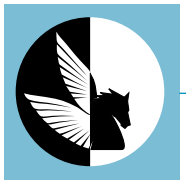
PEGASUS COMMUNICATIONS

THE SYSTEMS THINKER®

BUILDING SHARED UNDERSTANDING

VOLUME 13
NUMBER 2
MARCH
2002

IN THIS ISSUE:



FEATURE

DANCING WITH SYSTEMS

BY DONELLA MEADOWS

This article is an excerpt from Donella Meadows's unpublished manuscript "Thinking in Systems." It was originally published in *Whole Earth,* Winter 2001.

People who are raised in the industrial world and who get enthused about systems thinking are likely to make a terrible mistake. They are likely to assume that here, in systems analysis, in interconnection and complication, in the power of the computer, here at last, is the key to prediction and control. This mistake is likely because the mindset of the industrial world assumes that there *is* a key to prediction and control.

I assumed that at first, too. We all assumed it, as eager systems students at the great institution called MIT. More or less innocently, enchanted by what we could see through our new lens, we did what many discoverers do. We exaggerated our own ability to change the world. We did so not with any intent to deceive others, but in the expression of our own expectations and hopes. Systems thinking for us was more than subtle, complicated mindplay. It was going to Make Systems Work.

But self-organizing, nonlinear feedback systems are inherently unpredictable. They are not controllable. They are understandable only in the most general way. The goal of foreseeing the future exactly and preparing for it perfectly is unrealizable. The idea of making a complex system do just what you want it to do can be achieved only temporarily, at best. We can never fully understand our world, not in the way our reductionistic science has led us to expect. Our science itself, from quantum theory to the mathematics of chaos, leads us into irreducible uncertainty. For any objective other than the most trivial, we can't optimize; we don't even know *what* to optimize. We can't keep track of everything. We can't find a proper, sustainable relationship to nature, each other, or the institutions we create if we try to do it from the role of omniscient conqueror.

For those who stake their identity on the role of omniscient conqueror, the uncertainty exposed by systems thinking is hard to take. If you can't understand, predict, and control, what is there to do?

Systems thinking leads to another conclusion, however—waiting, shining, obvious as soon as we stop being blinded by the illusion of control. It says that there is plenty to do, of a different sort of "doing." The future can't be predicted, but it can be envisioned and brought lovingly into being. Systems can't be controlled, but they can be designed and redesigned. We can't surge forward with certainty into a world of no surprises, but we can expect surprises and learn from them and even profit from them. We can't impose our will upon a system. We can listen to what the system tells us, and discover how its properties and our values can work together to bring forth something much better than could ever be produced by our will alone.

We can't control systems or figure them out. But we can dance with them (see "The Dance")!

I already knew that, in a way, before I began to study systems. I had learned about dancing with great powers from whitewater kayaking, from gardening, from playing music, from skiing. All those endeavors require one to stay wide-awake, pay close attention, participate flat out, and respond to feedback. It had never occurred to me that those same requirements might apply to intellectual work, to management, to government, to getting along with people.

But there it was, the message emerging from every computer model we made. Living successfully in a world of systems requires more of us than our ability to calculate. It requires our full humanity—our rationality, our ability to sort out truth from falsehood, our intuition, our compassion, our vision, and our morality.

I will summarize the most general "systems wisdom" I have absorbed from modeling complex systems and from hanging out with modelers. These are the take-home lessons, the concepts and practices that penetrate the discipline of systems so deeply that

THE DANCE

1. Get the beat.
2. Listen to the wisdom of the system.
3. Expose your mental models to the open air.
4. Stay humble. Stay a learner.
5. Honor and protect information.
6. Locate responsibility in the system.
7. Make feedback policies for feedback systems.
8. Pay attention to what is important, not just what is quantifiable.
9. Go for the good of the whole.
10. Expand time horizons.
11. Expand thought horizons.
12. Expand the boundary of caring.
13. Celebrate complexity.
14. Hold fast to the goal of goodness.

one begins, however imperfectly, to practice them not just in one's profession, but in all of life.

The list probably isn't complete, because I am still a student in the school of systems. And it isn't unique to systems thinking. There are many ways to learn to dance. But here, as a start-off dancing lesson, are the practices I see my colleagues adopting, consciously or unconsciously, as they encounter systems.

1. Get the beat.

Before you disturb the system in any way, watch how it behaves. If it's a piece of music or a white-water rapid or a fluctuation in a commodity price, study its beat. If it's a social system, watch it work. Learn its history. Ask people who've been around a long time to tell you what has happened. If possible, find or make a time graph of actual data from the system. Peoples' memories are not always reliable when it comes to timing.

Before you charge in to make things better, pay attention to the value of what's already there.

Starting with the behavior of the system forces you to focus on facts, not theories. It keeps you from falling too quickly into your own beliefs or misconceptions, or those of others. It's amazing how many misconceptions there can be. People will swear that rainfall is decreasing, say, but when you look at the data, you find that what is really happening is that variability is increasing—the droughts are deeper, but the floods are greater too. I have been told with great authority that milk price was going up when it was going down, that real interest rates were falling when they were rising, that the deficit was a higher fraction of the GNP than ever before when it wasn't.

Starting with the behavior of the system directs one's thoughts to dynamic, not static, analysis—not only to "what's wrong?" but also to "how did we get there?" and "what behavior modes are possible?" and "if we don't change direction, where are we going to end up?"

And finally, starting with history discourages the common and distracting tendency we all have to define a problem not by the system's actual behavior, but by the lack of our favorite solution. (The problem is, we need to find more oil. The problem is, we need to ban abortion. The problem is, how can we attract more growth to this town?)

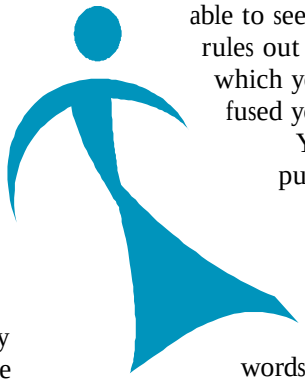
2. Listen to the wisdom of the system.

Aid and encourage the forces and structures that help the system run itself. Don't be an unthinking intervener and destroy the system's own self-maintenance capacities. Before you charge in to make things better, pay attention to the value of what's already there.

A friend of mine, Nathan Gray, was once an aid worker in Guatemala. He told me of his frustration with agencies that would arrive with the intention of "creating jobs" and "increasing entrepreneurial abilities" and "attracting outside investors." They would walk right past the thriving local market, where small-scale business people of all kinds, from basket-makers to vegetable growers to butchers to candy sellers, were displaying their entrepreneurial abilities in jobs they had created for themselves. Nathan spent his time talking to the people in the market, asking about their lives and businesses, learning what was in the way of those businesses expanding and incomes rising. He concluded that what was needed was not outside investors, but inside ones. Small loans available at reasonable interest rates and classes in literacy and accounting would produce much more long-term good for the community than bringing in a factory or assembly plant from outside.

3. Expose your mental models to the open air.

Remember, always, that everything you know, and everything everyone knows, is only a model. Get your model out there where it can be shot at. Invite others to challenge your assumptions and add their own. Instead of becoming a champion for one possible explanation or hypothesis or model, collect as many as possible. Consider all of them plausible until you find some evidence that causes you to rule one out. That way, you will be emotionally able to see the evidence that rules out an assumption with which you might have confused your own identity.



You don't have to put forth your mental model with diagrams and equations, though that's a good discipline. You can do it with words or lists or pictures or arrows showing what you think is connected to what. The more you do that, in any form, the clearer your thinking will become, the faster you will admit your uncertainties and correct your mistakes, and the more flexible you will learn to be. Mental flexibility—the willingness to redraw boundaries, to notice that a system has shifted into a new mode, to see how to redesign structure—is a necessity when you live in a world of flexible systems.

4. Stay humble. Stay a learner.

Systems thinking has taught me to trust my intuition more and my figuring-out rationality less, to lean on both as much as I can, but still to be prepared for surprises. Working with systems—on the computer, in nature, among people, in organizations—constantly reminds me of how incomplete my mental models are, how complex the world is, and how much I don't know.

The thing to do when you don't know is not to bluff and not to freeze, but to learn. The way you learn is by experiment—or, as Buckminster Fuller put it, by trial and error, error, error. In a world of complex systems, it is not appropriate to

Continued on next page ➢

➢ Continued from previous page

charge forward with rigid, undeviating directives. "Stay the course" is only a good idea if you're sure you're on course. Pretending you're in control even when you aren't is a recipe not only for mistakes, but for not learning from mistakes. What's appropriate when you're learning is small steps, constant monitoring, and a willingness to change course as you find out more about where it's leading.

That's hard. It means making mistakes and, worse, admitting them. It means what psychologist Don Michael calls "error-embracing." It takes a lot of courage to embrace your errors.

5. Honor and protect information.

A decision-maker can't respond to information he or she doesn't have, can't respond accurately to information that is inaccurate, can't respond in a timely way to information that is late. I would guess that 99 percent of what goes wrong in systems goes wrong because of faulty or missing information.

If I could, I would add an Eleventh Commandment: *Thou shalt not distort, delay, or sequester information*. You can drive a system crazy by muddying its information streams. You can make a system work better with surprising ease if you can give it more timely, more accurate, more complete information.

For example, in 1986 new federal legislation required U.S. companies to report all chemical emissions from each of their plants. Through the Freedom of Information Act (from a systems point of view, one of the most important laws in the nation), that information became a matter of public record. In July 1988 the first data on chemical emissions became available. The reported emissions were not illegal, but they didn't look very good when they were published in local papers by enterprising reporters, who had a tendency to make lists of "the top 10 local polluters." That's all that happened. There were no lawsuits, no required reductions, no fines, no penalties. But within two years, chemical emissions nationwide (at least as reported and presumably also in fact) had decreased by 40 percent. Some companies were launching policies to bring their emissions down by 90 percent, just because of the release of previously sequestered information.

I would guess that 99 percent of what goes wrong in systems goes wrong because of faulty or missing information.

6. Locate responsibility in the system.

Look for the ways the system creates its own behavior. Do pay attention to the triggering events, the outside influences that bring forth one kind of behavior from the system rather than another. Sometimes those outside events can be controlled (as in reducing the pathogens in drinking water to keep down incidences of infectious disease). But sometimes they can't. And sometimes blaming or trying to control the outside influence blinds one to the easier task of increasing responsibility within the system.

"Intrinsic responsibility" means that the system is designed to send feedback about the consequences of decision-making directly and quickly and compellingly to the decision-makers.

Dartmouth College reduced intrinsic responsibility when it took thermostats out of individual offices and classrooms and put temperature-control decisions under the guidance of a central computer. That was done as an energy-saving measure. My observation from a low level in the hierarchy is that the main consequence was greater oscillations in room temperature. When my office gets overheated now, instead of turning down the thermostat, I have to call an office across campus, which gets around to making corrections over a period of hours or days, and which often overcorrects, setting up the need for another phone call. One way of making that system more, rather than less, responsible might have been to let professors keep control of their own thermostats and charge them directly for the amount of energy they use (thereby privatizing a commons!).

Designing a system for intrinsic responsibility could mean, for example, requiring all towns or companies that emit wastewater into a stream to place their intake pipe *downstream* from their outflow pipe. It could mean that neither insurance companies nor public funds should pay for medical costs resulting from smoking or from accidents in which a motorcycle rider didn't wear a helmet or a car rider didn't fasten the seatbelt. It could mean Congress would no longer be allowed to legislate rules from which it exempts itself.

7. Make feedback policies for feedback systems.

President Jimmy Carter had an unusual ability to think in feedback terms and to make feedback policies. Unfortunately, he had a hard time explaining them to a press and public that didn't understand feedback.

He suggested, at a time when oil imports were soaring, that there be a tax on gasoline proportional to the fraction of U.S. oil consumption that had to be imported. If imports continued to rise, the tax would rise, until it suppressed demand and brought forth substitutes and reduced imports. If imports fell to zero, the tax would fall to zero.

The tax never got passed.

Carter was also trying to deal with a flood of illegal immigrants from Mexico. He suggested that nothing could be done about that immigration as long as there was a great gap in opportunity and living standards between the U.S. and Mexico. Rather than spending money on border guards and barriers, he said, we should

spend money helping to build the Mexican economy, and we should continue to do so until the immigration stopped.

That never happened either.

You can imagine why a dynamic, self-adjusting system cannot be governed by a static, unbending policy. It's easier, more effective, and usually much cheaper to design policies that change depending on the state of the system. Especially where there are great uncertainties, the best policies not only contain feedback loops, but meta-feedback loops—loops that alter, correct, and expand loops. These are policies that design learning into the management process.

8. Pay attention to what is important, not just what is quantifiable.

Our culture, obsessed with numbers, has given us the idea that what we can measure is more important than what we can't measure. You can look around and make up your own mind about whether quantity or quality is the outstanding characteristic of the world in which you live.

If something is ugly, say so. If it is tacky, inappropriate, out of proportion, unsustainable, morally degrading, ecologically impoverishing, or humanly demeaning, don't let it pass. Don't be stopped by the "if you can't define it and measure it, I don't have to pay attention to it" ploy. No one can precisely define or measure justice, democracy, security, freedom, truth, or love. No one can precisely define or measure any value. But if no one speaks up for them, if systems aren't designed to produce them, if we don't speak about them and point toward their presence or absence, they will cease to exist.

9. Go for the good of the whole.

Don't maximize parts of systems or subsystems while ignoring the whole. As Kenneth Boulding once said, don't go to great trouble to optimize something that never should be done at all. Aim to enhance total systems properties, such as creativity, stability, diversity, resilience, and sustainability—whether they are easily measured or not.

As you think about a system, spend part of your time from a vantage point that lets you see the whole system, not just the problem that may have drawn you to focus on the system to begin with. And realize that, especially in the short term, changes for the good of the whole may sometimes seem to be counter to the interests of a part of the system. It helps to remember that the parts of a system cannot survive without the whole. The long-term interests of your liver require the long-term health of your body, and the long-term interests of sawmills require the long-term health of forests.

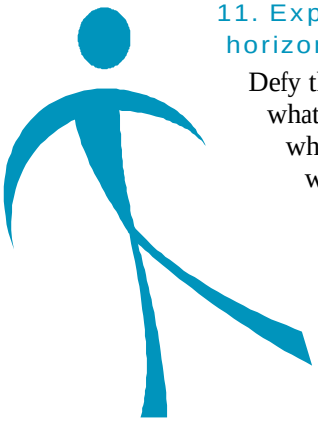
10. Expand time horizons.

The official time horizon of industrial society doesn't extend beyond what will happen after the next election or beyond the payback period of current investments. The time horizon of most families still extends farther than that—through the lifetimes of children or grandchildren. Many Native American cultures actively spoke of and considered in their decisions the effects upon the seventh generation to come. The longer the operant time horizon, the better the chances for survival.

Actions taken now have some immediate effects and some that radiate out for decades to come.

In the strict systems sense, there is no long-term/short-term distinction. Phenomena at different time scales are nested within each other. Actions taken now have some immediate effects and some that radiate out for decades to come. We experience now the consequences of actions set in motion yesterday and decades ago and centuries ago.

When you're walking along a tricky, curving, unknown, surprising, obstacle-strewn path, you'd be a fool to keep your head down and look just at the next step in front of you. You'd be equally a fool just to peer far ahead and never notice what's immediately under your feet. You need to be watching both the short and the long term—the whole system.



11. Expand thought horizons.

Defy the disciplines. In spite of what you majored in, or what the textbooks say, or what you think you're an expert at, follow a system wherever it leads. It will be sure to lead across traditional disciplinary lines. To understand that system, you will have to be able to learn from—while not being limited by—economists and chemists and psychologists and theologians. You will have to penetrate their jargons, integrate what they tell you, recognize what they can honestly see through their particular lenses, and discard the distortions that come from the narrowness and incompleteness of their lenses. They won't make it easy for you.

Seeing systems whole requires more than being "interdisciplinary," if that word means, as it usually does, putting together people from different disciplines and letting them talk past each other. Interdisciplinary communication works only if there is a real problem to be solved, and if the representatives from the various disciplines are more committed to solving the problem than to being academically correct. They will have to go into learning mode, to admit ignorance and be willing to be taught, by each other and by the system.

It can be done. It's very exciting when it happens.

12. Expand the boundary of caring.

Living successfully in a world of complex systems means expanding not

Continued on next page ➢

➢ Continued from previous page

only time horizons and thought horizons; above all, it means expanding the horizons of caring. There are moral reasons for doing that, of course. And if moral arguments are not sufficient, then systems thinking provides the practical reasons to back up the moral ones. The real system is interconnected. No part of the human race is separate either from other human beings or from the global ecosystem. It will not be possible in this integrated world for your heart to succeed if your lungs fail, or for your company to succeed if your workers fail, or for the rich in Los Angeles to succeed if the poor in Los Angeles fail, or for Europe to succeed if Africa fails, or for the global economy to succeed if the global environment fails.

As with everything else about systems, most people already know about the interconnections that make moral and practical rules turn out to be the same rules. They just have to bring themselves to believe that which they know.

13. Celebrate complexity.

Let's face it, the universe is messy. It is nonlinear, turbulent, and chaotic. It is dynamic. It spends its time in transient behavior on its way to somewhere else, not in mathematically neat equilibrium. It self-organizes and evolves. It creates diversity, not uniformity. That's what makes the world interesting, that's what makes it beautiful, and that's what makes it work.

There's something within the human mind that is attracted to straight lines and not curves, to whole numbers and not fractions, to uniformity and not diversity, and to certainties and not mystery. But there is something else within us that has the opposite set of tendencies, since we ourselves evolved out of and are shaped by and structured as complex feedback systems. Only a part of us, a part that has emerged recently, designs buildings as boxes with uncompromising straight lines and flat surfaces. Another part of us recognizes instinctively that nature designs in fractals, with intriguing detail on every scale from the microscopic to the macroscopic. That part of us makes Gothic cathedrals and Persian carpets, symphonies and novels, Mardi Gras costumes and artificial intelligence programs, all with embellishments almost as complex as the ones we find in the world around us.

14. Hold fast to the goal of goodness.

Examples of bad human behavior are held up, magnified by the media, and affirmed by the culture as typical. Just what you would expect. After all, we're only human. The far more numerous examples of human goodness are barely noticed. They are Not News. They are exceptions. Must have been a saint. Can't expect everyone to behave like that.

And so expectations are lowered. The gap between desired behavior and actual behavior narrows. Fewer actions are taken to affirm and instill ideals. The public discourse is full of cynicism. Public leaders are visibly, unrepentantly amoral or immoral and are not held to account. Idealism is ridiculed. Statements of moral belief are suspect. It is much easier to talk about hate in public than to talk about love.

We know what to do about eroding goals. Don't weigh the bad news more heavily than the good. And keep standards absolute.

* * * * *

This is quite a list. Systems thinking can only tell us to do these things. It can't do them for us.

And so we are brought to the gap between understanding and implementation. Systems thinking by itself cannot bridge that gap. But it can lead us to the edge of what analysis can do and then point beyond—to what can and must be done by the human spirit. ◘

Donella Meadows was a pioneering environmental scientist and writer who trained in system dynamics at MIT. She was a coauthor of the international best-selling book, *The Limits to Growth*, published in 1972. The book, which reported on a study of long-term global trends in population, economics, and the environment, sold millions of copies and was translated into 28 languages. She was also a coauthor of the 20-year follow-up study, *Beyond the Limits* (1992). For 16 years she wrote a weekly newspaper column, "The Global Citizen," which applied a systems perspective to international events and the global environment.

Donella was a Pew Scholar, a 1994 MacArthur Fellow, and cofounder of the International Network of Resource Information Centers (INRIC), also called the Balaton Group. She was a professor of environmental studies at Dartmouth College, and taught and lectured all over the world. Donella lived for many years on an organic farm in Plainfield, VT, and helped create an eco-village and organic farm in Hartland, VT. She also founded a "think-do tank" focused on sustainability (see "About Sustainability Institute"). Donella died in February 2001.

ABOUT SUSTAINABILITY INSTITUTE

Donella Meadows founded Sustainability Institute in 1997 as a "think-do tank" focused on sustainable resource use, sustainable economics, and sustainable communities. The staff of the Institute focuses on research and consulting to help public and private organizations boost their effectiveness when putting principles of social, economic, and environmental sustainability into practice. Current Sustainability Institute projects include simulation modeling of natural resource economies in agriculture and forestry, leadership development projects based on systems thinking for sustainability, and a project facilitating dialogues between an energy utility and its corporate customers to accelerate the shift toward sustainable energy sources. To learn more about the work of Sustainability Institute, visit http://www.sustainabilityinstitute.org.

TRANSFORMATION OF ETHOS AT THE U.S. NATIONAL SECURITY AGENCY

BY REBECCA OWENS PILLE

This is the first in an occasional series of articles that share lessons about how the U.S. National Security Agency is bringing about fundamental change as it reorients itself to the challenges of the 21st century. Subsequent articles will provide updates and specifics as to how NSA is undertaking this transformation effort.

In January 2000, the director of the National Security Agency (NSA), Lieutenant General Michael V. Hayden, engaged the Society for Organizational Learning (SoL) to help NSA transform the way it conducts business (see "About the NSA"). General Hayden believes that, to address the new challenges of a rapidly changing world, this transformation must occur in two dimensions—*mission* (the tasks involved in providing and protecting vital information) and *ethos* (the way NSA employees feel, think, and act as they take on that mission). Revamping the agency's mission involves implementing federally mandated reforms as well as updating technology and the way employees work together. Transforming its ethos—perhaps more daunting and the focus of this article—entails (1) undertaking a multi-level educational effort within the established organizational structure and (2) building in-house capability to foster continuous learning by leveraging an informal network of change agents.

Undertaking a Multi-Level Effort

SoL consultants and internal consultants are designing ways to weave new thinking tools and techniques into the fabric of the NSA culture. They have been helping NSA's senior leadership team redefine roles and responsibilities as a result of significant organizational restructuring, describe new leadership standards, develop an efficient decision-making process, and begin to run NSA like a business.

In addition, early in the change process, General Hayden identified a cadre of leaders who would champion the effort throughout the agency. Consultants are working with these leaders as well to help align their thinking and actions with NSA's strategic and business imperatives—and to model new attitudes and behaviors for others at all levels within the agency. These change leaders recognize that in order to model new behaviors for others, they must first transform themselves. In moving away from a traditional hierarchy, many have found that they need different skills, such as the ability to lead change, foster collaboration, and empower employees.

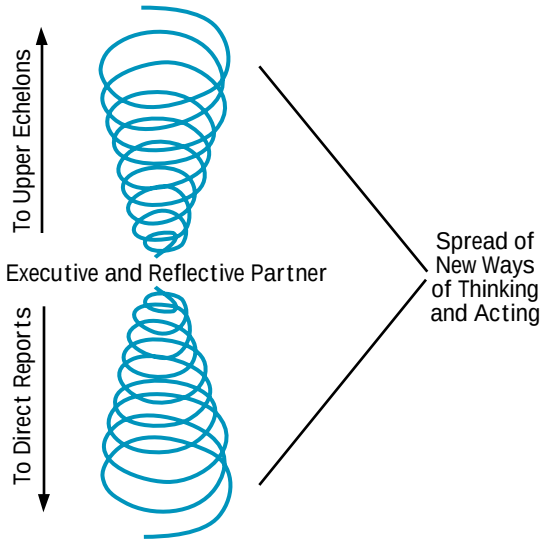
To develop these skills, these leaders are working with what we call *reflective partners*, usually internal consultants or change agents who volunteer to support an executive in learning new ways of leading. Reflective partners in turn receive training from experienced coaches. This process allows both the leaders and their partners to improve their interpersonal skills.

The role of reflective partner takes different forms, depending on the leader's needs. The goal of the relationship is to create time for leaders to reflect on how they interact with their peers and subordinates. Partners act as mirrors, helping executives gain insights into their actions and encounters with others. For instance, a reflective partner might accompany a leader to a meeting to observe and take notes on the interactions. The partner later provides feedback about the dynamics he or she observed and helps the leader learn from the experience.

Over time, leaders learn behaviors that can help them lead more effectively—and unlearn those that interfere with performance. The first people to notice changes in the leader

Continued on next page ➢

SPIRAL INTEGRATION



Spiral integration involves two types of spirals: a downward spiral (from executive to direct reports, as people further down the ranks become involved in learning different ways of working together) and an upward spiral (from executive to upper echelons, as interest in the change initiative surfaces from above). Spiral integration occurs naturally; it is not a program or a project to be managed. Instead, leaders model productive new ways of thinking and acting and then help others adopt those same behaviors.

➢ Continued from previous page

are his or her direct reports. Once executives come to trust their reflective partners, they often invite them to work first with their direct reports and then with their larger organization to bring innovative ideas to more and more people.

We call this process *spiral integration* (see "Spiral Integration"). So far, we have noticed two types of spirals: a downward spiral (from executive to direct reports, as people further down the ranks become involved in learning different ways of working together) and an upward spiral (from executive to upper echelons, as interest in the change initiative surfaces from above). Spiral integration occurs naturally; it is not a program or a project to be managed. Instead, leaders model productive new ways of thinking and acting and then help others adopt those same behaviors. In this way, spiral integration is facilitating change throughout NSA.

Building In-House Capability

By increasing our capabilities within NSA to maintain momentum around continuous learning and change, we lessen our need for outside help. Two organizations—one formal, Corporate Development Services, and the other informal, the Learning Leaders—assist individuals, teams, and organizations in their efforts to change. Linked to the work being done by SoL consultants, these two internal groups provide continuity by sponsoring training courses, hosting learning events, and offering consulting services to people who are trying to transform how they and their organizations work.

Corporate Development Services is composed of NSA employees who have advanced training and education in applied behavioral sciences, specializing in organization development. This organization's work is supported by the Learning Leaders, an informal network of NSA employees from a wide variety of disciplines who have a passion for innovative thinking. The Learning Leaders began more than four years ago as a grassroots effort to help bring about fundamental change at NSA. Many people in this network support spiral integration by serving as reflective partners, facilitators, and champions for change wherever they work.

Preserving the Best

The first year of the transformation initiative was marked by unprecedented changes as we implemented federally mandated reforms, restructured the organization, and named new leaders throughout the agency. The work with SoL focused on educating the top leadership team, building internal capability to support the change process, and beginning to work with mission teams. The second year was characterized by the launch of a reflective partnering practice for senior leaders, spiral integration in many parts of the organization as managers introduced new tools and techniques, and a "settling in" to the new organizational structure. In this coming year, we will expand our capability at all levels, work more with mission teams, and communicate stories and lessons learned to the workforce.

We have found that this gradual approach to change ensures that the best of NSA's ethos—a dedication and passion for serving America—is being preserved. At the same time, the organization is developing the collaborative skills, agility, and speed we need to tackle the emerging challenges of the 21st century. ▪

Rebecca Owens Pille leads Corporate Development Services and is the focal point for the Learning Leaders network. She has worked in the change arena within the federal government for over a decade and formalized her experience with a master of science degree in applied behavioral science from Johns Hopkins University.

ABOUT THE NSA

The National Security Agency is the U.S. government's cryptologic organization—America's codemakers and codebreakers. NSA coordinates, directs, and performs highly specialized activities to protect U.S. information systems and produce foreign intelligence information. A highly technologic organization, NSA is on the frontiers of communications and data processing. It is also one of the most important centers of foreign language analysis and research within the U.S. government.

As the world becomes more and more technology-oriented, protecting U.S. information systems becomes increasingly challenging—and important. This mission involves protecting all classified and sensitive information that is stored in or sent through U.S. government equipment. The agency's support spans from the highest level of the U.S. government to the individual soldier, sailor, airman, and marine.

NSA's other mission—providing foreign intelligence information to the U.S. government—results from a discipline known as Signals Intelligence (SIGINT). SIGINT's modern era dates from World War II, when the U.S. broke the Japanese military code and learned of plans to invade Midway Island. Based on this intelligence, the U.S. defeated Japan's superior fleet. The use of SIGINT is believed to have directly contributed to shortening the war by at least one year.

Additionally, NSA conducts one of the U.S. government's leading research and development programs. Some of the agency's R&D projects have significantly advanced the state of the art in the scientific and business worlds. NSA's early interest in cryptanalytic research led to the first large-scale and solid-state computers, predecessors of the modern computer.

Most NSA employees are headquartered at Fort Meade, MD, located between Baltimore and Washington, D.C. The agency's workforce represents an unusual combination of specialties: analysts, engineers, physicists, mathematicians, linguists, computer scientists, and researchers, as well as customer relations specialists, security officers, data flow experts, managers, and administrative and clerical assistants.

For more information on NSA, see http://www.nsa.gov.

VIEWPOINT

AREN'T LEARNING ORGANIZATIONS CURIOUS?

BY ROD WILLIAMS

For all the powers of computers, Picasso considered them useless because "they give only answers." Isn't one of the remaining advantages of being human that we can give questions and not just answers? The ability to spontaneously and pleasurably discover new questions is an expression of "curiosity," which by its nature cannot be forced, commanded by another, or scheduled. We intuitively recognize curiosity as a crucial element supporting the "readiness to learn" in children and in ourselves.

Overcoming School

Although a key factor in creativity and learning, curiosity is rarely mentioned—or encountered—in the classroom or on the job. Earlier this century, the educator John Dewey said "school should be less about preparation for life and more like life itself." Those of us who complained in high school that what we were taught had no relevance to our lives now face the absolute relevance of learning in order to make a living. Too often, though, the school of our real adult lives—the workplace—still has an aura of oppression.

Despite the supposed "intrinsic pleasure" of learning, we usually settle for the extrinsic rewards of salary and career advancement and forgo the rest. But this cheerless learning is merely another kind of labor; a courtship without passion, forced by the arranged marriage of another's interests with our time and effort. However, when we brush against our own interests, our hearts and minds race faster. Nevertheless, many organizations undertake learning initiatives in the tradition of schooling, without giving workers the imprimatur to savor its guilty pleasures.

But, as our rapidly evolving economy increasingly demands that we use our minds rather than our muscles, we can hardly afford not to understand this passion for knowledge and embrace it, especially in the workplace. The leading edge of knowledge, curiosity can accelerate breakthroughs in productivity and performance like few other forces. When workers become curious, they suddenly have an immediate and truly personal stake in the process of discovery. Explicit recognition of the value of curiosity to an organization's progress is a declaration of every worker's capacity to catalyze change.

Signature Questions

Yet, it's possible to read many of the major works in the field of organizational learning without ever coming across the word "curiosity." Is something important missing here, or is the word's absence merely trivial?

What we really want our "learning organizations" to do is create new knowledge. If this is our aim, then we must forswear our usual re-mixing of what is already known. Nor can we rely on external resources to tell us what we should be curious about. To create new knowledge, we must discover the signature questions of our organizations—those that we are uniquely able to ask, that are at the same time expressions of everything we already know and everything we don't know. These signature questions are at the very heart of the knowledge-creation process, and they are the engine for "curious organizations."

Growing Curiosity

From this perspective, if the leaders of the knowledge economy are to resemble gardeners rather than charismatic heroes, as suggested by Peter Senge in an interview in *Fast Company*, then they should think of their organizations as curiosity "farms."

To that end, if we refashioned our learning organizations into "curious" organizations, what would they look like? How would they function? What would happen if we assembled a "curious team" and gave it room to develop a refined sense of its own kind of knowledge-creating process and the independence to manage that process according to its needs? Would a curious team work together differently and produce different outcomes than a learning team? How might such outcomes be used to advance our organization's mission or improve its bottom line?

Leaders, if you can embrace these questions as your own, you will then begin to understand how to tend your "farms" and enliven your workplaces with the generative energy of truly active intelligence.

Rod Williams is a clinical psychologist curious about knowledge-creation processes in human systems. He is also the marketing and e-commerce manager at Pegasus Communications.

YOUR THOUGHTS

Please send your comments about any of the articles in *THE SYSTEMS THINKER* to editorial@pegasuscom.com. We will publish selected letters in a future issue. Your input is valuable!

ARE LIMITED MODELS USEFUL?

I found some aspects of the "From the Headlines" article by Richard White in the August issue troubling. It lead me to ask the question, "What are we doing with causal loop diagrams (CLDs)?" Are CLDs fulfilling their promise of leading to deeper understanding of underlying structure and systemic problems, or have we drifted into using them in a limited fashion that does little more than expand our knowledge of problem symptoms?

My inquiry is not a critique of Mr. White's article nor the utility and value of his insights. Nevertheless, I found myself asking, "Does the Flying Blind CLD identify critical leverage points and their respective causal influences that would lead to sustainable change and desirable systemic behavior?" I pose my questions as an invitation to a conversation on the role of CLDs and what we should expect from them in a publication such as *The Systems Thinker.* I have neither answers nor a framework for the conversation, only a hope we can deepen our understanding of using CLDs.

My assumption is this: CLDs were conceived as a tool to assist us in challenging our mental models and leading us to deeper understandings of underlying structure and the dynamics of problems. Many published CLDs are limited in scope (influenced in part by space constraints) and present many causal influences as simple ones (one cause, one effect). Do such models serve as a springboard to expand our thinking, or do they make it too easy to accept the simple relationships as sufficient explanations of dynamic behavior?

Mr. White's article focused on the growing number of air travelers and the corresponding demand for seasoned captains. His mental model seems to suggest that the number of airline travelers is only (or at least overwhelmingly) responsive to public perceptions of airline safety. Does this identify an effective leverage point? Anecdotally, one current phenomena appears to contradict this premise: Sales of Ford Explorers continue unabated despite well-publicized safety concerns. Is safety the driving force? Airlines already enjoy Five Sigma quality. Is pilot experience a determining influence (in the context of a multiplier effect) or one of many contributing influences?

The preceding questions are not posed to nit-pick Mr. White's CLD but to focus on the use of CLDs in general. Is systems thinking enhanced by the use of limited models that necessarily omit causal influences? Should CLDs be expected to serve as rough drafts for computer-based system dynamics models? Ignoring that CLDs do not make stocks, and flows cannot be made explicit, should CLDs still be expected to convey accumulation? Should CLDs be built up from high-leverage variables, with other variables added as space allows?

Should a "litmus test" for a well-developed CLD be the recognition of high-leverage variables? Should CLDs only be regarded as rough sketches and thus not have to meet a particular standard? Should we accept CLDs as multiple and additive insights of a problem without expecting any one of them taken separately to describe its core dynamics, accepting each as one of many contributions?

In the December 1996 issue of *The Systems Thinker*, George Richardson and Colleen Lannon raised concerns about CLDs. Although their focus was primarily one of notation, the broader issue is still before us—what *are* we doing with CLDs? Must we simply remember that CLDs are always starting points and never ending points? Have we come to expect too much from CLDs, or are they effective tools that we have come to misuse, overuse, or underuse?

–Bill Braun

Editor's Response:

I would like to thank Bill Braun for raising some provocative questions that I hope will serve as the basis for a stimulating conversation among readers. We've set up a forum on our web-based bulletin board for this ongoing discussion; to participate, go to www.thesystemsthinker.com and scroll down to "Go to The Systems Thinking Forum." I hope to publish a summary of the dialogue that takes place there in a future issue.

Since The Systems Thinker *was launched 13 years ago, the intent of the "From the Headlines" column has been to help readers recognize systemic dynamics at work in newspaper and magazine articles. By offering a one-page summary of a real-world dilemma and a diagram depicting a possible structure that might begin to explain the behavior being described, we hope these articles suggest new routes of inquiry into common problems and stimulate readers to look for loops in their everyday activities.*

The causal loop diagrams in these articles represent one person's theory about some aspect of the underlying structure. They are not meant to be comprehensive; in fact, because they're based solely on news reporting from a variety of sources, they likely overlook a number of key variables. We always welcome readers to challenge the assumptions that went into these models as a way for all of us to deepen our knowledge of the tool and of the issue under exploration. We hope the "From the Headlines" articles continue to stimulate the kind of questioning and reflection found in Mr. Braun's letter.

—JM

READER RESPONSE TO "CURBING SCHOOL VIOLENCE—OR FUELING IT?"

The "Systems Thinking Workout" challenge posed in the October issue cited experts who believe that many efforts to eliminate school violence "may not only be ineffective but may actually backfire." Alan Ticotsky, a Waters Foundation systems mentor in the Carlisle, MA, schools, and Debra Lyneis of the Creative Learning Exchange share an example of how fifth-grade students used causal loop diagrams to analyze the problem of bullying—and the surprising results they came up with.

One way to address school violence may be to help young students learn to resolve conflicts in their everyday dealings with one another. Following the Open Circle social competency curriculum developed at Wellesley College, students in Carlisle, MA, are building a common vocabulary and strategies for solving problems, with civility as a major goal. Carlisle students also use system dynamics tools throughout their curriculum. Could they combine their ability to use systems tools with their experience analyzing social behavior? Would students explicitly recognize feedback as a driving force in classroom behavior?

Julia Hendrix's fifth-grade class had become quite facile with causal loop diagrams. Students could diagram population changes in ecosystems they were studying. It was time to apply their knowledge to a social system, specifically their own classroom. Ms Hendrix asked the students, working in pairs, to develop CLDs describing the techniques they use in school when someone is bothering them. The guidance counselor and Carlisle's two systems mentors, teachers supported by the Waters Foundation, were invited to the class.

Student conversations were interesting and surprising in several ways. The ease with which the children used CLDs amazed the mentors, who found the tool difficult to teach to adults and to understand for themselves. The adults all agreed that the overall tone of the class was very focused, and insightful comments about bullying and annoying behavior were voiced in many teams. But it was the simplicity and power of the causal loops, and the unexpected message, that astounded the teachers.

A few students drew causal loops that reflected the social competency lesson of "D and D Behavior." The theory is that some behavior is so dangerous or destructive that it requires adult intervention. When bullying occurs, students should alert a teacher who will make the bullying stop (see "D and D Behavior").

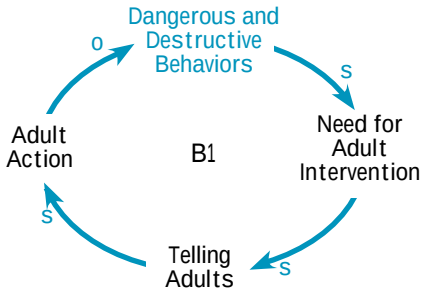
Most of the teams, however, came up with a diagram that they felt better reflected the reality of schoolyard life. The large majority of the class felt that telling an adult actually makes the bully retaliate more severely after the adult leaves (see "Retaliation").

Drawing the causal loops clarified the students' thinking and gave them an objective way to express their views on adult intervention—with four adults in the room! Drawing the loops also provided them with a chance to brainstorm alternative solutions, like confronting the bully directly, getting support from friends, ignoring the behavior, or even including the bully in positive activities.

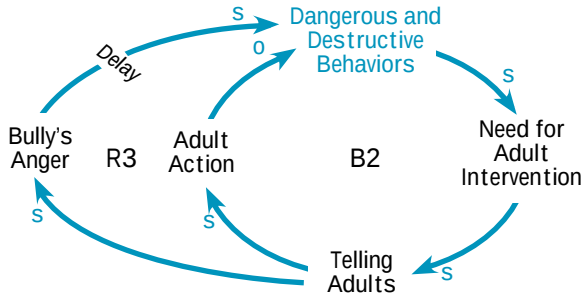
The initial reaction among the teachers varied. Ms. Hendrix was gratified that her students could transfer the skills learned in an ecology unit to another area of the curriculum. The systems mentors were happy to see a classroom application of a tool they were struggling to teach. The guidance counselor, on the other hand, was concerned that students saw adult intervention as not only ineffective but potentially negative.

These loops, drawn by children, are very simple and incomplete. Just the same, at their own level, students used them to address a problem together. ■

D and D Behavior



Retaliation



FROM THE FIELD

Sustainability Institute Offers Consulting Grants

Funded by a grant from the Surdna Foundation, Sustainability Institute has consulting time available to mentor organizations working on issues of environmental, social, and economic sustainability. To learn more about this opportunity, contact Drew Jones at 828-236-0884 or apjones@sustainer.org.

Access Interviews with Thought Leaders

Meet 25 of today's eminent thinkers on knowledge and leadership through the Thought Leaders Interview Project at http://www.dialogonleadership.org/. In these interviews and conversations, they share their own journeys, the questions that originally motivated them, and what they consider the evolving essence of their own work. This global interview project, sponsored by McKinsey & Company and the Society for Organizational Learning, and conducted by Otto Scharmer in collaboration with Ikujiro Nonaka, Peter Senge, Michael Jung, and Joseph Jaworski, offers a fascinating view into the emerging next generation of leadership thought.

PEGASUS NOTES

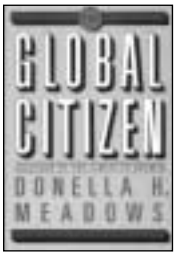
The Systems Thinker Web Site Launched

At the beginning of February, we went live with thesystemsthinker.com, a web site that includes:

- a searchable index of all *The Systems Thinker* article titles and authors
- a list of articles (with summaries) available for purchase in PDF format
- fee-based access to a library of current and past volumes
- sample articles and issues
- an introduction to systems thinking
- a link to the systems thinking discussion forum

We hope you find these new web-based resources useful and encourage you to send us feedback about your experience of accessing them. Please contact webmaster@pegasuscom.com with your thoughts and ideas.

Exploring Global Connections



Donella Meadows, the author of this month's feature article, was a leader in the field of system dynamics until her death a year ago. For many years, she published an engaging syndicated column called "The Global Citizen," in which she explored how the seemingly unrelated decisions we make every day determine the future for us all. Island Press published a collection of these essays in the 1991 book *The Global Citizen*. This classic begins with the provocative essay "System Dynamics Meets the Press" and covers topics such as poverty and development, land use and urban growth, sustainable energy policies, leadership, and keeping going when the going gets tough. This book is a must-have for anyone interested in exploring the complex connections and interrelationships that shape our world and for which we are all responsible. To order, call 1-800-272-0945, or go to www.pegasuscom.com. Order# OL018, softcover, $17.95.

For information about reading and using causal loop diagrams, go to www.pegasuscom.com/cld.html.

LEARNING QUOTES

"Simple, clear purpose and principles give rise to complex, intelligent behavior. Complex rules and regulations give rise to simple, stupid behavior."

—Dee W. Hock

"If we are to achieve a richer culture, rich in contrasting values, we must recognize the whole gamut of human potentialities, and so weave a less arbitrary social fabric, one in which each diverse human gift will find a fitting place."

—Margaret Mead

To explore the latest "At Any Rate™" learning lab, go to http://www.pegasuscom.com/AAR/model.html.

THE SYSTEMS THINKER®

Managing Editor: Janice Molloy (janicem@pegasuscom.com)
Founding Publisher: Daniel H. Kim
Publisher: Ginny Wiley
Editor: Kali Saposnick
Production: Nancy Daugherty
Circulation: Glenn Ceurvels (glennc@pegasuscom.com)

THE SYSTEMS THINKER® explores both the theory and practice of systems thinking and related organizational development disciplines. Articles by leading thinkers and practitioners articulate the challenges and issues involved in creating organizations on the leading edge of innovation. We encourage dialogue about systemic issues and strive to provide a forum for debating such issues. Unsolicited articles, stories, and letters to the editor are welcome.

THE SYSTEMS THINKER® (ISSN 1050-2726) is published 10 times a year by Pegasus Communications, Inc. Signed articles represent the opinions of the authors and not necessarily those of the editors. The list price is $189.00 for one year. Site licenses, volume discounts, and back issues are also available.

Orders and Payments Offices
Phone 800-272-0945 • 802-862-0095 • Fax 802-864-7626
customerservice@pegasuscom.com
PO Box 2241
Williston, VT 05495 USA

Editorial and Administrative Offices
Phone 781-398-9700 • Fax 781-894-7175
editorial@pegasuscom.com
One Moody Street
Waltham, MA 02453 USA

www.pegasuscom.com