



### **Leading System Dynamics Expert Speaks at Rotman**

**John Sterman**, one of the world's leading thinkers on system dynamics, was featured in the 17<sup>th</sup> session in the *Rotman Integrative Thinking Seminar Series* in March. Sterman is the Standish Professor of Management and director of the System Dynamics Group at MIT's Sloan School of Management.

Sterman began by telling the packed classroom that "All models are wrong: yet every decision you make is based on a model of some sort." We think what we see is what is really there, he says, and that's not our fault. "There are a huge number of neurons in the brain, and their job is to find the edges of objects. This leads to illusions – but because it goes on at the hardware level of your brain, you can't 'turn it off'."

When a manager chooses to solve a problem in a certain way, it often has a domino effect – creating what Sterman calls 'legacy effects' of poor prior decisions. "Attention may be focused in the wrong direction – for instance, the manager might be focusing on customers. He can see the 'customer' domino immediately in front of him, but he can't see all the other dominoes in the line – some are quite far away. By pushing that first one over, he gets rewarded, but someone else has to deal with the legacy of that decision."

Most of today's businesspeople work within an ordered system of goals, decisions, and subsequent impact on the environment, he says. "But we are actually embedded in a much larger system: there's feedback along the way, and that affects the outcome. All decisions have two kinds of effects – those you think about, and those you don't. In addition, other agents are making decisions at the same time you are, which compounds the scenario."

Sterman gave the example of health plans that only allow prescriptions from a specific list of drugs. "Their goal is to limit prescriptions to cheaper, generic drugs and save money." However, a number of feedback mechanisms weren't considered. "Because they are using cheaper drugs, people don't get better as fast, and are more likely to return to the doctor. In some cases, they may end up needing surgery, and there may be more emergency room visits. Or, they can remain contagious longer, and more people are affected. In any case, the end result of saving money isn't met."

So how can we get around these tendencies for weak modeling? "Identify areas you aren't looking at," says Sterman, "and then generate a way to measure how important they are. There are always feedback effects that aren't being considered."

The greatest potential for improvement comes when the modeling process leads to changes in deeply-held mental models, says Sterman. But the more fundamental the mental model, the more defensive people will be about changing it.

In the 1990s, DuPont found out they were spending more than ever on maintenance, but getting less out of it than their competitors. How could they be spending more and getting less? "Equipment accumulates defects -- but not right away. You can either correct it when the defect occurs, or through preventative maintenance (PM). But cost-benefit wise, PM is often not worth it: breakdowns increase as different feedbacks compound -- which can lead to decreased competitiveness. A worse-before-better tradeoff occurs, and costs incur before the benefits show.

How can each of us become a better systems thinker? "Constantly expand the boundaries of your mental models. Seek out multiple points of view. Avoid blame -- focus instead on feedback and system structure. Develop not only technical skills, but skills in dialogue, empathy and self-reflection."

In the end, says Sterman, it's about thinking globally, but acting locally. "Take a smaller piece of the puzzle and affect it. And aim high."