

President's Address to the System Dynamics Society 1997 System Dynamics Conference, Istanbul, Turkey

George P. Richardson
Rockefeller College of Public Affairs and Policy
University at Albany – State University of New York

As those who have come before me know, it is a great honor, but a bit daunting, to stand before you today and speak as the President of the System Dynamics Society. The field now has forty years of history behind it — if you are counting from the time Jay Forrester first had the idea to enhance management understanding by linking computer simulation with knowledge about the role of information feedback in the dynamics of human affairs. If you are counting from the origins of feedback thought, we have to acknowledge that we are only the most recent forty years in a long, rich history going back to the ancient Greeks and beyond. Two thousand years ago the Hebrew's Pirke Avot affirmed that “one good deed leads to another good deed, and one transgression leads to another transgression.” The Koran has even a more powerful multiplier: “He who shall present himself with good works shall receive a tenfold reward; but he who shall present himself with evil works shall receive none other than a like punishment.” And Black Elk told of the ancient wisdom of the North American Oglala Sioux, that “the power of the world always works in circles, and everything tries to be round.”

But for some reason, feedback thought is not the natural way people think about the problems that swirl about us every day — feedback thought is always an endangered species. As a field, and as a Society, we are doing our best to help it survive in a mental jungle ruled by static, linear behemoths that see little more than one-way chains of logic, correlation, and perhaps an occasional vicious circle. Make no mistake: Our goal is nothing less than to make feedback thought the king of this mental model forest. [Yes, friends, we need a Forrester in this forest!] For if the dynamic problems of the world are fundamentally of a feedback nature, our thought must incorporate feedback structure or it is doomed to be a pale shadow of reality, and we are doomed to short-sighted, narrow-boundary thinking that will fundamentally fail us in the long, dynamic run. But you knew that.

I wish to speak today about a vision for the system dynamics community. We have a sense of our mission and method— improving policy design using computer simulation and a feedback perspective — but I don't believe we have a well-founded sense of how we should be organized to work on this mission. I have the opportunity here to suggest a vision, so I'm going to offer one, based on some reflections on a few problems and what I see as our great potential.

Problems for the Future

In 1995 at the Tokyo Conference, and later in print in the *System Dynamics Review*, I had the

opportunity to describe eight problem areas that appear to be both opportunities and threats for the system dynamics community. For this vision I am speaking about, it is worth reflecting on them again and noting our progress in the last two years. The areas are:

- Understanding model behavior
- Accumulating wise practice
- Advancing practice
- Accumulating results
- Making models accessible
- Qualitative mapping and formal modeling
- Widening the base
- Confidence and validation

How have we been doing? The issue of **Understanding Model Behavior** refers to our need for formal software tools that aid the processes of model analysis; we need help teasing out the linkages between structure and behavior in our more complex formal models. The good news is that progress is being made. A dissertation by Mojtahedzadeh at the University at Albany developed a formal tool that identifies dominant causal pathways around a chosen variable in a given behavior pattern, and showed list of useful heuristics for using the tool to uncover even subtle connections between structure and behavior. Similar efforts using other approaches are surfacing in the works of Kim and Kampmann. The battle is not yet won — tools for understanding model behavior is still our most outstanding unsolved technical problem — but we are making progress. Soon you may be able to highlight a variable in a model and click on a “dominant structure button” and receive immediate on-screen reports that enable you to assert with confidence what parts of a complex model are most responsible for the behavior of that variable at every point in time in a simulation.

The next three problem areas — **Accumulating Wise Practice**, **Advancing Practice**, and **Accumulating Results** — show mixed accomplishment. There is no doubt that practitioners in academia, consulting, and the public and private sectors are experimenting continually with approaches to policy modeling that really work, that really lead to insightful, valid, and implemented results. And there is no doubt that some practitioners are helping clients dramatically improve policies and business processes. Yet some of these advances are hidden away from the field as a whole — the results are confidential, the process is propriety (a consulting trade advantage), or there simply isn’t time to get the word out. Common wisdom says that many are so busy doing and creating that they do not have time to tell the rest of us of their advances.

But there is a larger issue here. In our efforts to do the best applied work we can, we do not do the careful studies we need to determine which of our experiments, which of our innovations, are actually creating the successes. If a group model building intervention succeeds in producing alignment around a new set of policy initiatives and appears to lead directly to implementation,

what parts of the process were critical to the success? We are guided here by our intuitions and natural preferences, but it is likely here that we are making the same mistakes using the same patterns of thought we are trying to improve in others — those static, linear patterns I spoke of that see little more than one-way chains of logic, correlation, and perhaps an occasional vicious circle. And it is likely we will stumble into the very kinds of superstitious learning we are trying to help others avoid. We must find improved ways to learn what really works in client-based work and why it works. I suspect that will take some collaboration, and that is part of the vision.

It appears that we have made very little progress in the area of **Making Models Accessible**. A person not present at the creation of a complex model faces a daunting task to “get inside” the model and understand its structure and dynamics. (That may be one reason for the continuing emphasis on group model building — the people who need to know will have been present at the creation and have internalized their understandings.) In our collective abilities to “open” a model for others, we have not advanced beyond the earliest works in the field. Worse, some articles fail to reach publication because authors are unable to reveal model structure and its links to dynamics in ways others can understand. And we have no ongoing research or experimentation in this area to guide us. We are left to intuition and, we hope, good writing and good pictures. We may still be correctly accused of creating formal models that are not much more accessible than the mental models we are striving to improve. We need to expose the methods of our best expositors and test their extensibility.

In the area of **Qualitative Mapping and Formal Modeling** we are making strides toward understanding when to do which, but much more is needed. The threat, of course, is that we will overextend the qualitative interventions beyond what real insights and analyses they can support, and we will produce seriously flawed results that will be believed in the name of systems thinking. On the quantitative side, the danger is that policy insights remain locked within the formal model because we fail to make results intuitive. We require collaboration here also, and a skeptical frame of mind, to expose the limits of qualitative mapping and the richest ways to link it to formal modeling and robust policy analysis.

We are actually doing better than most of us know in the problem area called **Widening the Base**. Here we are interested in expanding the number of people worldwide who recognize systems thinking and system dynamics concepts and are ready for understandings couched in feedback terms. Here the wonderful work of Senge has had the greatest impact, but there are other less well known developments. McKinsey and Company is on a serious campaign to build its capacity to incorporate system dynamics modeling into its consulting services, and they are justifiably proud of a number of successes they have had already. The System Dynamics Institute initiative among consultants around Boston is another worthy effort. And as each of us completes work with public sector and private sector clients with insightful, implemented results, the base is widened further.

Most interestingly, in the United States there is a growing number of school districts teaching dynamic systems thinking and simulation modeling to grade school children. I saw some results from a first and second grade class — these are seven year old children. They did a fruit fly population experiment and graphed the population size over time, and the students generated the stock-and-flow structure of the simple system. In another exercise, the teacher drew a causal-loop showing a pair of rabbits at the top and a lot of little rabbits at the bottom and drew from the kids the story of self-reinforcing dynamics the picture tried to capture. Then she asked the children for other such drawings. She got a number of expected variations on her theme — a pair of horses and lots of foals, a pair of ducks and a lot of little ducklings — but she also received a drawing from one little boy with a Nike symbol at the top and a dollar bill at the bottom, connected by the arrows forming a positive loop. This seven-year old explained that “the more shoes Nike makes, the more money they will make, so they can make still more shoes.” Amazing. [And the boy was not related to Yaman Barlas, as far as I know.] Now another child drew a factory spewing smoke connected to a large black cloud, saying “the more factories the more pollution, and the more pollution the more factories,” and one of those links doesn’t make much sense. But the point is, kids can think dynamically and in loops, and in later grades (fourth and fifth) they can play with simulations and in some schools they are creating models as early as the sixth grade — those are twelve-year-olds. Without a doubt, the base is being widened, but this is still only the beginning.

I could continue with comments about our slow progress in the area of **Confidence and Validation**, but here is the point —

Constituencies of the System Dynamics Community

There are implications in this review of these eight problem areas, beyond the problems themselves — implications for the vision I spoke of. The implication that stands out the most to me concerns the “constituencies” of the system dynamics community. Who makes up the System Dynamics Society? Who comes to its meetings? Who writes in its journal? And who stands to gain from knowing about our work?

In telling the stories in the previous paragraphs, I have found it necessary to refer to four or five separate constituencies:

- academic researchers
- consultants
- practitioners in the public and private sectors
- school educators.

I submit that the system dynamics community can not reach its full potential until all four constituencies are at home and well represented among us. And so far, they are not quite. It might be like a stool — four legs is preferred, being quite stable but having the potential for a bit of chaotic wobbliness that makes for an interesting dynamic seat; three legs is rock solid but shows

no dynamics; and we, the system dynamics stool, can not stand at all in the long run if we manage to involve only two of these constituencies, or, perish the thought, only one.

How well are we doing? We are highly successful, I think, in providing a welcoming space for academics. Our conferences have an academic research character, and our journal adheres to high academic standards of peer review and scholarship. But how might we look if we were striving to be equally inviting to consultants, professional practitioners, and school teachers?

Our conferences might look a bit different. We strive for involvement of all four constituencies, and we have been sporadically successful at various conferences in getting people from all four groups to attend and interact. A view of the papers in this conference suggests Yaman Barlas and his program committee have been unusually successful in this regard. But a serious effort in this direction might involve a “constituency chair” for each group as a part of the program committee of every conference, a person charged with getting a critical mass of participants and papers in their area to the conference. Suppose we were successful. Those critical masses would attract others like themselves and we would have a self-perpetuating mechanism for widening the base — positive feedback loops in our own structure and behavior.

Better yet, the interactions between these groups is always healthy for the field. Consultants and practitioners in the public and private sectors can push us ahead with interventions designed in the rapid flow of events to do the best for their clients. Those of us from academic settings can raise the nasty questions about where the successes are coming from and why? We can not learn without both of these kinds of activities. And the school teachers have a role as well. They may be the best teachers of system dynamics among us, for they are figuring out how to enable little children and teenagers (even tougher than little children) to acquire systems thinking and system dynamics modeling capabilities. Our applications enrich them; their pedagogy teaches us.

And I’d go so far as to suggest that our journal could look a bit different as well, catering to these four constituencies, without losing its academic standing and scholarship. We could strive to have excellent work from each of the four constituencies represented in the *System Dynamics Review* at least once and preferably more than once every year. Here the notion of associate editors for each of the four constituencies might work, or at least for the three under-represented groups. Even the review and production process could adjust: A great application sent in by a public sector practitioner, who happened not to have the time or inclination to seek out all the relevant references, could be enhanced in the editing process by academics who know or love to find all those references. The result is more great applied work in the *Review* that meets our demands for scholarly contribution.

The Vision

My vision, then, for the system dynamics community is a blend of four constituencies —

academics, consultants, practitioners in business and government, and teachers — with two overlapping approaches — qualitative systems thinking and quantitative simulation modeling — who combine together in this community to achieve the synergies that will truly advance our field and the understandings of those we serve. Our joint mission is to improve policy analysis and design using systems thinking, simulation, and a dynamic feedback perspective.

I sense that visions become reality if they are repeated, so let me say again: Let us envision the system dynamics community to be

- a blend of four constituencies — academic researchers, consultants, practitioners in business and government, and teachers
- with two overlapping approaches — qualitative systems thinking and quantitative simulation modeling

who combine together in this community to achieve the synergies that will truly advance our field and the understandings of those we serve.

I hope here in Istanbul we have some of all four constituencies. I know from Yaman's fine work we have at least three of them here. As an academic, trying to teach and do research and client-centered work in the public sector for the good of public policy, I welcome you all — researchers, consultants, practitioners, and educators — to the riches of the days that follow. And I deeply thank you for the honor of the opportunity to speak about this vision.