends in large measure on a scenario which reflects the appropriate response to each of these considerations, the construction of that scenario depends on certain constraints inherent in the simulation situation. The amounts of control, complexity, and crisis in a scenario should ideally be determined by the purpose of the run; but the personnel, staffing and time available to the simulator place some restrictions on the complexity of the scenario. Early consideration of key factors can eliminate the problem of having a scenario which is inconsistent with the needs of resources of a game.

PURPOSE OF THE SIMULATION

Clearly, the single most important determinant of the requirements for scenario design is the purpose of the simulation. A simulator cannot begin to construct his scenario without first deciding precisely what he wants to accomplish with his run. Is he using the game for teaching, training, or research? If for teaching, what concepts does he wish to emphasize? If for training, what skills must players acquire? If for research, what variables will be examined? How will they be controlled? What data will be generated? Once the simulator has his purpose firmly in mind, he can begin constructing a scenario which will have as much control, as many issues, and as high or low a level of tension as he needs.

For example, if the simulation is a simple teaching exercise, it is usually most profitable to limit staff control and maximize the learning experience of playing the game by allowing situations to develop spontaneously through player interactions. If, however, the exercise is directed toward acquiring certain specific skills or learning very specific ideas, the scenario may have to be very issue-specific (one problem only) and may require considerable staff monitoring in order to focus player attention on the proper game elements. And a high-powered research effort in which several variables are manipulated while others are held constant may demand a very high degree of control.

RESOURCES AVAILABLE FOR THE SIMULATION

A simulator must consider more than the purpose of his run when planning a scenario. While elaborate or complex options such as tight control of play or incremental crisis development may be desirable for some simulations, they may not be feasible due to limited resources which may constrain scenario construction. Some such limitations are the time available for planning and conducting a run, participant experience with the situations they will encounter in play, and staffing requirements.

Time available: How long will the simulation run? When there is only a short period of time available for playing, too many issues or the gradual development of a crisis situation may make the simulation either confusing or boring. On the other hand, a single-issue format or an initial crisis may be unwise for a long run, since early resolution of the problem may leave participants with "nowhere to go" and lead to the elimination of conflict or routinization of the run.

Equally important, how long will the simulator and his staff have to prepare and write the scenario? If time is too limited, it will not be possible for the simulator to put enough thought and imagination into a very complex scenario. The result of a too-hasty compilation of a multiple-issue scenario, in which issue interaction and possible complications have not been adequately thought out, may be disastrous for the run.

Participants: Who are the players, and what is the simulator's access to them? Because of the expertise which comes from years of training, State Department officials and career military officers might be far more proficient in simulating high-level government decision-making than high school or college students. Complex, multi-issue scenarios can more easily be handled by players having some experience with such situations; indeed, simulators should beware of overloading inexperienced players with numerous issues requiring some kind of expertise.

No less important a consideration is the amount of access a simulator has to his players before the game. The training of participants is an essential part of any simulation. Lack of prerun briefing time can limit player familiarity with the rules and procedures of the game. In circumstances where training and briefing time is extremely limited, a simulator should avoid introducing too much complexity into the game culture. Or, if multiple issues or other complexities are absolutely necessary, he may have to adjust his training schedule to include special sessions for briefing selected groups on particular topics.

Staffing: How many staff members are available to work on the scenario and monitor the run? Complexity in a scenario demands careful planning, constant checking, and continuous monitoring. A small staff is unable to handle too elaborate a scenario without neglecting other duties and seriously impairing the quality of the simulation. Neither can a small staff exercise continuous control of game developments to any significant degree. A large, well-trained staff, however, can handle imputs and outputs for a number of different situations and deal with subtle manipulation of game conditions when necessary. A large, untrained staff, on the other hand, can easily lead to a disastrous experience.

There is no foolproof method for ensuring that a simulator has designed precisely the scenario he needs, but careful and realistic examination of the purposes and resources available for a run will certainly help him to do so.

TYPES OF SCENARIO INPUTS

Scenario inputs can be categorized according to when they are employed in the game. Background inputs provide historical information about the relationships existing in and among teams and players. Time 0 inputs give players a summary of their resources and capabilities at the beginning of play. And postinitiation inputs provide the simulator with a means of controlling the course of play after a run has started.

BACKGROUND INPUTS

Background information is critical to the success of the simulation, since it sets the mood and begins building participant expectations which will affect behavior throughout the game. Background materials are the primary mechanisms for building the game culture.[6]

Basic background information is most commonly contained in a written history which may reflect a past, present, forecasted, or fictional situation. Such a history, if well written, can implant a culture which might otherwise take several periods of actual play to develop.

For each possible scenario perspective—past, present, future, or fictional—certain considerations and warnings are in order. Each is described below, together with some guidelines for its successful use.

Reviving the past. One possible focus for a simulation is the re-creation of past events. For example, the Stitelman/Coplin game on the American Constitutional Convention teaches players the principles of decision-making by letting them take the places of James Madison, Alexander Hamilton, and others who attended the meetings which framed the Constitution. Although such an exercise can be interesting, it may also be dangerous. When Charles and Margaret Hermann (1967) attempted to simulate events leading to World War I using the Inter-Nation Simulation with a *disguised* scenario, seven of their seventeen participants successfully identified the referent situation. This becomes a serious problem if the simulation is being used for research rather than pedagogical purposes.

Playing the present. In the spring of 1972, an Inter-Nation Simulation was run at the Ohio State University to study the effects of current events on Canadian-American relations and Canadian foreign policy in general. Participants played out a scenario which closely resembled the world situation of the day—a growing threat from China, an India approaching nuclear capability, French alienation from the Western nations, and interference in the efforts of dissident French Canadians to secede from Canada. Information retrieved from the game was then examined to uncover any interesting patterns in Canadian behavior.

Playing the present is particularly useful for lending perspective to current policy problems. A simulator could perhaps create a situation similar to the present-day problems in Vietnam, NATO, or the international economic system. The failure to disguise the scenario situation adequately, however, may provide predispositional behavior by the participants. The participant who knowingly plays General DeGaulle, for example, may allow his own perceptions and opinions about DeGaulle's personality to structure his actions and responses, either consciously or unconsciously. If this type of behavior is not desired, it can rapidly lead to a disintegration of the main fabric of the simulation.

Forecasting the future. Richard A. Brody (1963) employed a future-oriented scenario in his simulation study of the "n-th country" theory of nuclear proliferation. By postulating the future development of new nuclear nations and employing postinitiation scenario devices to add members to the nuclear club periodically, Brody was able to use INS in an analysis of the effects of proliferation on system stability.

A scenario based on reasonable extrapolation of present trends can produce a very interesting game. Such games are probably most popular at the college level and in a variety of business settings. They can be used in policy-planning courses, international relations courses, economics courses, and war-gaming studies. One also finds such scenarios frequently used by researchers employing all-computer simulation (Bloomfield and Whaley, 1965).[7] The payoff from a forecast scenario depends on the quality of the forecast. A poor forecast will obviously limit the predictive capability of the simulation (though interesting processes may still emerge).

Fictional analogues. Within the classification "purely fictional" or "hypothetical," one finds a myriad of different scenarios ranging from the absurd (the Vatican becomes a nuclear power) to the "thinkable" (Quebec secedes from Canada). The scenario for the Stitelman/Coplin game DECI-

SION-MAKING IN CONGRESSIONAL COMMITTEES is a fictional analogue with a high degree of correspondence to its referrent situation. Involving the deliberations of a House-Senate conference committee over a mythical anti-crime bill, this scenario allows players to capture the realism inherent in the structure of the game without requiring that they deal with real issues or current problems.

While most fictional analogues are of the type described above, it is possible to construct a scenario which has little or nothing in common with situations familiar to players. A simulator would be wise, however, to avoid the more implausible, science-fiction types of scenarios, since a very real danger exists that the simulation might not be taken seriously by the participants. Considering the time, resources, and preparation involved in running a simulation, such a failure would be both serious and unfair to participants who are expecting an enjoyable and valuable experience.

Having determined the basic perspective and issue content of the scenario, the simulator must now decide how to present the material to the participants. Most often given is a written history of events occurring in the simulated environment prior to Time 0, the starting "date" of the simulation. The content of this document depends on

- the number of playing units (teams);
- the time span covered by the scenario (last two days, last two years, last two decades); and
- the amount of detail desired.

In addition to the basic history, one can add "accessories" as desired. But with the addition of each accessory, the cost of the simulation goes up—costs of additional planning, more staff preparation time, more participant preparation time, and greater resource requirements (higher for some accessories than for others). Creative scenario construction presents both an opportunity and a challenge to the simulator, but the question of whether an accessory adds or detracts from the overall desired effect of the exercise must always be considered.

To list here all the possible embellishments one can make to the basic scenario would be impractical if not impossible. But we might look briefly at a few categories of "accessories."

One is the video taped history. Like the written history, this can be prepared from one of several perspectives (analogous to past, present, future, or fictional situations). Its greatest disadvantage is the requirement for specialized television facilities not readily available at many institutions. Furthermore, additional advance planning is necessary, since a well-organized video script requires hours of writing, researching, staging, and rehearsing. Despite the hard work, however, the results are worthwhile. Experience at the Ohio State University with video-taped history supplements for the Inter-Nation Simulation has indicated that the video tape can create a game culture equivalent to that provided by many hours of running time. The enthusiasm of the participants (as well as the staff who prepare and record the tape) and the quality of their performance is measurably superior to that of participants who receive only a written history.

There are other accessories, more readily available than video tape, which can be used to enhance background information. These accessories fall under the rubric "simulated or fabricated documents." The variety of such documents is limited only by the ambition, creativity, and resources available to the simulator. The most common fabricated documents are old newspapers, although others might include simulated public reports, memoranda, public records, intelligence estimate tables, or budgets.

Another supplement to the basic background material is the individual or team scenario, which provides certain players or teams with information that is not available to all participants. These special scenario materials elaborate an individual's or group's specific relationships or attitudes vis-à-vis other players, give classified information regarding resources, and so on.

One of the basic maxims for the success of the simulation experience is the more background material the participant has to study and absorb, the more time he must be given to familiarize himself with that material prior to the beginning of the game. The time required is determined not only by the number of documents he must read, but also by their length, complexity, and the degree of familiarity demanded. It is important to reiterate that accessories should not be tacked on solely for cosmetic purposes. There should be a reason for including every item in a package of scenario materials. The simulator must carefully consider the implications of everything he includes. He does not want to overwhelm the player with irrelevant information (unless, of course, he is exploring the effects of information overload); nor does he want to risk the danger of reducing the credibility of the simulation exercise.

TIME 0 INPUTS

Time 0 inputs include the initial values of basic game variables–types and amounts of resources, development capabilities, absolute power relationships–which are in effect at the beginning of the simulation. Background information may be supplemented by a current newspaper, a statement of the relationships between teams, a supplement to the history which might introduce sudden new developments, public opinion polls, advisers' reports, and the like. In the INS, for example, the teams learn the state of current natural resources, military capabilities, decision latitude, and public satisfaction before play begins.

In games whose models incorporate specific payoff mechanisms through which players are confronted by the consequences of their actions, it is important to consider the interaction of Time 0 inputs with expected payoffs. For example, in INS, the probability that the central decision maker (the player acting as the leader of his "nation") will remain in office is dependent, in part, on his ability to mobilize political support for unpopular resource allocations. This capability, denoted "decision latitude" in the simulation, is originally specified as a Time 0 input. By specifying a certain decision latitude, the simulator can operate through the player's model-based reward structure to make him more or less sensitive to political attack and thus constrain his perception of his ability to operate freely in the game environment. For example, if the scenario postulates the existence of a small, underdeveloped nation with an unstable political regime, the simulator must be careful to arrange the Time 0 input (in this case decision latitude) to conform to that description, and induce the appropriate behavior.

The preparation and distribution of Time 0 materials does not differ significantly from that of background materials; indeed, it is vitally necessary that they be prepared simultaneously to ensure coordination between past and present states of the simulated environment.

Most initial parameters can be distributed to all players, although a few may be released only to certain individuals or teams. In the INS example mentioned above, players receive accurate information *only* for their own countries; the initial parameters which they receive for other teams are only approximate values.

Time 0 inputs are perhaps the most important scenario materials, since they alone are required to begin play. The simulator should make certain that no essential materials have been omitted; such omissions could paralyze player activity for want of information.

POSTINITIATION INPUTS

Under most circumstances, scenario construction ceases with the establishment of initial parameters. Once these are disclosed, players assume their respective roles, and play begins. It is then expected that the game environment will develop automatically from the interaction among players (or, in the case of man-machine simulations, between players and the computer model). The simulator ceases to influence players and, except for resolving occasional ambiguities in rules and procedures, can expect to take no further part in the development of the game.

In some circumstances, however, it may be desirable or necessary for the simulator to alter the game environment after play begins. When a simulation is being run for research purposes, it may be desirable to inject an experimental stimulus during the course of play. It may be necessary to redirect a game which appears to be moving in a direction ill-suited to its intended purpose, or it may be necessary to restimulate player involvement lost as a result of the failure of some anticipated situations to develop. For these and other reasons, the simulator may wish to modify the context in which play is occurring. Whenever the simulator comtemplates an input to the game during play, he is dealing with a third type of scenario input: the postinitiation input.

Whether such inputs are to occur at all is a decision of crucial importance. From the experimental standpoint, the injection of scenario changes during play always constitutes a stimulus, and therefore has implications for both within-run validity and between-run reliability. Even when the simulation is being used for teaching, scenario modification during the run risks loss of spontaneity and realism. Taken to extremes, such modification can result in a rigidly structured game in which scenario-umpire interaction takes place after virtually every player decision.

All postinitiation modifications fall into two very broad categories—planned and unplanned.

Unplanned Modification

Unplanned modifications are inputs created during the course of play. They may involve radical alteration of game variables or procedures or may require the development of an entirely novel procedure on the spur of the moment.

For example, in one run of INS at Ohio State, it was found useful to permit two nations to integrate politically—though no provision for such a procedure is contained in the rules for participants. Such modifications may be desired for a number of reasons. For example, a situation may develop during the course of play on which the simulator would like to capitalize.

Or players may be ignoring certain situations which were posited in the scenario. Unplanned modification provides the simulator with a mechanism for utilizing a good development or rectifying a bad one.

Even in situations such as these, unplanned modification may do more harm than good. Simulations run for research purposes, for example, must adhere to research designs which do not allow arbitrary modification of game variables. In addition, unplanned modifications may possibly modify more than the simulator intended to change. Such unforeseen ramifications can drastically alter the complexion of a game.

Planned Modification

A planned modification differs from an unplanned modification in that both its substantive character and the mechanism by which it is to be input are specified in advance. Planned modifications can be input in one of three ways: (1) spontaneous input; (2) sequenced input; and (3) contingent input.

(1) Spontaneous input. In this mode, a preplanned modification to the scenario is made at the discretion of the simulator. Its purpose may be to speed up a slow game development, introduce conflict in what appears to be too passive play, or restructure the game environment radically[8] in order to observe player reactions. For example, in Gamson's SIMSOC, a variety of experimenter-induced "natural disasters" can be used to rupture the normal plan of interregion communications, imposing an additional element of stress. Alternatively, an "invasion" can be announced, with a consequent resource cost.

Note, however, that even in this relatively unstructured situation, the alternative scenario modifications, while *spontaneously inserted,* are *not spontaneously generated.* On the contrary, particular care must be taken to ensure that a new scenario input does not clearly contradict some aspect of the preceding development of play or assume knowledge on the part of players which they do not, in fact, possess. Because spontaneous modification risks both confusion (on the part of both players and staff) and loss of realism, it should be undertaken only with extreme care. The alternative control actions should be prespecified, and the decision to modify should follow a careful consideration of the possible advantages to be gained.

(2) Sequence input. When planning time and operating staff resources permit, this mechanism can be a useful way of avoiding the risks involved in spontaneous input. The essential component of a preplanned modification sequence is the development of an input schedule. Coordination of the schedule with background information helps to avoid inconsistency between initial conditions and postinitiation inputs and ensures that players will have the information necessary to react to the new condition before any input is made. The sequencing of several successive inputs adds a developmental quality to the environment, so avoiding the radical transformation frequently accompanying spontaneous input. Thus, for example, sequenced input can be a useful way of developing crises, when an initial crisis framework is not desired, and when the experimenter does not expect that the crisis situation will develop automatically as a result of play.

Finally, sequenced input is probably the best method of introducing an experimental stimulus when the game is being used for research. Sequencing the input ensures both control and between-run reliability. Brody's (1963) simulation of nuclear proliferation and Burgess and Robinson's (1969) simulation of coalition-building provide particularly good examples of the use of sequenced modification.

(3) Contingent input. Although sequenced input is probably a substantial improvement over spontaneous input, its use is constrained in many cases by the possibility that the game's development may render an intended input irrelevant or unreasonable. Contingent modification attempts to meet this problem while retaining the dynamic quality and controlled

flexibility of sequenced input. As the term implies, contingent input involves the insertion of preplanned scenario changes *if* and only if play develops (or fails to develop) in an expected way. Like sequenced input, contingent input involves the use of programmed changes according to a prepared schedule. It differs, however, by making each discrete input decision a function of the state of the scenario at the scheduled input time.

In its simplest form, a contingent input could be an instruction to stop inserting sequenced inputs after some player action makes further modifications unnecessary or irrelevant. At the other extreme, contingent input may involve the construction of an elaborate set of decision trees, arranged to provide several alternative inputs at each interval. The choice of input, then, rather than the decision to input, becomes a function of preceding player action at each scheduled input time. Construction of this latter form of contingency scheme is a complicated task, demanding close familiarity with the game and a substantial amount of preparation. For a complex, multiple-issue scenario, this sort of scheme can quickly get out of hand, and its operation can become confusing and unwieldy. In this case, it may be best to develop the contingent input sequence only for one issue stream, and either use one of the other forms of postinitiation modification for other issues or simply leave them to free play. Since construction of the more complicated version of the contingency program involves prefabrication of three or four inputs for each one which will actually be used, its preparation requires substantial time and effort.

One can simplify the use of contingent input somewhat by planning types of patterns of input rather than the specific inputs themselves. Thus, when the schedule calls for a modification, the program offers a type of input (hostile event, friendly event) corresponding to the state of play (war, peace); the simulator then tailors the specific input to conform both to the predesignated type and to the existing game situation. Since the actual tailoring does not take place until just prior to insertion, it is vital that this be done by some person at once intimately familiar with the purposes and premises of the game, and completely informed about the current state of play. In addition, if intelligence reports, news releases, memoranda, and the like are to be used to input information, it is often helpful to have them prepared by someone familiar with the format and phraseology of such documents. A well-prepared, plausibly written input can add greatly to the realism of the modification. The use of contingent insertion has implications for run-to-run consistency, and therefore its use must be carefully considered when the purpose of the game is research. Contingent modification does not necessarily undercut control of intervening variables, but it does make that control a more complicated task, and this consequence should not be ignored at planning time. If it appears that reliability of data will be impaired, sequenced input may be more appropriate, even though it is less flexible.

Finally, when either sequenced or contingent insertion is employed, it is often helpful to prepare the actual documents ahead of time to the extent possible, and to disseminate the input schedule to all major operating staff personnel. The former helps avoid log-jams and confusion in the control room, while the latter ensures that staff members will not give conflicting or contradictory information to players.

There are several conceivable mechanisms for inserting postinitiation modifications. In his simulation of nuclear proliferation, Brody used changes in quantitative parameters (resources available to players) to introduce the modification sequence. Burgess and Robinson employed a confederate player to initiate prespecified messages and take prearranged actions according to a carefully developed schedule. In the National Security Simulation, the experimenters employ control-developed news releases, intelligence reports, and diplomatic cables. If facilities permit, closed-circuit television or public address equipment may be used to disseminate news "flashes" quickly to all players. Whatever vehicles are finally chosen, it is most important that they not differ significantly from the regular information-disseminating mechanisms used during the game, so that the players will not recognize a certain input as an obvious control intervention. Rather, the modification should meld as closely as possible with the kinds of communication used by players themselves.

CONCLUSION

In the preceding paragraphs, we have attempted to clarify some of the principal considerations underlying scenario development and to suggest some useful mechanisms for planning and constructing scenarios.

It is perhaps worth noting that much remains to be learned about the impact of scenarios on game outcomes. A recent article (Simon, 1972), for example, describes the differential impact on essentially the same game of scenarios postulating war and business respectively as the game contexts. The more complex the game structure, the more difficult it becomes to establish the boundaries between scenario- and model-induced effects on player behavior. Yet such knowledge is vital both to game design, and to experimental research employing simulation techniques. While the elaboration of a research design by which to explore this issue is clearly beyond the scope of this paper, the issue itself represents, in our opinion, an important and potentially fruitful research enterprise.

At any rate, it cannot hurt to reemphasize the vital importance of careful scenario-planning to the success of a game or simulation. Such activities, like any involving human interaction, are necessarily sensitive to the milieu in which participants are expected to perform. A plausible, dynamic, and interesting scenario may mean the difference between a fast-moving game, in which players become totally absorbed, and a dull, lackluster operation from which neither players nor simulators learn. The mechanisms discussed here can hopefully ease the planning task; but they cannot substitute for a lively, creative imagination. In the end, scenario construction is more art than science, and an innovative scenario, however ill-prepared, may well surpass one which is well planned but unimaginative. The authors hope, of course, that the two are not incompatible, and that the techniques we have described will help to stimulate, not constrain.

NOTES

1. The reader should note that there is presently a plethora of special purpose games on the market designed to handle only one scenario–that for which the game was developed. See, for instance, many of the games marketed by INTERACT (e.g., Mission, Division, or Disunia among others) or some by Science Research Associates (e.g., American Constitutional Convention, Decision Making by Congressional Committee). This paper is concerned basically with those simulations allowing flexible scenario construction; e.g., INS, National Security Simulation, SIMSOC, International Politics Simulation, World Politics Simulation, and the like.

2. The scenario is not, of course, the sole mechanism by which conflict can be induced. In games in which discrete payoffs are linked to specific alternative strategies (as in the two-person games familiar to the game theorist), the arrangement of payoffs may itself structure conflict. In the familiar Prisoner's Dilemma game, for example, the existence of a noncooperative strategy having less risky payoffs than the cooperative strategy tends to push players into conflict, despite the mutual advantage of cooperating (for a useful discussion, see Schelling, 1966).

3. Although simulation is presently used more for teaching than for research, there are a number of simulation studies which involve the injection of experimental stimuli: Drabek and Haas' (1966) study of stress and human performance, Burgess and Robinson's (1969) work with alliance cohesion and public goods, and Brody's (1963) study of the effects of nuclear weapons proliferation. In addition, much methodological discussion by social psychologists focuses on the problems of stimulus-response techniques in experimentation.

4. Reproductions of historical situation have been used in several research efforts aimed at the validation of simulation as a predictive device, the better known projects being Hermann and Hermann's (1967) World War I simulation and Zinnes' (1966) comparison of hostile behavior in historical and simulate environments.

5. We will use this term hereafter to refer to any time following the beginning of the run.

6. This notion of "game culture" is sufficiently important to warrant a short discussion. Game culture, or a sense for the history and developments leading up to the initial scenario conditions, is an important part of the simulation environment. It is the bond between strangers which allows them to participate in simulations as cohesive teams.

But in a sense of game culture is not easy for players to develop. Robert Noel comments that "runs of the simulation should be sufficiently long to allow game history and tradition–game culture–to develop, say thirty hours at a minimum"

(Guetzkow et al., 1963: 101). His contention is the more startling when one recalls that, for most simulations, it is both necessary that players identify early with the game environment and impossible to run for such an extended period of time.

7. To mention only a few–Frank Hoole, "Decision-Making in the World Health Organization: The Budgetary Process"; Data Resources, Inc., economic projections and forecasts; Abelson, Pool and Popkin election forecasts.

8. By radical, we normally mean some modification which alters the established rules of play.

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