Group Model Building[1]

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Abstract

Ongoing research in the Rockefeller College of Public Affairs and Policy is focusing on strategies for efficient and effective model building in groups. The intent is to involve a relatively large client group in the business of model formulation, not just conceptualization. Recent projects have explored strategies for accelerated group model building in the context of two public policy problem areas: the burgeoning cost and caseload of foster care in New York State, and recent unexplained increases in Medicaid costs in the state of Vermont.

Five roles appear to be essential to support effective group model building efforts. We term the five roles the *facilitator*, the *content coach*, the *process coach*, the *recorder*, and the *gatekeeper*. This article identifies the five roles, briefly overviews the two problem areas, sketches the design of the group model building efforts, outlines the apparent results, and hypothesizes principles and strategies to guide future group modeling efforts.

Introduction

Ongoing research in the Rockefeller College of Public Affairs and Policy is focusing on strategies for efficient and effective model building in groups. The work is related to efforts by Richmond (1987), Vennix (1990), and Morecroft (1991), and grows out of more than fifteen years of research on computer-aided, facilitated meetings.[2]

Group model building, as we intend the phrase, signals the intent to involve a relatively large client group in the business of model formulation, not just conceptualization. The goals are a wider resource base for insightful model structure, extended group ownership of the formal model and its implications, and acceleration of the process of model building for group decision support. However, the pitfalls generated by group processes and the modeling process are formidable.

It appears that no fewer than five roles or functions are essential to support effective group model building efforts. We term the five roles the *facilitator*, the *content coach*, the *process coach*, the *recorder*, and the *gatekeeper*. Many of us have tried to make do with one or two individuals handling these five roles (usually implicitly), but our experiences with large modeling groups struggling with weighty problems involving diffuse knowledge suggest the roles are often best handled by five separate individuals. Ideas for the importance of these roles grew out of the group process literature,[3] the

[1] The authors gratefully acknowledge the contributions of Fred Wulczyn, Omer Jirdeh, and Sauwakon Ratanawijitrasin to this work.

[2] See, e.g., Milter and Rohrbaugh (1985), Phillips (1988), Carper and Bresnick (1989), Rohrbaugh (forthcoming), and Vari and Vecsenyi (forthcoming). See Vennix et al. (1992) for further references.

[3] The earliest group process literature contains descriptions of numerous leadership roles that

system dynamics literature,[4] and experiences of the Decision Techtronics Group at the University at Albany,[5] including work done in 1987 and '88 for the New York State Insurance Department on medical malpractice insurance regulatory policy.[6] Recent projects at the Rockefeller College have explored strategies for accelerated group model building involving these five roles. The explorations have been carried out in the context of two public policy problem areas: the burgeoning cost and caseload of foster care in New York State, and recent unexplained increases in Medicaid costs in the state of Vermont.

The Five Roles

The initial modeling motivation.

In work done for the New York State Insurance Department in 1987 and 1988, one of the authors (Richardson) experienced some difficulties working with a five-member model reference group in preparation for two two-day decision conferences on malpractice insurance regulatory policy. Reflecting on the difficulties, we hypothesized that they stemmed from the multiple roles the modeler was trying to fill. The modeling tasks involved drawing out information from the reference group and about the structure and behavior of the problem, formulating that information in a model, presenting and explaining that model formulation back to the reference group, eliciting their reactions for model corrections and refinements, and carrying out the necessary revisions and extensions. All the while, the modeler had to function simultaneously as an enlightened group process coordinator, knowledge elicitor, group facilitator, and system dynamics educator.

The modeler had the advantage of carrying out these meetings in the context of the work of the Decision Techtronics Group. As a result, he knew of the importance of a second person who could focus on recording information so the modeler/consultant could be saved that task, but nonetheless, the rest was too much. The modeler/consultant found he could not focus on all the necessary group tasks at the same time: His modeler/explainer/educator roles became confused with, and sometimes even contradicted, his roles as knowledge elicitor and group process facilitator. We modelers might have missed or ignored the confusions, as we and other modelers have in the past, but DTG decided to conduct our next meeting with an experienced group facilitator, and a much more powerful way of handling group model building discussions was revealed.

Five roles in group model building

This more powerful way involves explicitly separating the distinct roles involved in the group model building process. Following further experiments with group model building efforts, which are described in the subsequent sections of this paper, we have identified what we believe are five essential roles. The people who fulfill these roles form the basis for an effective *group modeling support team:*

The *facilitator:* functions as group facilitator and knowledge elicitor. This person

must be assumed in order for groups to be effective (Benne and Sheats 1948). Recent developments in the definition of facilitator roles have helped to clarify how group leadership can be provided by both internals and externals (Schein 1987, Kayser 1990, Friend and Hickling 1987).

[4] Hints of multiple roles in modeling with groups appear in Stenberg (1980) and Vennix (1990). Roberts (1977) emphasizes rapid development of an initial model, maximum in-house participation, and the importance of the role we have termed the gatekeeper. We take the "gatekeeper" term from the R&D literature (Allen 1970).

[5] See Milter and Rohrbaugh (1988); Mumpower, Schuman, and Zumbolo (1988); McCartt and Rohrbaugh (1989); and Schuman and Rohrbaugh (1991).

[6] See Richardson and Senge (1989) and Reagan-Cirincione et al. (1991).

pays constant attention to group process, the roles of individuals in the group, and the business of drawing out knowledge and insights from the group. This role is the most visible of the five roles, constantly working with the group to further the model building effort.

The *content coach:* focuses not at all on group process but rather on the model that is being explicitly (and sometimes implicitly) formulated by the facilitator and the group. The content coach serves both the facilitator and the group. This person thinks and sketches on his or her own, reflects information back to the group, restructures formulations, exposes unstated assumptions that need to be explicit, and, in general, serves to crystallize important aspects of structure and behavior. Both the facilitator and the content coach in our experiments have been experienced system dynamics modelers.

The *process coach:* a person who focuses not at all on content but rather on the dynamics of individuals and subgroups within the group. It has been both useful and annoying that our process coach is not a system dynamics modeler; such a person can observe unwanted impacts of jargon in word and icon missed by people closer to the field. The process coach in our experiments has tended to serve the facilitator; his efforts have been largely invisible to the client group.

The *recorder:* strives to write down or sketch the important parts of the group proceedings. Together with the notes of the content coach and the transparencies or notes of the facilitator, the text and drawings made by the recorder should allow a reconstruction of the thinking of the group. This person must be experienced enough as a modeler to know what to record and what to ignore.

The *gatekeeper:* a person within, or related to, the client group who carries internal responsibility for the project, usually initiates it, helps frame the problem, identifies the appropriate participants, works with the modeling support team to structure the sessions, and participates as a member of the group. The gatekeeper is an advocate in two directions: within the client organization he or she speaks for the modeling process, and with the modeling support team he or she speaks for the client group and the problem. The locus of the gatekeeper in the client organization will significantly influence the process and the impact of the results.

We hypothesize that some of these five roles may be combined, or distributed among the consultants and the clients in a group model building project, but that all five roles or functions must be present for effective group support. We further hypothesize that group modeling efforts can be significantly accelerated by explicitly recognizing the five roles and deliberately assigning them to different skilled practitioners.

The Cases

Foster care.

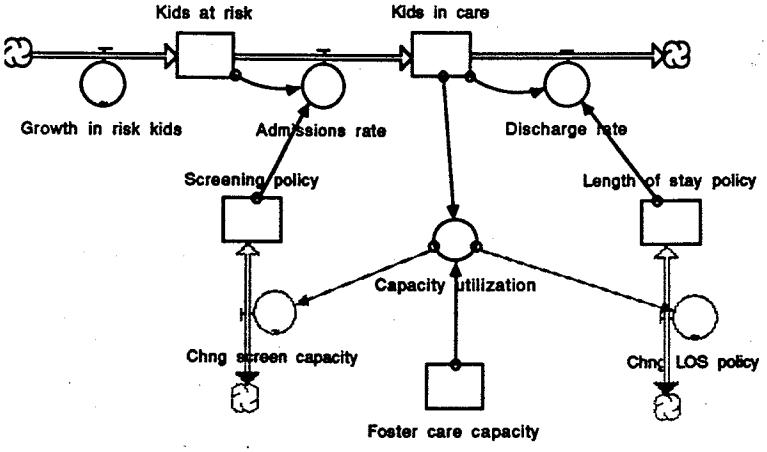
In 1990 system dynamics practitioners at the Rockefeller College were approached by Dr. Fred Wulczyn of the Department of Social Services (DSS) in New York State to explore the potential of simulation modeling to aid understandings of the structure and dynamics of foster care populations. Traditionally a small and placid part of the New York State budget, foster care began to grow dramatically after 1985, owing, it is thought, to the emergence of the crack cocaine epidemic. Nationally known for the creation and analyses of extremely detailed data bases of foster care in several states, Wulczyn had two interests: contributing to solutions of the problems generated by rapid growth in the need for foster care in New York City and elsewhere, and experimenting with nonlinear simulation modeling to reveal structural foundations for

complex dynamics. Some extremely detailed modeling work, showing the ability match Wulczyn's data, was pursued at the Rockefeller College to the point of reports and recommendations to the Commissioner of Social Services (Wulczyn 1990a, 1990b).

To further the effort, Richardson and Andersen became interested in exploring an *accelerated* group modeling effort that had as its core idea the separation of three primary roles that had seemed significant in the medical malpractice work: a group facilitator/knowledge elicitor, a modeler, and a recorder. Wulczyn assembled a group of experts in foster care willing to spend two days experimenting with a simulation modeling approach largely unfamiliar to them.

The two-day workshop began with the sketching of a simple *concept model* of the foster care system (Figure 1). The concept model served three purposes. First, it was the medium for teaching the stock, flow, and causal link icons to be used throughout the workshop. Second, the concept model was used to demonstrate there are links between structure and dynamic behavior. The model was simulated three times, showing the effects of successively closing negative feedback loops (indicated by the dotted structures shown in Figure 1), striving to control the foster care caseload. Third, and perhaps most important, the concept model served to initiate discussion about the structure and behavior of the real system. The model looked enough like the foster care system to be immediately familiar to the participants, but it was agonizingly inadequate, and discussion of how to improve it began immediately.

Figure 1: Foster care *concept model*, initially shown in the foster care group modeling workshop with constants for screening and length-of-stay. The negative loops indicated by the dotted structures were added, one after the other, bringing the case load under control, with various adverse consequences.

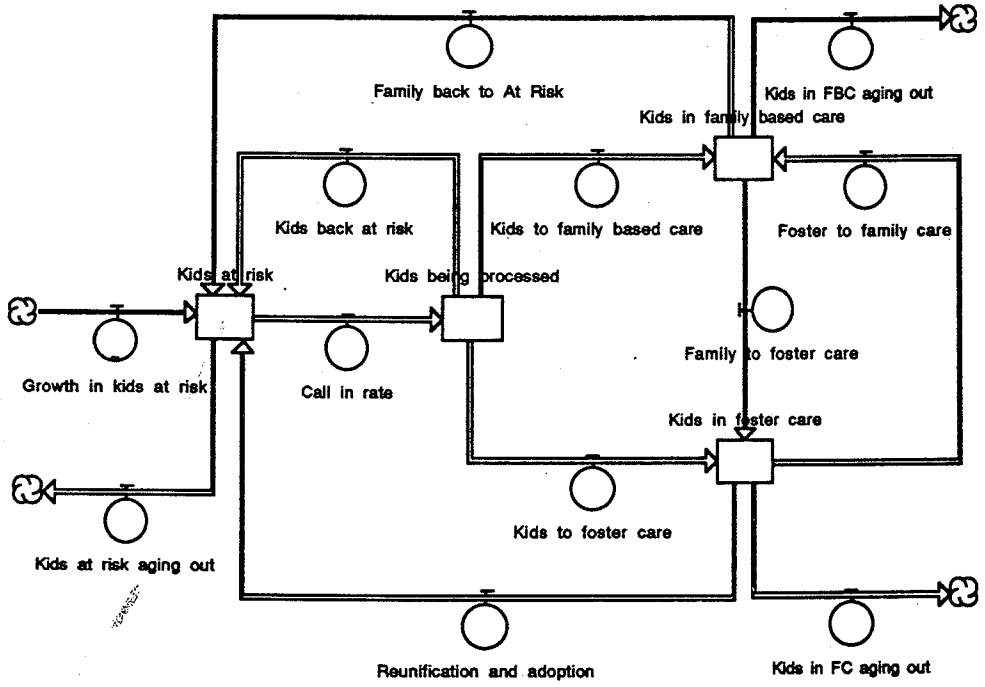


The facilitator/knowledge elicitor then took over, and the group began discussing dynamics and the stocks and flows of children in the foster care system. Large white boards were used to sketch diagrams; standard white flip charts stored important ideas; notes were kept on a computer by a recorder; and the content coach, as refiner of model structure, sketched and formulated and reformulated on paper, periodically taking over the discussion to work with the group about what he heard them saying.

The group evolved the view of stocks and flows of children in the foster care system shown in Figure 2. By dinner time on the first day of the workshop, the rudiments of a

model formulation involving four sectors had been crafted by the group and the modeling support team: Child stocks and flows, Child Protective Services staff and Case workers, Care capacities, and Workload effects. The process coach spent the evening after dinner translating the model into STELLA,[7] while the facilitator worked with the group to assign values to parameters, initial values, and initial flows (which proved surprisingly helpful). The next morning, after a session stepping back to review the definition of the problems being addressed, the model was simulated for the group.

Figure 2: Stock-and-flow diagram of foster care populations conceptualized in the foster care group modeling workshop. The model formulated around this structure, parameterized, and simulated during the workshop contained more than 80 equations (10 levels) organized in four sectors: Child stocks and flows, Child Protective Services and Case workers, Care capacities, and Workload effects.



The workshop was considered a great success by all the participants, with the modeling team flushed with enthusiasm about developing a significant model with the active participation of twelve experts in under two days. Yet little obvious follow-up work resulted until this year, when modeling support team worked with a group of foster care agency heads in New York City in a similar but much abbreviated fashion to set a base for understandings about the implementation of an initiative in New York State foster care known as HomeRebuilders. This experimental program will alter funding mechanisms in an effort to focus resources on *after care*, an idea that was supported by model-based analyses from the foster care modeling work.

Medicaid in Vermont.

Prior to 1990 Medicaid costs in Vermont had been reasonably predictable. Although rising, costs were sufficiently well-behaved to allow the department's traditional approaches to anticipate and budget for next year's costs well. But in 1990, Vermont's

7 Richmond, Vescuso, and Peterson (1987).

Department of Social Welfare, the state's designated Medicaid agency, part of its Agency of Human Services, was forced to go back the Legislature several times in the space of six months to request budget adjustments to cover dramatic unanticipated increases in costs. Concern about the traditional approaches led to the opportunity to try to introduce systems thinking and simulation into the workings of the Agency of Human Services. The new head of the Agency approached one of the authors (Steinhurst), who had been involved extensively since 1982 using system dynamics modeling and simulation to forecast Vermont's electrical energy demand and supply. The Agency head wanted to approach the Medicaid cost problem in particular, and Vermont human service planning in general, more systematically, although he had a diffuse notion of what that meant, more in the vein of the MIS/program budgeting approach[8] than system dynamics. Steinhurst held several small group sessions with Agency management, presenting STELLA and discussing the systems approach.

Steinhurst then contacted system dynamics practitioners at the Rockefeller College to see if they knew of work on Medicaid in the system dynamics literature. Fresh from the foster care work, Andersen and Richardson were interested in trying again to engage a large group in the modeling process, so they set up with Steinhurst a series of modeling workshops as a part of a project to model the Medicaid cost problem.

The Medicaid problem is a significant one and had high visibility in the Vermont Agency of Human Services, so there were a number of groups of players who needed to be involved. Steinhurst identified

Stakeholders: Agency and department heads with significant responsibility for Medicaid program or financial management in the state, members of the Governor's staff, and an invited outsider from the National Governor's Association;

Experts: a group of people within the Vermont Agency of Human Services (including some stakeholders) who are most knowledgeable about the Medicaid system in Vermont, together with some members of key health care policy groups outside AHS;

The Core Modeling Group: a small group of people who would directly support the model building efforts with data and analyses and who could be expected to carry on the simulation work after the initial group work was completed.

He assembled lists of people in these categories, developed their interest, taught many of them something of the system dynamics approach, and enrolled them in the project.

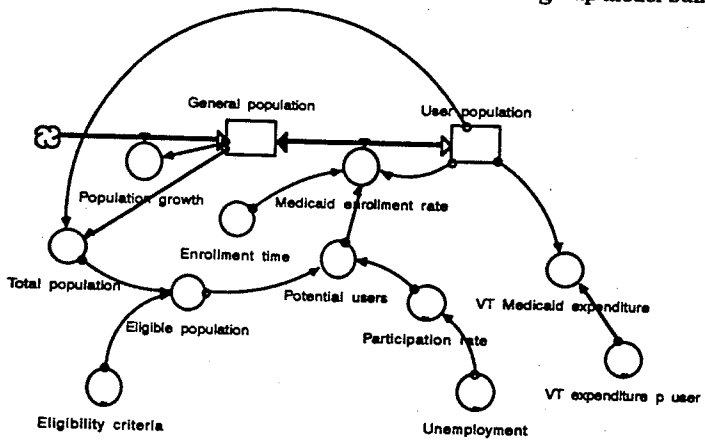
With its visibility and potential political importance, the project became larger than the experimental work with the foster care model group. The modeling team was reluctant to enter two days of workshops with all three groups, including the important Stakeholders, without a warm-up group model-building workshop or rehearsal. So we carried out a sequence of group model building workshops, in which the first and third involved the Expert and Core subgroups in the most modeling intensive parts of the project:

May 28, 1991: Expert and core group modeling workshop
June 27-28: Stakeholders, expert, & core group modeling workshop
July 16: Expert and core group model revisions workshop

As in the foster care workshop, the May and June Vermont Medicaid workshops both began with a concept model, diagrammed in Figure 3.

[8] See, for example, Churchman (1968)..

Figure 3: Initial concept model for Vermont Medicaid group model building workshops.



The intended adequacies and inadequacies of the concept model stimulated discussion, which led in the first workshop to the model diagrammed in Figure 4. The obvious malleability of the models, and their partial fit to the mental models of the participants, led to a laundry list of concepts and variables the group wished to see incorporated into a full model useful for forecasting and policy.

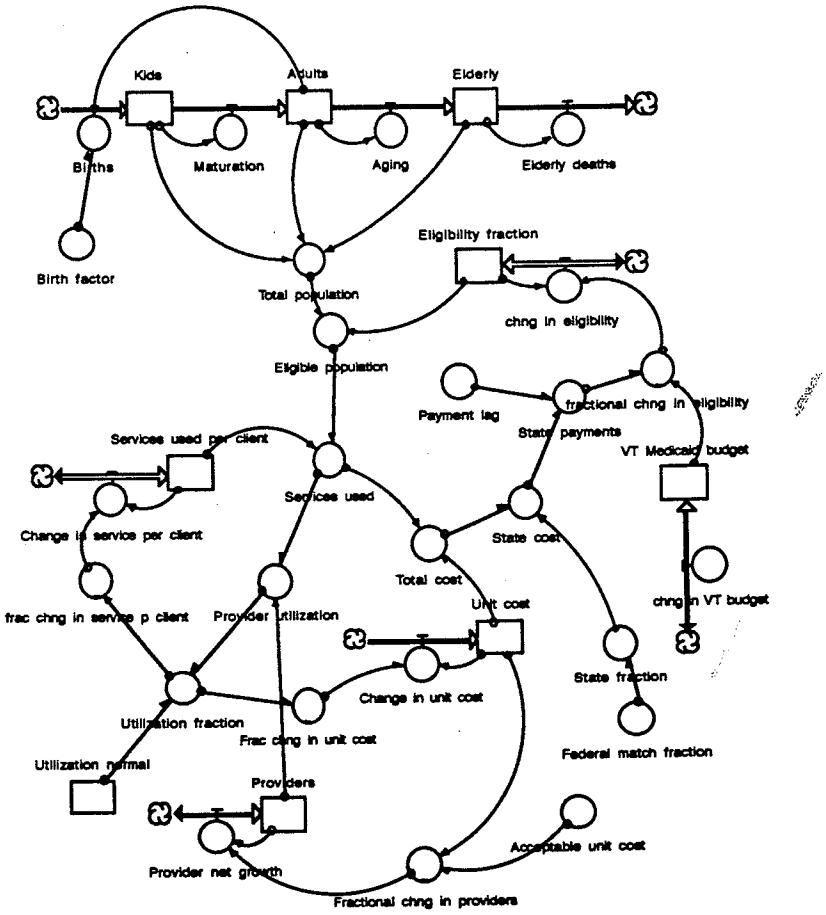
The second of the three workshops was attended by all three groups, Stakeholders, Experts, and the Core group. The interaction proceeded as in the previous group model building workshops, but a working model did not result. Modeling proceeded after the workshop in the more traditional way (behind the scenes), and the third workshop used the five role scheme (without the process coach) to review, critique, and revise the model. In this last workshop, the content coach acted not quite as a master modeler but more as a reflector on the group's discussion, a "contemplator" whose job was to refine and crystallize the thinking of the group. We came to understand that the role of the content coach is more general than "modeler," and that there is great value to having a person reflecting on the group's thinking and reflecting it back to them.

Discussion

Perceived value of recognizing the five roles

The complexities of problem conceptualization, model formulation, and group process suggest that separating the roles of group facilitator, knowledge elicitor, and model crystallizer in large groups greatly facilitates model development. Our experiments have involved a conceptually complete group of five actors. Many system dynamics practitioners have pursued group work by themselves, commonly aided by a person within the group fulfilling the role of we have identified as the gatekeeper. In such one-person shows, the system dynamics practitioner functions at various times, or simultaneously, as group facilitator, knowledge elicitor, educator, modeler, and recording secretary. At a minimum our experiments and the literatures they are based upon suggest that recognizing these multiple and conflicting roles is essential for smooth group process and effective model-based group strategy support.

Figure 4: Simple Vermont Medicaid model developed during the first group modeling workshop. The model was formulated by the content coach while listening to the first hour-and-a-half of facilitated group discussion, presented back to the group, composed in STELLA during the break, and simulated for the group.



But it is very likely the minimum is not enough. To accelerate group modeling to the point of conceptualizing, formulating, and simulating a reasonably complex model in two days almost certainly requires a team of several people each paying attention separate aspects of the process. Even for more traditional modeling projects in which models are built in the weeks between client group meetings, the most powerful minimum is not one person enlightened by perceiving several essential roles, but at least two people in a group modeling team, one focusing on group facilitation, knowledge elicitation, and initial drafts of structure, and the other focusing on the problem, the system being conceptualized,and refinements of structure. We suspect that the best group modeling work in system dynamics follows at least this minimal team structure, with members of the team unconsciously moving into and out of the roles we have described. Just as a fluent basketball team plays better when positions are assigned, we suspect that assigning roles in group modeling, even fluid ones, will

significantly improve the play.

Potential pitfalls
Role conflicts: The content coach can interfere with the flow of group process being shaped by the facilitator/elicitor. In our experiments the content coach would occasionally present to the group and discuss reflections on the group's problem definition, system conceptualization, model formulation, and policy implications. If not done with great care, moves by the content coach can derail lines of thinking being pursued by the facilitator/elicitor.

A process coach, focusing solely on intra-group interactions, can be enormously beneficial in helping the facilitator maintain the group's motivation and momentum. However, both process and content coaches have to keep in mind that the facilitator/ elicitor is, in a sense, on stage and vulnerable. Hearing that "the group is unraveling," "something must be done to energize those folk over there," and the like, can be unnerving. We have chosen the word "coach" advisedly — a coach does more than diagnose problems; a coach suggests plays. And great coaches make their suggestions with deep knowledge of the situation in the game and all the players' strengths and weaknesses.

Explainer/elicitor conflicts: Most system dynamics group work must involve some discipline-centered teaching about the approach, along with the group-centered elicitation of knowledge about the structure and dynamics of the problem. Explaining the mysteries of system dynamics or of a particular model formulation can get in the way of uninhibited group discussion centered on the problem independent of approach or formulation. There are two worst cases: teaching too much about the system dynamics approach and model formulations, and teaching too little about them. Teaching too much interferes with getting information about the group's problem. The group learns much about the approach, the modeling team hears mostly just what it taught, and the group's problem remains largely unaddressed. Teaching too little can lead to badly targeted group discussions that do not help the development of a dynamic, feedback view of the problem.

In our work on Vermont Medicaid, the group worked extremely well together but was reluctant to go beyond numerical data to assert causal mechanisms in the intricate doctor/patient/reimbursement Medicaid system. The modeling team pressed for some causal feedback views, but did not force an endogenous dynamic feedback view. In the end the team was left with few insights about the causal structure of critical parts of the system. The further modeling work that followed, undertaken by the Rockefeller College team and the Vermont core group, has been strong on time-series data but weak on feedback structure and insight. The Vermont model-based group work might be faulted for trying to be too responsive to the group, and for failing to do a good job presenting and motivating the system dynamics approach.

Future Directions
The next steps are more tests of the approach, and the exporting of it to others to test the extent to which it can stand by itself. We hope to design experiences for our graduate students in which they take over all the roles involved in group model building. We are coming to believe that enlightened ability to support groups in rapid model-based investigations is an essential component of the tool kit of professional system dynamics practitioners.

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