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CHAPTER 35

On Getting Simulation Models Used in International Negotiations: A Debriefing Exercise

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35.1. Introduction

Problems approached through international negotiation — especially multilateral negotiation — tend to be large-scale and long-term. They involve complex phenomena and issues that can only be grasped with the help of scientific research. Furthermore, since their complexity and rather global nature usually makes these problems cross the boundaries of single scientific disciplines, results from various fields have to be synthesized in a way that:

- Represents adequately the global functioning of the phenomena involved at the biophysical level.
- Adapt to the way members of the international community formulate the problem when engaging in negotiation.

Such synthesis of existing data and understanding to assist decision-making is one of the main objectives of systems analysis in general, and of simulation modeling in particular.

The matter is notoriously difficult to grasp in the abstract, and involves skill and experience. Therefore, to formulate an answer to the question of how to get a model used, we have chosen an approach where one of us (L.M., who is a management science researcher) "debriefed" the other (L.H., who is an experienced practitioner in building models and getting them used).

The material presented here is based mainly on the current experience of Leen Hordijk as leader of the Acid Rain project at IIASA. This project's RAINS model can be used to simulate the emission of acidic pollutants in Europe, their transport and deposition, and their effects on the environment. The purpose of the simulation work is to provide a technical reference basis for current negotiations to curb acid rain in Europe, especially in the framework of the Convention on Long-range Transboundary Air Pollution, located in the United Nations' Economic Commission for Europe, Geneva. In the course of building the model, much effort has been devoted to try and ensure its actual use. The skill in these efforts stemmed from L. Hordijk's previous experience with similar "modeling-for-use" projects, especially in the Netherlands. In the course of the exercise, we also discussed these cases when necessary to complement the example of the RAINS model [1]. Although mainly based on experience with RAINS, this chapter is by no means an account about getting that particular model used in international negotiations.

The aim of debriefing is to tap expertise acquired "on the job". It consists of making explicit, through systematic questioning, the more or less implicit understanding of a certain problem that a practitioner has acquired over time. It is an attempt to put skill acquired through experience into a form more accessible to analysis and teaching.

But debriefing raises methodological problems: how should the information "extracted" be structured, and how should the questioning be organized accordingly?

We approached this question in a novel way, so that the study presented here really had two goals:

- To contribute to a better understanding of the skills involved in getting models used in international negotiations.
- To experiment with a relatively new method for debriefing practitioners in matters of strategies and negotiations.

We first briefly present the methodological guidelines we adopted for the exercise. We then present in more detail that part of the material produced by the debriefing results which is relevant to the issue of the use of models.

35.2. Debriefing "in Terms of Games": The Methodological Framework

Even a bulky piece of analysis can include only a limited amount of information. By comparison with any article or a book, the amount of understanding involved in a practitioner's skill is overwhelming. To capture such extensive understanding in the narrow limits of analysis causes serious problems, be it in terms of the total amount of information involved, of the variety of themes or fields to be covered, or of the number of details that are unconnected in practical thinking, but cannot be left that way in analysis. The debriefing concept is intuitively appealing, but raises challenging methodological problems [2].

The most traditional solutions are akin to surveys and memoirs. In a debriefing conducted like a survey, one will ask the practitioner a predetermined set of questions, very much like what is familiar from magazine polls. This approach provides precise and comparable answers covering the questions considered to be important by the interviewer. But knowing what questions to ask is half of the issue. The approach requires in particular that a good understanding of the problem's structures be available beforehand.

Memoirs, or totally free-wheeling interviews, represent the opposite extreme. The choice of issues and the structuring of the problem are chosen entirely by the practitioner. The result is usually lively and informative, but loosely structured. Typically, a practitioner will not structure the problems he has faced and solved in a systematic manner; he will rather underline, and comment on, those aspects of the matter which to him are novel, interesting, challenging, or which he thinks are usually overlooked. The core of his know-how, the basics and reflexes on which his skill is based, will thus often escape formulation because he is unaware of some, considers others to be too trivial or lacks proper formulation.

Our objective in this exercise was mainly to identify the most basic, most general structures and dynamics of the strategies and tactics involved in building a model for use by policy-makers in a negotiation context. We considered that only on this basis could details, refinements, and the advanced understanding of good practitioners be integrated into a coherent, transferable whole. We had to find a debriefing formula focusing on the structuring of the problem, rather than on the solutions to all the various difficulties associated with it, and which vary so much from one particular case to the next. A survey-type formula could not be retained because it produces much content, but is not very effective in exploring the structure of problems.

To unravel the particular structures of the subject of the debriefing — getting models used in our case — can only be left to the "debriefed" practitioner, as the exercise goes along. But the practitioner cannot formulate the way he implicitly structures his approach of situations unless he receives help, especially questions and hints on what kind of structures can be looked for. This help, and the tools allowing it, have to be the contribution of the "debriefer".

35.3. Getting a Simulation Model Used in an International Negotiation

35.3.1. General framework of the game

When confronted for the first time with a new game, one will first see the board or game space, the other players and the various elements of the paraphernalia: dice, fake (or real) money, chips, and so on. One will also very soon learn the principles and the crux of the game: "Monopoly", for instance, is about real estate speculation, and the crux of the game is to put everyone else out of business. What are the equivalent basic structures in our BMU game?

The basic structure of the game is presented in *Figure 35.1*, which shows that playing BMU is actually playing simultaneously four quite distinct games:

(1) Each member of the research team is involved as an active participant in one or another scientific field, the results of which are to be synthesized in the model. Each scientific field is more or less clearly bounded, with a relatively stable set of players, whose interactions follow the rules of the scientific game. In BMU, there are as many such games as required by the scope of the model and the composition of the team; we have called them Scientific Field Games (FG).

(2) A modeling effort is often pursued within a certain institutional framework. It can be, for example, a project of a consultancy firm, or a program of an institute. This framework is a distinct game with its specific bureaucratic or economic rules, stakes and tricks: we refer to it as the Parent Institution Game (PG). Part of the effort of any modeling team is spent on surviving or prospering in this element. How the players do it and how they succeed has a strong bearing on whether and how the model gets completed, and eventually used.

(3) Use of the model occurs in a specific decision-making environment, such as an international conference or an international organization. This constitutes yet another distinct game, with its players, its own rules and outcomes: we call this the Use Game (UG).

(4) Finally, building the model is a distinct game in its own right, obviously of central importance here. We will call it the Modeling Game (MG). Its players are the members of the research team, and its desired outcome is the completion of the model.

The crucial principle in BMU is active creation and successful maintenance of a kind of constructive coherence between such disparate semi-closed scenes as a set of scientific fields, an international policy debate, a research bureaucracy and its financial supporters: an easy statement, but a difficult achievement!

In the following analysis, we will be primarily concerned with the Use Game, and with those aspects of the Modeling Game that are relevant for getting
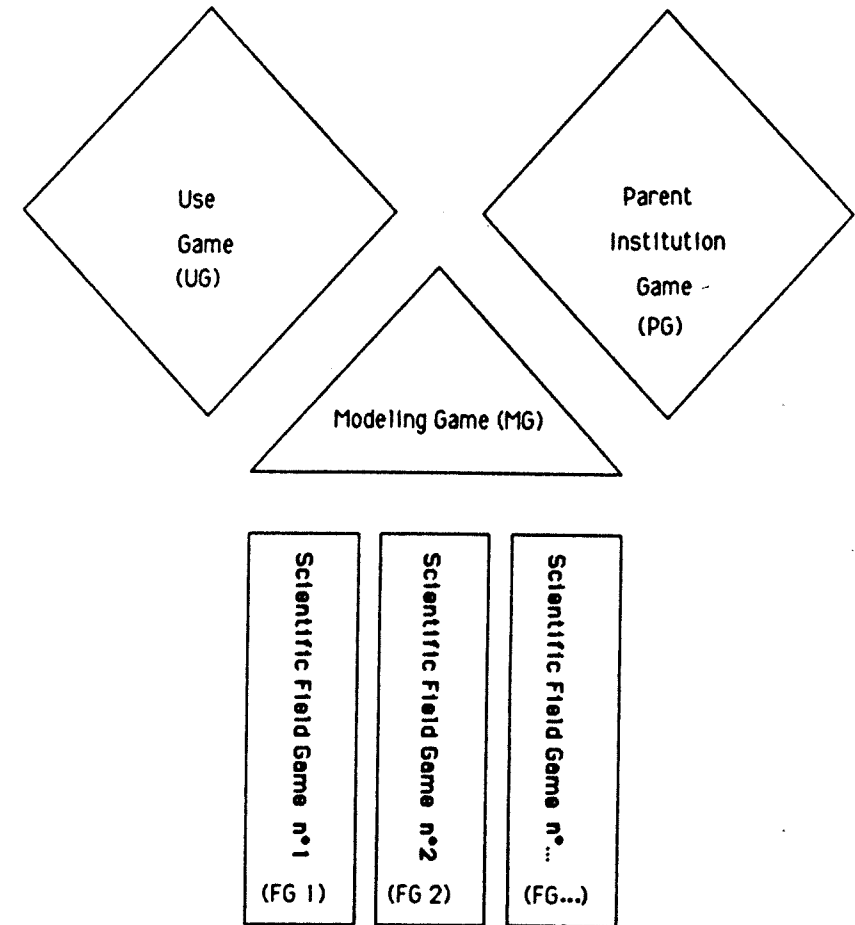

Figure 35.1. General structure of the BMU Game.

the model used. The general description of these games as provided here is meant to help model practitioners, their financial supporters and their evaluators, in organizing their thinking about the issue of getting the model used. They can use this material to identify and structure relevant information when preparing a model for use.

However, it is not enough to identify what information is needed, and to structure it once it is obtained: obtaining it is a challenge in itself. Our first recommendation will be that one needs to identify in each country — and more generally in each subgame one will have to enter — an experienced person who is willing to provide such information as deemed necessary. We have named such persons grey-haired experts in the scientific subgames and grey-haired advisors in the bureaucratic and political subgames. It is hard to overemphasize the importance of taking the time and effort to identify such persons and cultivate steady relations with them.

35.3.2. Basics of the Modeling Game

The basics of the Modeling Game are represented in *Figure 35.2*. The triangle represents the boundaries of the game. The various shapes around the large circle indicate the players. These are designated in terms of the roles they play, not of the persons playing these roles: the same person can be a player in several games, and also play several roles in the same game.

The large circle contains the major issues and the corresponding rules and interaction structures:

-   The project plan sets the basic rules on which the game relies: aims, attribution of roles, means available, time available, etc.; these basic rules are changed if the plans are modified during the game.
-   Much of the model quality will rely on good integration of various submodels and on the scientific coherence of the whole; this subgame is a major responsibility of the leader.
-   Each participating scientist is a specialist; he is thus "chasing two hares at the same time": excellence within his scientific field, and integration of knowledge from this field into the model. It is rare that these two objectives totally coincide, so that there is constant negotiation to assure that both concerns get addressed satisfactorily.
-   The use and allocation of available logistics and secretarial help is also a subgame of its own right.
-   Finally, simulation models run on computers. Access to the hardware, programming the different parts of the model, and assuring that, when they are assembled, the composite model functions satisfactorily and is reasonably user-friendly, is a complex and absorbing game, the results of which have a crucial bearing on the quality of the model for users.
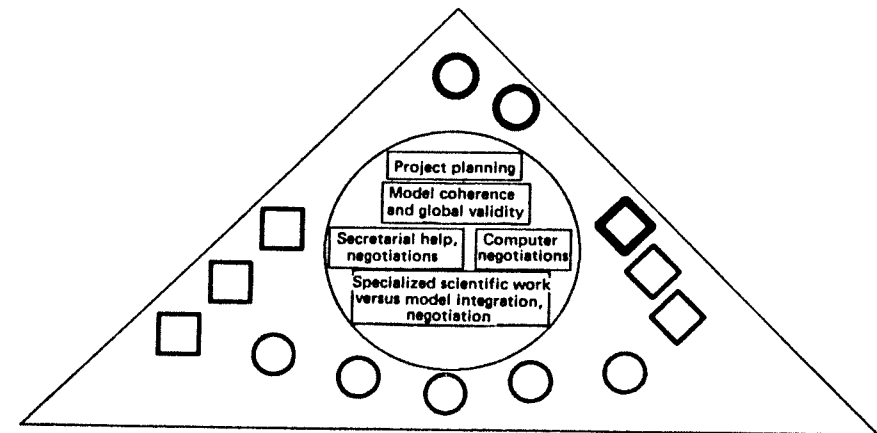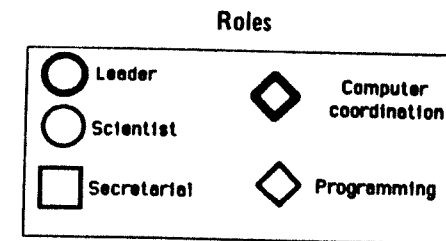

Figure 35.2. The Modeling Game.

35.3.4. Model-building with use in sight: Issues and phases

Of the various subgames in the Modeling Game, project planning, model coherence and computer negotiations are directly relevant for the ultimate use of the model. Usability should be a major concern in these activities, starting right at the onset of the model-building effort. How, specifically, can this goal be met?

A second look at the phases we just described will help answer the question. The issue of use presents itself quite differently at the various stages of the game as we just described them. We have sketched this in *Figure 35.3*.

During the three phases of the preliminary or planning stage, the issue is to evaluate the chances that the model will be used. From the use point of view, is it worth pursuing, funding, institutionalizing? This question presents itself differently in each phase of the planning:

- In phase 1, the issue is to clarify the place of use in the original idea. Is it central, so that use is the main aim of engaging in the exercise; is it planned as the natural outcome of producing new and useful information; or is it a facade prompted by the financial or institutional pressures toward immediately usable products of research?
- In phase 2, one should be able to ascertain whether the idea of use is precise and realistic. At this stage, an operational definition of use should be provided, and not only a definition in principle. For the latter, it would suffice to state that the model is for use by practitioners in negotiations about the topics covered by the model. For an operational definition of use, it will be necessary to specify the particular practitioners, the negotiation forum, and how precisely the model would be used.
- In phase 3, one can start finding out if the envisaged users are really interested in the idea. At this stage potential users should be contacted, at least at an informal level. Their reaction will be important: are potential users politely skeptical, interested in principle, or already giving signs of an operational intention of use?

At the second stage, when research is done at a full-scale level, the priority for the partners in the modeling effort is to get the model build and used. This involves the following issues:

- In phase 4, the model should be made known to the users' forum or fora, so that the involved parties can start considering it as a resource for negotiation or decision making This involves surmounting inevitable opposition, and receiving or creating opportunities to present the effort to all parties concerned. In this phase, it is also important to provide the users with an opportunity to get involved in the project — for instance, by participating in review meetings, by providing data, etc. Finally, it is at this time that rather irreversible decisions are made about the structure of the model. Needless to say, the envisaged use has to be one of the bases for this design; for this, user feedback is essential.

- In phase 5, the project should maintain users' attention and keep the users involved. In this phase, everyone in the modeling team is very absorbed in getting the model done and running. At the same time, the users have many subjects of interest other than a model that has not yet delivered anything. Also, competition is likely to emerge. One may be tempted to feel that what has been acquired in the previous phases may be taken for granted, but one should not. Especially since the technical task of building the model becomes so absorbing at this stage, it will take a special effort to keep users informed and involved, and to make sure that the model itself does not, for technical reasons, stray away from its potential intended use.
- In phase 6, one must ensure that the products will be available on time, in a form suitable for use. This winding-up phase of projects is delicate, because it puts the team in a paradoxical situation: if the research work is nearly finished, all resources will tend to be attracted to other projects that are in more challenging phases. If the team continues to work, it will always be tempted to go a little farther in research, rather than just documenting what has been achieved. In this phase, actual use of the model should also start: there should be intense activity of the modelers in the Use Game.

If the model has not made its way to actual use in phase 6, it is unlikely to make it later on, because the indispensable resources, energy and momentum will no longer be available. If the model does start to get used, then it is important to provide users with good service, because most of the use will happen after the core research is over. This follow-up phase is largely a matter of logistics for maintenance and adaptation of the model. It is also at this stage that the effort should be evaluated by the users, not by the proponents of the model!

35.4. Basics of the Use Game

35.4.1. Board and players

We just discussed what "use" looks like from the point of view of those financing, supervising and building the model. We sketched an image of this as a specific environment, which we have called the Modeling Game. Seen from there, the "users" have a strong tendency to be viewed, even if only implicitly, as a rather abstract, mistakenly unified entity. But the term "users" covers a whole set of people and organizations with different interests, who operate in a specific and diverse environment, which we have called the Use Game. To get users involved, to obtain their support, it is necessary to understand to a certain extent the games they are playing. In fact, a certain amount of involvement in the Use Game will usually be necessary to remove barriers and build enough support for actual use.

As above, let us start with an overview of the board of the Use Game, as sketched in *Figure 35.4*. In international negotiation, model use will, more often than not, be conducted in the framework of some organization, convention, or other set of procedural mechanics. This is a game in its own right. Main players are the delegates, chairperson, and other negotiators. In the game set, there will usually be a secretariat to facilitate the procedure and assist with technical matters. Secretariat members are also players; they will play their own marbles in the game, somewhat like the banker in a casino game. Also, *ad hoc* technical working groups are likely to be formed to face those issues that are both complex in content, and politically sensitive. Each one is a subgame of a sort.

Furthermore, no delegation is a transparent and monolithic reflection of a country. In each country that is a party to the negotiations, there are likely to be debates about the interests to promote at the international forum, and about the best strategy for doing so. The latter can include the use of a simulation model. This is yet another game in which national administrative organizations (agencies, ministries, etc.) are the parties, and in which individual players are leading scientists (collaborators, competitors, friends, or supporters of the model we are trying to get used) and officials (each of whom also has a certain potential as ally or opponent). In each country, the interplay between science, policies and politics seems to follow specific patterns and rules with which experienced nationals in the field have learned to play.

35.4.2. Getting it used: Targets and moves

Given this general background, which strategies should the model-builder follow to get his product used? To answer this question, it is necessary first to get an idea of the possible winning or losing outcomes — that is, of the possible types and levels of use.

The notion of the use of models in international negotiation oscillates between two extreme concepts of the role of complex applied studies and decision-support systems in controversial decision-making. A somewhat caricatured account will help to describe the debate.

At one extreme is a vision that is part of the current folklore of decision-support systems. Underlying many proposals and — mostly preliminary — developments, is a fantasy of negotiators gathered around a colorful screen displaying a "negotiator-friendly" computer program. It answers their questions swiftly, thanks to a large database and to simulation models based on the result of state-of-the-art, impartial scientific studies. At last confronted with objective and understandable information, following long stages of groping in the dark, the negotiators can play with the program and explore the many facets of the issue. Before they are even aware of it, they have abandoned their entrenched positions, hammered out joint gains, and they all wind up as winners. If this utopia were true, international negotiations could be considered just another type of video-game [6].
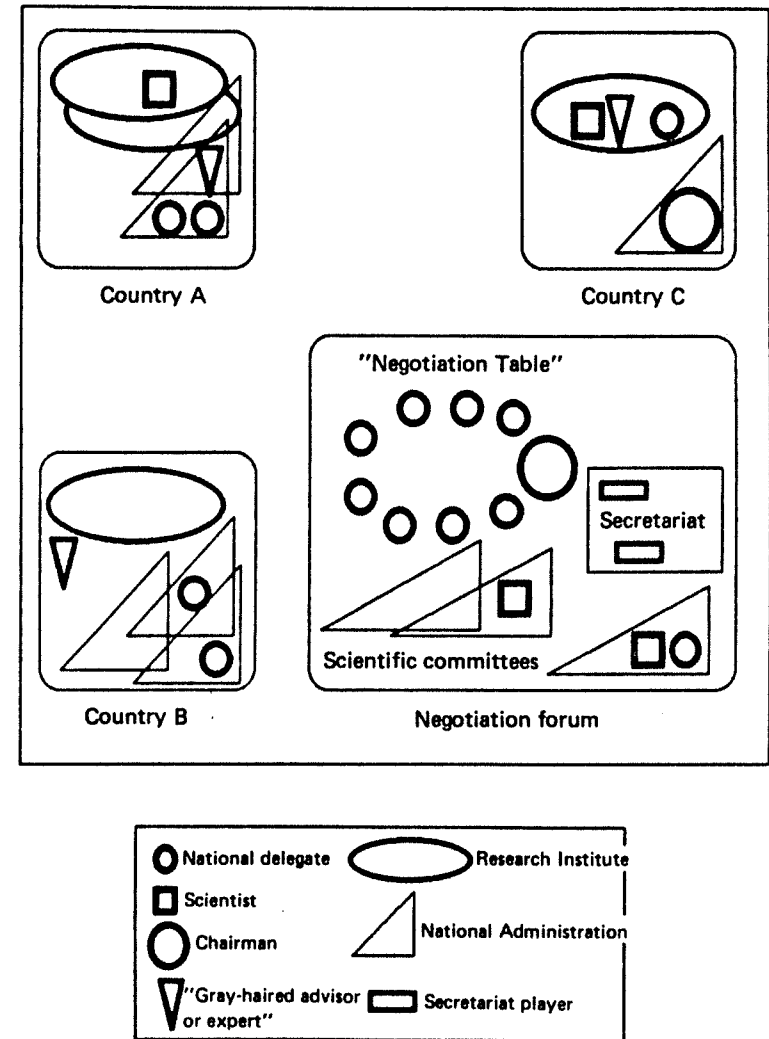

Figure 35.4. The Use Game.

At the other extreme is a more acid concept of simulation models — and of any applied studies — as just another play in the tactics of decision-making processes. In this view, negotiation is so dominated by politics that, if a model is used at all, it will be by a party that finds its position supported by its results. If another party holds a different position, it will always find an alternative model to support it, or interpret the existing data differently. If it does not find such an alternative model, it will fund its development. In the end, the negotiators, armed with competing models, will shoot divergent results at each other [7].

There is some truth in both of these concepts, and a lot of room for intermediate positions. We propose to organize this range of potential use situations in the following two dimensions. The first rests on the distinction between use by all negotiators collectively, or by only one or some of the negotiating parties. The second dimension is based on a distinction between the simulation model seen as the active ingredient pushing the negotiation process along, and a model seen as a more neutral scientific reference for discussions in a negotiation process that itself remains fundamentally based on politics. To these situations of use, we would like to add situations of nonuse, by one (or a few) or by all participants, at a level of indifference to the model, or of actively fighting it. The resulting scope of possible use or nonuse situations is sketched in *Table 35.1.*

Table 35.1. Types and levels of use of a simulation model in the negotiation process.

Role of model	User level	
	Individual	Collective (joint use by all parties)
Model as a motor of the process	A party promotes the model as an active basis for its position	All parties agree to use the model as reference framework for the process
Model as source of information	A party uses the model to complement the argumentation of its position	The model is considered by all parties as one source of information used in the process
Model indifferent because marginal or useless	A party is reluctant to move from the political to a more technical ground	The negotiation is so adversarial that "rational" analysis of the problem plays little role
Model undesirable	A party disagrees on the science or fights the model as a tactic in the negotiations politics	Prospects for the use of the models are terrible

At the most ambitious level of use, the model is a moving force in the process. It can be used as such by one or a few delegations. This is particularly the case when a party wants something done about a problem, but faces strong reluctance supported by scientific uncertainty on the exact nature, extent, or origin of the problem. A model is a powerful way for such parties to mobilize what scientific evidence there is, and if possible, force consideration of the issue. A model can also be used as a key activating factor of the process by all parties jointly. This is in particular the case when there is agreement to use the model as a common framework allowing proposed solutions to be tested, possible joint benefits to be explored, etc. This concept of the model as a mediator seems to dominate, so to speak, the emerging efforts in computer-aided negotiations.

This is, however, a very ambitious concept of the use of models, one which seldom comes true. But the use of models should not be seen as an "all or nothing" situation. It can be conceived, like the use of any applied science, in a more traditional fashion. In this way, research results provide a source of information and reference for the rationality of envisaged solutions, which is mobilized as necessary in the course of the negotiation process, itself moved and dominated by procedures and politics. Again, the model can be used individually as a rationale to defend a politically established position, and to work out its technical details. It can also be used collectively as a yardstick to foster better articulation of positions, and as a reference for discussion of details.

Nonuse can stem first from indifference to the model. This is likely to be based on the view that the predominance of politics makes complex and still uncertain scientific results irrelevant. Most of the time, this will be because one party — or the whole negotiation — is highly politicized. It can also happen because negotiators are weary of complex models. They can perceive these as providing results, which, since the negotiations cannot understand their basis, could as well be arbitrary, and will reduce their degree of control on the outcome of the negotiation.

Finally, it can happen that one, a few, or many of the parties will fight the use of the model in the negotiation. If too many of the parties fight the use of the model, one might want either to reconsider the value of the model, or to consider another decision-making forum for its use. If the opposition just comes from one or a few parties, it is quite natural. It can stem from a disagreement about facts or concept of the model, which then has to be dealt with at the scientific level. This can be the case, for instance, if one country has quite specific, if marginal, technical problems, and these do not receive adequate attention in the model because it is based on the general case. But opposition also often stems from tactics: it can be a way to maintain a level of high uncertainty about the issue if this is favorable to one's position; it can be a way to delay the procedures and discussion; it can be a way to deny the existence, the significance, the cause of a problem, or the possibility of remedying it. In that case, the difficulty has to be dealt with at the political level.

To this point, what we have done is basically to associate precise and structured — although very general — descriptions with the notions of "users" and "use". How do they combine when it comes to action — that is, to getting the users to use the model?

35.4.3. Getting it used: The process

It must first be realized that the modeler is only a quite marginal player in the Use Game. His possibilities for direct intervention are very limited: an occasional presentation of the modeling work and results, or participation in a technical working group. We have also seen that the use of the model necessitates action at the political level to put it on the agenda, to overcome opposition, etc. Action at this level is necessary, but it can only be indirect, through the intervention of players with influence in the Use Game: active delegates, chairpersons, influential secretariat members.

Furthermore, we have seen that the initial attitudes of delegates and other players with regard to the model could be actively supportive (usually on political grounds), mildly supportive (usually on technical grounds), reticent or hostile (on political or technical grounds, or due to ignorance). The crux of action here is to find ways to make these attitudes evolve favorably. Those changes in players' positions that are connected to the credibility and relevance of the model do not require tactics beyond good modeling work and sound presentations when the opportunity is given (of course, making sure the opportunity is given is an important point of strategy). But when it comes to influencing positions at the political level, one will have to leave the initiative to active allies: those who tend to support the model on political grounds.

These intrinsic limits to the intervention in the Use Game finally make the strategic concerns of the modeler much simpler than they might have looked at first sight. These concerns are threefold:

(1) Building a model that is fit for use, i.e., scientifically state-of-the-art and adapted to users' needs.
(2) Acquiring a clear enough picture of the Use Game to know what one is facing, and identify what strategic and tactical help will be necessary, and its potential sources.
(3) Making active allies in the Use Game — those who will be the actual promoters of the model, and will be able to overcome opposition.

At first sight, these conclusions seem to pertain entirely to a concept of the use of the model by one party or coalition in the negotiation, as opposed to its collective use by all parties to help with the process (in other terms, it would correspond only to the left column in *Table 35.1*). This is not so, however. The following discussion of this issue should permit an integration of these two extreme concepts of the use of models in negotiation, as well as give a better idea of the Use Game. What has to be considered here is the dynamic process of getting the model used.

Indeed, the use of a simulation model is still too often seen as a static issue — as if, at the end of its building, the model would or would not be used, as a product is or is not sold after production. But one look at the Game Use board and at *Table 35.1* makes it clear that it should rather be understood as a dynamic process. Many of the players in the Use Game will have to be approached separately. They will have varied attitudes toward the model, and use it — or not — in different ways. It will be a long-lasting effort to neutralize the hostile and turn the potentially interested into actual users.

In this gradual development, we have seen that the action is basically in the hands of a limited number of active supporters of the model. If they succeed in getting the model adopted, it will be through a process of diffusion, gradually rallying parties to its cause. This diffusion process is narrowly linked with the negotiation process. The latter consists of each active party trying to rally the others around a position that it finds acceptable. The model is a means to that end: it helps rallying positions first around a framework one finds acceptable, thus laying the table for solutions one finds acceptable. Both processes are parallel, each one reinforcing the other: progress in the negotiation makes the model easier to adopt, and vice versa.

This, we hope, gives a clearer view of how the Use Game works in addition to its basic static structures, as we have proposed. However, it still does not seem to apply to the concept of collective use of the model, which is strikingly put forward by the motto: "the computer as mediator". A key to that issue can be found in the concept of the mediator as a third negotiator, proposed by Faure in Chapter 34 of this volume. Following his argument, it is rather mistakenly assumed that the mediator or the chairman is considered to bring into the process a type of intervention totally different from that of the negotiators themselves — a difference often captured by the term neutrality. Faure shows examples of non-neutral but very effective mediation interventions, and proposes a consideration of the mediator as just another negotiator in the process, egoistically pursuing his own agenda. The difference is that, for a variety of reasons, the mediator's agenda involves among other things trying to make the other parties reconcile their differences. So it can be that a mediating negotiator actively promotes a simulation model, leading to a process of diffusion exactly similar to what we just described when one party promotes the model for its bargaining ends.

Actually, the most convincing existing example of the "computer as negotiator" confirms this point of view. In his description of the use of an MIT model of the economics of deep-sea mining in the Law of the Sea (LOS) convention negotiations, Sibenius shows the chairman of the convention skillfully using the model to promote his agenda of helping parties reconcile extreme initial positions. He shows how the model, because it was relevant and scientifically credible, was instrumental in salvaging a negotiation process that was close to total deadlock [8].

So the two concepts of the role of a model in negotiation, respectively, as a support for partial positions and as a means to foster cooperative problem-solving, are not essentially different. One role can even lead to the other. In all cases, the actual use of a model results from its promotion by one or a few players with influence in the negotiation. When successful, this promotion results in a gradual spreading of the acceptance of the model, in close connection with the negotiation process.

35.5. Conclusion

We started the exercise described in this chapter moved by the following motives and orientations:

- We regarded the practical use of simulation models as important both to help reach better outcomes in negotiations about complex issues, and to justify the big investments made in building simulation models.
- We considered that such practical use of models rests above all on their scientific credibility, but also depends to a considerable degree on relevant strategic initiatives on the part of the proponents of the model. The success of such initiatives, we thought, relied largely on specific skills acquired through experience.
- To improve the use of models, we were interested in the possibility of facilitating the acquisition of such skills by modelers. This could be done, we thought, by providing them with a relevant analysis of the main issues and possibilities for action involved in the situation of trying to get a simulation model used.
- In our view, this analysis had to be based mostly on debriefing: an explication of the practical understanding acquired by a practitioner with several successful experiences in the process of building models that actually got used.
- Finally, we regarded the prospects of success of such a debriefing as scant if it were based on a traditional survey-type questionnaire or on free-wheeling interviews, so we decided to try a new approach of debriefing "in terms of games".

In the course of the exercise, we have obtained significant results in three directions: a clarification of the issue of the use of a model in international negotiation, the tentative development of practical methodological tools to improve effectiveness in getting a model used, and the fruitful testing of a new debriefing method. We will briefly review each of these three results.

First, the exercise has provided a clarification of the issues involved in model use. It has helped dispel a rampant vision that somehow, magically, models will make their way into the negotiation process and do what negotiators have hitherto been unable to do themselves. The use of a model should not be viewed as a "yes or no" issue: it has varied modes and degrees. The user(s) of the model cannot be considered as a monolithic entity or a homogeneous lot, but as people with various interests and positions with regard to the model and operating in institutional environments of their own. Use should not be postponed to the end of the modeling effort, because it can only be the result of a gradual dynamic process, in which building the model and getting it used are closely connected.

Secondly, this clarification of the issue of use has produced tools that can facilitate the diagnosis of problems associated with the use of a particular model. These tools provide guidelines on how to identify the relevant elements in a use situation, how to take into account the issue of use at various stages of model-building, how to define what kind of use is a realistic aim, how to identify practical initiatives that can be taken. We hope that these guidelines have some degree of general value, so that they can be used both as a practical guide to getting models used, and as a support to facilitate discussions, planning, and evaluation of the use of a model. Its potential users cover the whole range of actors involved in the construction of a model: the model builders themselves, their financial supporters, their collaborators, the supervisors of the effort, etc.

Thirdly, we consider the exercise and those of its results presented here as one successful test of the method of debriefing in terms of games, which we had set out to define and test. Some concepts for such use of the game analytical framework have emerged in the course of the debriefing. They appear in this presentation of the results; however, it is too early to present them in a systematic fashion. Going farther in that direction will require further experimenting with debriefing in terms of games, integrating in this practice the results of the more theoretical work on the game concept (which is being pursued in parallel [9]) and articulating the use of the game approach for debriefing with its use for training and education on which work is also being developed in parallel with the effort presented here [10].

Notes

[1] It is important to note that the present chapter does not address specifically the use of this particular model, but problems of use and debriefing methodology in general. For a introduction to the RAINS model and its use, see: J. Alcamo *et al.* (1985), Integrated Analysis of Acidification in Europe, *Journal of Environmental Management*, 21; L. Hordijk (1986), Acid Rain Abatement Strategies in Europe, in T. Schneider (ed.), *Acidification and its Policy Implications*, Elsevier.

[2] Confronted with the same problem, M. Wheeler has selected a different approach from the one proposed here. He writes: "Presenting a comprehensive view of everything that a practitioner does would be too formidable a task; instead, we have searched for issues or themes of special importance. In one instance, for example, we explored with an environmental advocate how he balances negotiation and litigation strategies; interviewing a mediator, we looked at the opportunities and obstacles to early intervention" (Michael Wheeler (1985), *Protocols for Debriefing Practitioners*, Program on Negotiation Working Paper 85-2, January). By contrast, the approach we have retained here aims at forming a global image of the innumerable things a practitioner does and of the way they are related to each other.

[3] L. Mermet (1987), *Game Analysis: An Analytical Framework to Bridge the Practitioner–Researcher Gap in Negotiation Research*, IIASA Working Paper WP-87-084, September.

[4] One will find an example of a methodology to interview practitioners which rests on a combination of survey techniques and systems perspective in chapter 11, by Sven B. Lundstedt, in this volume.

[5] For a discussion of simulation games, see Ingolf Stahl (1983), *Operational Gaming — An International Approach*, Pergamon Press.

[6] On the perspectives and limits of computer models to support social decisions, see: D.H. Meadows and J.M. Robinson (1985), *The Electronic Oracle*, John Wiley.

[7]   This view is defended in a nuanced and informed way in: GRETU (1980), *Une étude économique a montré... Mythes et réalités des études de transport*, Paris, Cujas, 1980.

[8]   James K. Sebenius (1981), The Computer as Mediator: Law of the Sea and Beyond, *Journal of Policy Analysis and Management*, 1, (1), pp. 77-95.

[9]   See note [3].

[10]   L. Mermet (1986), *Aims in Nature, Means in Society: Negotiation and Strategy Analysis for Environmental Management*, IIASA PIN Project, May.

CHAPTER 36

Dynamic Solution of a Two-Person Bargaining Problem

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36.1. Introduction

This chapter deals with a two-person bargaining problem given by a set of the payoff vectors attainable by the players through some joint actions and by a disagreement point reached if the players fail to agree. Bargaining problems have been studied by, among others, Nash (1950), Raiffa (1953), Kalai and Smorodinsky (1975), Kalai (1977), Meyerson (1977), who propose some solutions; but they are confined to one-shot solution concepts that describe only possible final agreements for the bargaining problem.

The dynamic bargaining process presented here starts from the disagreement point and, through successive agreements of the players, leads to the final payoffs. The successive agreement points reflect the progress in the bargaining process. In the chapter, we consider the continuous case of the process, presented in Bronisz, Krus, and Wierzbicki (1987), in which the successive agreement points form a continuous trajectory. To assure "fairness" in bargaining, the equal concession axiom is imposed, which says that the Lebesgue measures of payoffs refused during the process in the regions favorable to particular players are the same.